Master Thesis

Distribution of water during drought

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Delft University of Technology

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Distribution of water during drought

by

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Preface

Before you lie my master's thesis, marking the completion of my Master's in Complex Systems Engineering and Management, and the conclusion of my journey at the Faculty of Technology, Policy, and Management as a student at TU Delft. Throughout this chapter, I've acquired valuable knowledge, forged lasting friendships, and cherished unforgettable moments. Here, I'd like to extend my gratitude to all those who supported me along this path. Although the journey of thesis writing didn't go the conventional route, the unwavering support, encouragement, and guidance from my committee ensured we navigated it successfully.

The composition of my graduation committee has changed several times over time. However, this does not leave the fact that I want to thank each of them for the help they have provided me. First and foremost, I would like to thank Ellen for her assistance in setting up the project, after which Mark took over this guidance. I want to thank Mark in particular for the intensive support you provided me with and for knowing when to push me, resulting in direct and clear feedback instead of beating around the bush. I also want to thank Frans for his knowledge and chairing of my graduation committee. From Deltares, I want to thank Marjolein for providing technical insight into the complex world of water, as I have certainly encountered its complexity. Without all your help, I would never have come as far as I have now.

A huge thank you goes out to my group of graduate student friends, 'Het Laatste Loodje'. Thank you for the breaks we took, during which we had discussions, shared our frustrations, offered support, and, most importantly, concluded with productive stand-ups. My final thanks go out to my family, who supported me through thick and thin during this process.

Tim Poppe
19-02-2024

Executive summary

In recent years, there has been an increase in the frequency of droughts attributed to the evolving climate. The prospect of more frequent drought is becoming increasingly real. Consequently, effective water management during periods of drought becomes crucial. During times of drought, a tension arises between the demand for water and the management of water in times of scarcity. To gain a better understanding of this, water distribution models are employed. These models serve as valuable tools for decision-makers, aiding them in better preparing for periods of drought and water scarcity.

These water distribution models offer insights that can assist decision-makers in enhancing their preparedness for periods of drought. For these models to be truly effective, it is crucial that the values they represent adequately capture the interests of the stakeholders involved in the water distribution. Failure to do so may lead to contested usage of these models. Therefore, this research aims to identify how key stakeholders' interests are represented in water distribution models and whether they experience value conflicts with how this is done with their interests. To provide further clarification, the research will delve deeper into the alignment of stakeholders' interests, as encapsulated in values, with the existing practices of water distribution models. This exploration leads to the following research question:

> *How do water distribution models that could be used to prepare for and allocate water during times of drought align with key stakeholders' values?*

To achieve this goal, this study can be regarded as a case study examining how stakeholders perceive water distribution models. Specifically, the distribution model utilized by Deltares, known as the Quick Water Allocation Scan Tool (QWAST), serves as a case study to gain insights into how water is distributed during periods of drought in the Netherlands. Within this case study, literature research has been conducted. The literature research focuses on the QWAST water distribution model and explores the role of QWAST in water allocation, particularly during times of water scarcity. Additionally, the literature research investigates values and how they can be translated to key stakeholders, ultimately determining how these key stakeholders are identified concerning their water demands. In addition to the literature review, interviews were conducted with the identified key stakeholders. These interviews aimed to understand the values that underpin their claims regarding water demands and their perspectives on water-related issues.
Four sectors can be distinguished based on water demand: agriculture, inland shipping, drinking water, and nature. Among these four sectors, the preservation of nature is not sufficiently ensured, as non-compliance with laws and regulations undermines the importance of nature's interests. QWAST plays a role in the debate on drought and water distribution, serving as a model for stakeholder discussions without imposing policies or obligations.

Due to different water demands, value conflicts were expected, but they were not observed. The actors involved generally acknowledge the need to balance water demand across the four sectors. However, upon looking closer at the specific water demand, challenges emerged. Because during drought, every stakeholder seeks to protect their interests. This challenge is also evident with the use of QWAST, showing that in times of water scarcity, the actors involved are less aligned on actions based on the overview provided by QWAST and the resulting water allocation. This is attributed to the incompleteness of QWAST when it comes to addressing the issue of drought. Drought extends beyond surface water, the focus of QWAST, to also include groundwater.

Each sector demands a specific quality and quantity of water. This results in a complex set of claims. The competing claims revolve around the challenge of determining how to allocate water among different sectors. The primary concern for sectors is whether the water distribution problem is accurately reflected in QWAST. Also, the sectors highlight that as it stands, the model is not very useful in aiding decision-making in conditions of scarcity. There is still much to achieve in terms of managing drought via groundwater. There are other possibilities to deal with water management to prevent water scarcity from occurring, instead of via the management of surface water.

All in all, it can be concluded that the values that the different key stakeholders hold with water distribution models are overarching and this means that the anticipated conflicts at value levels are absent. However, despite significant overlap in values, QWAST remains incomplete in its ability to offer insight into policy options concerning drought. Consequently, its added value is not deemed significant. QWAST does not provide help on how to deal with drought and water demand. Before addressing QWAST, consider exploring alternative options. Stakeholders question the relevance of using QWAST as a water allocation tool for distributing water during drought if it overlooks groundwater use. It's more practical to address groundwater management directly, especially in drought situations. First, tackle the water scarcity issue before prioritizing water distribution through QWAST. While there is knowledge about surface water distribution and expectations, it falls short in guiding policy for drought management. The current picture remains incomplete and insufficient for making informed decisions. So, due to the complex set of water claims, QWAST is not considered incorrect but is deemed incomplete.

In the ongoing development of QWAST, it is recognized that there exists a policy rationale driving its development. Deltares is actively shaping QWAST into a water allocation model, approaching it with a water management perspective. However, there's a notable disparity as sectors, excluding nature, predominantly view the water allocation model through an economic lens. Recognizing this, the recommendation centers on making stronger connections between the model, policy considerations, and economic perspectives. By integrating QWAST with a component that can quantify the impact of drought on sectors, the value of the modeling tool can be increased for stakeholders. This approach ensures a more complete understanding, catering to both the water management and economic facets of decision-making. Another way to go is to initiate a discussion on QWAST and stimulate a comprehensive dialogue on water allocation, covering both surface and groundwater. Assess the efficacy of QWAST in combining these inclusive discussions and organizational efforts. Following that, initiate a discussion on reaching a consensus regarding how to tackle water scarcity, particularly in terms of establishing a water allocation framework.

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1

Introduction

The new national climate scenarios reveal a warmer future for the Netherlands, marked by increased tropical days and reduced frost days in all seasons (KNMI, 2023). Summers will become drier, featuring more frequent, hotter, and longer-lasting heat waves, accompanied by decreased rainfall and heightened evaporation, making droughts more common. Despite variations in scenarios, ranging from considerable to smaller changes, it is essential to prepare for extended periods of heat and drought, as observed in the notably dry summer of 2018, which may become the norm by 2100 (KNMI, 2023). Drought is a multifaceted phenomenon characterized by prolonged periods of dry weather conditions. These conditions can have negative effects across various sectors, including agriculture, shipping, natural ecosystems, and freshwater resources (Van Loon et al., 2016). The negative effects on these sectors are causing problems in the economy, society, and environment (Philip et al., 2020). To understand and prepare for the impact of drought, it's important to fully understand what causes drought, how drought works, and what are the consequences of a period of drought. This understanding is key to creating good plans to reduce the problems drought causes (Mishra & Singh, 2010).

1.1. Drought

Drought is a complex phenomenon whose definition varies due to differences in hydro- meteorological variables, socioeconomic factors, and the stochastic nature of water demands in different regions worldwide (Panagoulia & Dimou, 1998). Consequently, diverse perspectives on drought definitions exist, with researchers proposing various interpretations. The World Meteorological Organization (WMO) defines drought as "a sustained, extended deficiency in precipitation" (World Meteorological Organization, 2014). Importantly, the choice of defining variable results in the categorization of drought definitions into four distinct types (Wilhite & Glantz, 1985).

Figure 1.1 provides an overview of the four primary types of drought, aiding in the understanding of their classification. The first type is meteorological drought, characterized by a region experiencing prolonged precipitation scarcity over a specific timeframe. Traditionally, meteorological drought conditions have been assessed using precipitation data (Santos, 1983; Eltahir, 1992), where drought is defined as a shortfall in precipitation compared to normal values. The second type is hydrological drought, which occurs when both surface and subsurface water resources are insufficient to meet established water demands in a given water resources management system (Mohan & Rangacharya, 1991). Traditionally, streamflow data has been the

primary indicator for analyzing and assessing hydrological drought conditions. The third type is agricultural drought, typically defined by a decrease in soil moisture levels leading to crop failure (Liu et al., 2016; Dai, Zhao, & Chen, 2018). Soil moisture decline is influenced by various factors contributing to meteorological and hydrological droughts, along with the difference between actual and potential evapotranspiration (Mishra & Singh, 2010). The fourth type is socio-economic drought, which occurs when water availability falls short of meeting water demand. Socio-economic drought usually emerges when agricultural, meteorological, and hydrological droughts reach a certain level of severity. These four types of drought are interconnected, with hydrological and agricultural droughts being influenced by meteorological drought.

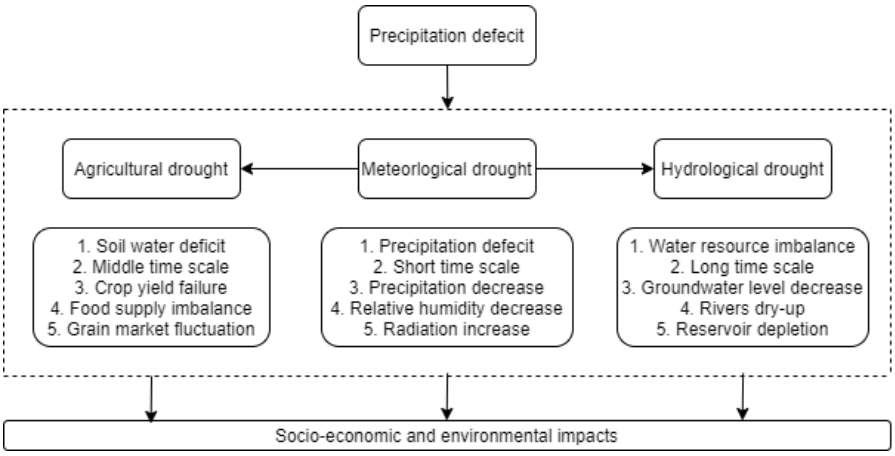

Figure 1.1: Overview Droughts

Figure 1.1 illustrates the interrelations between the four drought types, emphasizing the impact of meteorological drought on hydrological and agricultural droughts. This thesis focuses primarily on hydrological drought, defined by Van Loon (2015) as a deficiency of water within the hydrological system, leading to abnormally low streamflow in rivers and reduced water levels in lakes, reservoirs, and groundwater. This focus arises when drought occurs in the Netherlands, causing both surface water and subsurface water to be insufficient to meet the water demand. This is due to the Rhine, the major source of surface water, becoming drier, and a decrease in subsurface water. As a result, the water demand cannot be fully satisfied. In the Netherlands, a period of drought is influenced by climate change, as depicted in Figure 1.2.

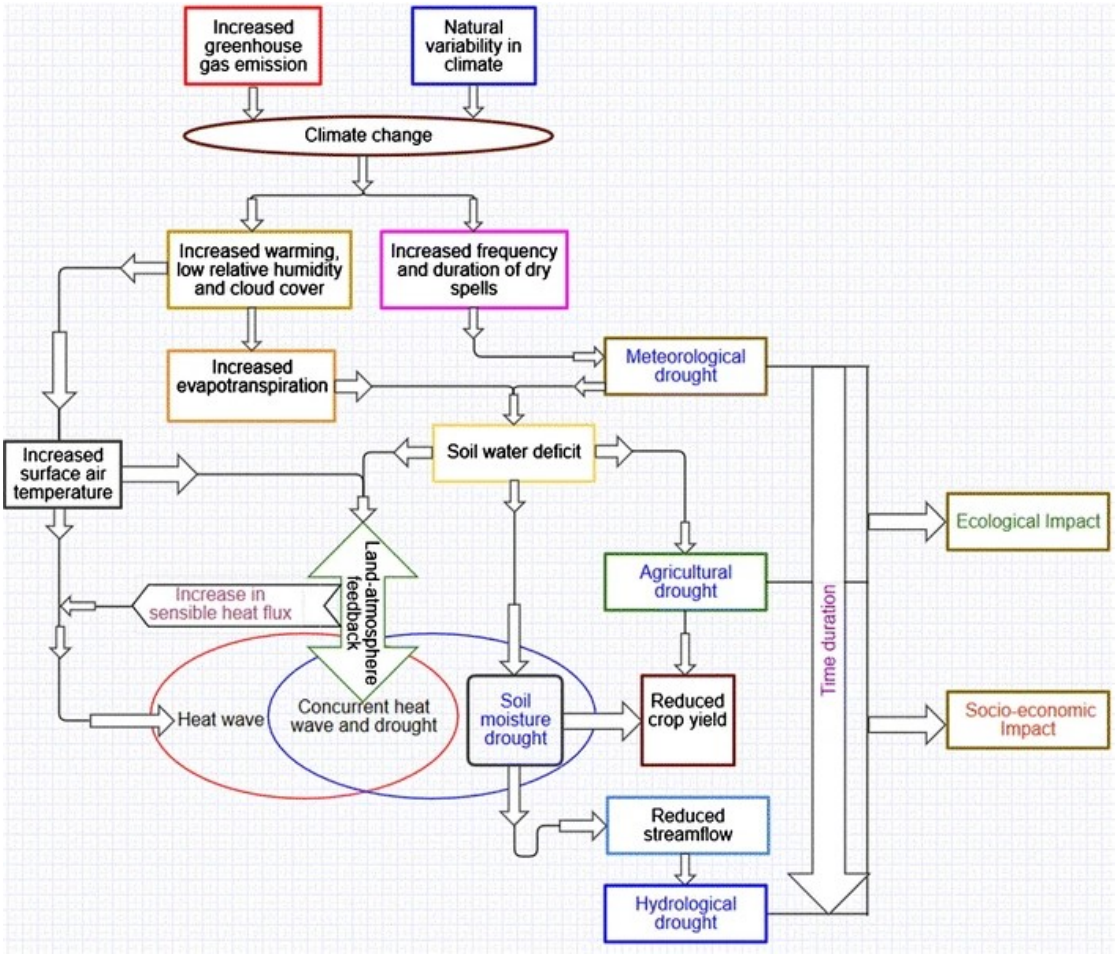

Figure 1.2: Influence climate change on droughts
(Van Loon, 2015)

1.2. Rhine River System

During droughts, the River Rhine becomes the primary water source for the Netherlands as precipitation is not available during these periods, highlighting its crucial role in the water supply to the country (Ministerie van I&W, n.d.). The Rhine stands as one of Europe's most significant rivers, originating in the Swiss Alps, as depicted in Figure 1.3 (Havinga, 2020). This extensive river network encompasses the Rhine, an important waterway for the ports of Cologne, Düsseldorf, Rotterdam, Strasbourg, and Basel. Entering the Netherlands at Rhine kilometer 857, specifically in Lobith, branching into the Waal River and the Pannerdensch Kanaal. Subsequently, it further divides into the Nederrijn and the IJssel at the IJsselkop, as visualized in Figure 1.3. The hydrological characteristics of the Rhine River are distinctive, and molded by precipitation, discharge, and water management strategies. At Lobith, the main measurement station in the Netherlands, the average annual discharge of the Rhine stands at approximately 2,300 cubic meters per second (m^3/s) (Ministerie van I&W, n.d.).

Lobith plays a significant role in managing the river's water resources (Gensen, 2018). It

serves as a critical monitoring point for assessing the flow of water through the Rhine River. The distribution of discharge at Lobith is dynamically influenced by several physical factors, including precipitation patterns, snowmelt, tributary contributions, and water management practices upstream (Havinga, 2020). From Lobith onwards, it is therefore possible to adjust how much water, the discharge, is sent where. Thus, if less water is available in times of drought, even more, careful consideration will have to be given to how water is sent across the Lower Rhine, IJssel, and Waal. These factors shape the physical reality of how water is allocated. So the physical factors influence how much comes in at the junction point at Lobith and how exactly the incoming water is then distributed is determined by a distribution key. The Lobith distribution key is an influential tool, as emphasized by Klijn et al. (2022). The utilization of this distribution key becomes important, ensuring a supply of fresh water even in a period of drought. The allocation of water between the northern and western regions of the Netherlands takes center stage.

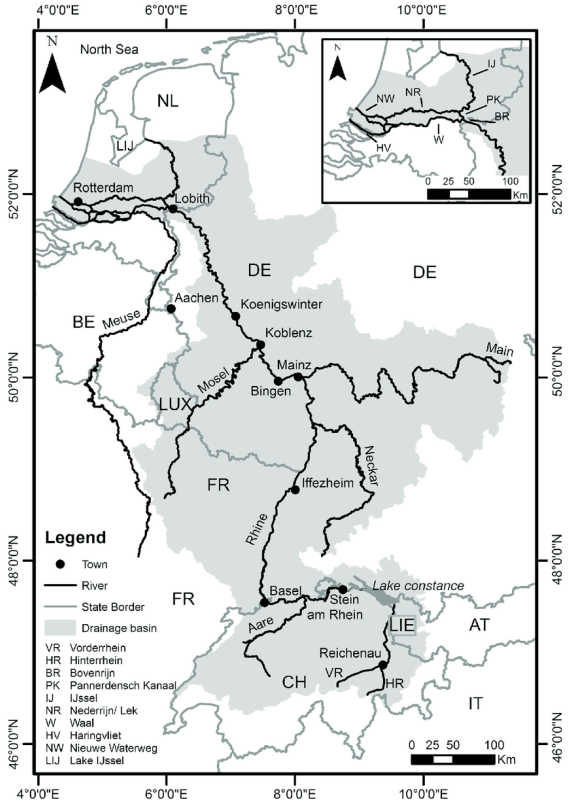

Figure 1.3: Rhine River
(Havinga, 2020)

Understanding the discharge distribution at Lobith is important in managing water allocation and meeting the diverse needs of different sectors. The influence of the discharge distribution at Lobith extends to navigation and transportation along the Rhine River. The physical implications are evident in the determination of water levels and flow rates at this critical point, directly affecting the navigability and carrying capacity of vessels. These practical considerations have a tangible impact on regional trade and transportation networks. In essence, the discharge at Lobith serves as an indicator of water availability, flow conditions, and the overall well-being of the Rhine River system. This information is pivotal for making choices regarding water allo-

cation. By closely monitoring and understanding discharge distribution at Lobith, there can be effective management and safeguarding of this vital water resource, ensuring its sustainable use across various sectors. Actors can manage this through the use of modeling lenses that can provide insight into what happens if you make changes to the allocation key used at Lobith. This model will be examined within this research and look at how the different actors play a role in this.

1.2.1. Allocation key

Changing the allocation key not only affects the supply of water to agriculture, drinking water, nature, and shipping but there is a whole other issue at stake, namely salt intrusion. In the western parts of the Netherlands salt intrusion is a significant challenge. Salt intrusion refers to the infiltration of salt into freshwater systems, including rivers and groundwater, and it is particularly relevant in this region due to its susceptibility to seawater penetration from estuaries and coastal areas. (Prinsen & Becker, 2011). This salt intrusion can harm agriculture by making the soil too salty for crops, reducing yields, and affecting freshwater sources, making drinking water unsafe. It also disrupts nature, harming wetlands, habitats, and the health of fish, impacting human livelihoods and infrastructure. A trade-off arises between two choices, dividing the freshwater over the Netherlands so that functions are preserved or maximizing the use of freshwater to prevent saltwater intrusion. But it is quite intertwined. which makes it all the more difficult and complex to combat. Therefore the Dutch government and research institutions actively engage in the study and management of salt intrusion to mitigate its adverse impacts (Duan, 2016).

The urgency to secure freshwater resources during droughts underscores the necessity for policies and practices that guarantee the sustainability of freshwater resources (Wilhite, Sivakumar, & Pulwarty, 2014). Because the Netherlands depends on agriculture and shipping, both relying on enough water, the risk of drought is a real worry (van Tilburg & Hudson, 2022). Therefore, it is crucial to develop robust strategies that strengthen the Netherlands against the severe impacts of drought, which significantly affects the country's freshwater resources. Thus how the available water is distributed has important implications, and this is done with the help of water distribution models. Water distribution models simulate the allocation of water across the Netherlands during droughts using a distribution key. This involves adjusting parameters to determine the most effective water distribution at low discharges. These models incorporate actors in two ways, actors provide information about what their water demand is, and on the other side, these models simulate what they eventually get. It is therefore important to find out which actors play a role after which it is crucial to look at how these actors act and with what mindset. This mindset will be examined based on value theory. It will investigate whether or not conflicts arise between the different actors when water is distributed during drought. Ultimately, this information will be used to demonstrate the actual strength of using models in drought.

1.3. Knowledge gap and research questions

Occurrences of drought are becoming more frequent and this pattern as well as the impact of drought are expected to become even more impactful. The importance of effective water management is underscored by the presence of water scarcity during drought, leading to tension among competing water demands. Water distribution models can be employed to support decision-makers in preparing for drought and water scarcity scenarios. It is crucial for actors involved in decisions regarding water distribution to be convinced of the value of these models. Otherwise, their usage becomes contested. Therefore, the alignment of their interests, which are encapsulated in values, with the current practices of water distribution models will be explored,

as to how they may potentially conflict.

Thus this research will focus on how well are the interests of these actors represented in water distribution models. This leads to the following main- and sub-questions:

> How do water distribution models that could be used to prepare for and allocate water during times of drought align with key stakeholders' values?

To answer the main research question the following sub-research questions are formulated.

1. Which aspects play a role in water management due to increasing droughts as a result of climate change in combination with modeling droughts?
2. What are the key components and underlying principles of the existing water distribution model used for a period of drought?
3. What are the stakeholders' perceptions regarding the modeling of droughts, and what are the key concerns?

1.4. Report Structure

The introduction lays the foundation by introducing and elucidating the problem that ultimately led to the formulation of the primary research question. Following this, the research approach explained, which will guide the methodology for addressing the various sub-questions aimed at answering the main research question. The next chapter will analyze the concepts of values and stakeholder modeling, exploring their interrelation. After that, chapter four will elaborate on the chosen water distribution model, followed by an actor analysis to identify key stakeholders. Chapter five will present and analyze interview results. Subsequently, the following chapter will delve into a discussion of the findings and recommendations for future research. The seventh chapter will then conclude with the conclusion.

2

Research Approach

This chapter outlines the research approach and methodologies used in this study. It begins by outlining the type of research undertaken, detailing its objectives, methodology, and rationale for adopting a case-study approach. Subsequently, it delves into the diverse data collection methods utilized. Lastly, it concludes with an exploration of the data analysis techniques employed.

2.1. Research rationale

The conducted research is exploratory and aims to identify how key stakeholders' interests are represented in water distribution models and whether they experience value conflicts with how this is done with their true interests. To provide further clarification, the research will delve deeper into the alignment of stakeholders' interests, as encapsulated in values, with the existing practices of water distribution models. Performing an in-depth analysis of their actions and underlying mindsets, assessed through the lens of value theory. Because of the nature of this study, a qualitative research method is considered suitable.

Qualitative research

Qualitative research refers to specific methods to collect and analyze data (Almeida, Superior, Gaya, Queirós, & Faria, 2017). There are techniques in qualitative research that, without the need for quantification, depict and explain people's experiences, interactions, and behavior. Qualitative research is utilized for gathering and analyzing data, typically consisting of descriptive, textual, or conversational information (Dziopa & Ahern, 2009). These datasets are often presented in an unstructured or semi-structured format. This approach focuses on finding out "what" people experience and do, and "why" they think and believe the way they do. Qualitative data sets feature small sample sizes, enabling an exploration of the subject. Various qualitative research methods exist, including interviews, experiments, text analysis, and case studies.

In this research, a qualitative approach has been selected to align with the objectives and the data type. The goal is to understand the interests of key stakeholders and explore how the values of these parties are represented in the use of water distribution models during drought. An aspect of this choice is the expected data, which comprises a set of personal perspectives and experiences, to be presented descriptively. Qualitative methods excel in capturing subjective experiences and thoughts. Moreover, the unstructured and descriptive nature of the data aligns with the principles of qualitative research methodology. Therefore, the decision to use a qualitative research approach was suited for this study.

Case study

A case study approach has been chosen to investigate water distribution during drought using the Quick Water Allocation Scan Tool (QWAST). This allows for insight into its functionality and the dynamics among different stakeholders. Using case study methodologies, researchers transform the bounds of quantitative statistics, delving into the behavioral dynamics perceived by the key actors involved. Case studies are inherently geared towards a profound exploration of contemporary real-world occurrences. This method entails contextual examination of a select number of events or conditions, along with their intricate interconnections (Zainal, 2007). The qualitative insights drawn from case studies not only aid in the exploration and representation of real-life data but also offer a means to elucidate the intricacies that experimental or survey research might inadvertently overlook (Yin & Heald, 1975).

Yazan (2015) distinguishes three categories of case studies, namely descriptive, exploratory, and explanatory case studies. Exploratory case studies aim to explore new or under-researched topics and generate preliminary insights. They help researchers identify potential research questions and develop a better understanding of the subject. Imagine a researcher interested in the impact of artificial intelligence (AI) on customer service. An exploratory case study might involve interviewing early adopters of AI-based customer service solutions to understand their experiences and challenges. Descriptive case studies provide a comprehensive and detailed account of a particular subject, answering questions like ”What happened?” ”Why did it happen?” and ”How did it happen?” These studies aim to present a holistic view of the subject. Consider a case study that thoroughly examines the growth and success of a startup company. It would provide a detailed overview of the company’s history, strategies, challenges, and key milestones, offering a comprehensive description of its journey. Explanatory case studies delve into causality and aim to explain why and how a specific phenomenon or event occurred. Researchers use these studies to test hypotheses and uncover the underlying mechanisms. In an educational context, an explanatory case study might explore the impact of an interactive teaching method on student performance. The study would investigate the causal relationship between the teaching method and improved learning outcomes, seeking to explain how and why this teaching approach is effective. This research is exploratory as it delves into the relatively unexplored combination of drought modeling and values.

Case study research, while valuable, does have its limitations. The case study research process is inherently complex and lacks standardized procedures. Researchers must navigate these procedural uncertainties by possessing qualities such as the ability to pose insightful questions, attentive listening, adaptability, objectivity, and a profound understanding of the subject matter (Yazan, 2015). Furthermore, the method’s capacity for scientific generalization is limited, primarily because it often involves small subject pools, sometimes as small as just one subject. This raises questions about the feasibility of drawing general conclusions from a single case study. Lastly, case studies can be perceived as time-consuming, intricate to execute, and leading to the generation of extensive documentation (Zainal, 2007).

CoSEM relevance

The Master’s program in Complex Systems Engineering and Management (CoSEM) at Delft University of Technology provides students with the necessary skills to analyze and address challenges within complex socio-technical environments. This study delves into managing scarce water resources during drought, considering factors such as climate change, diverse internal perspectives of actors, and human behavior. It employs model studies to explore these issues. These water distribution models form part of a vast complex system characterized by numerous

actors and interactive processes. Effective modeling is integral to this interactive process, as it relies on the interplay of various organizational aspects, including social, organizational, technical, and institutional characteristics. Recognizing the interdependence among these aspects, the study incorporates different perspectives and employs relevant theories for analysis. The analyses employed in this study are drawn from the CoSEM Master program. As a result, this research is consistent with the CoSEM Master program, as it tackles socio-technical processes within intricate, multi-actor environments involving diverse perspectives from both public and private stakeholders.

It is essential to note that an exploration of value conflicts through actor modeling is lacking in existing literature. Therefore, this research aims to fill this gap by developing an overview.

2.2. Data collection

This section will cover the various data-gathering methods. Desk research and interviews are the two techniques of data gathering employed in this study. Desk research will make up the first portion of the study, and interviews will make up the second.

Desk research

Firstly desk research on scientific articles, governmental documents, and company reports is conducted. This research served two main purposes. Initially, it aimed to gather background information necessary for introducing the subject, defining terminology, and setting research boundaries. This phase provided an understanding of drought and its implications. The second part of the desk research focused on understanding the theoretical aspects, specifically examining values and their correlation with drought. Additionally, an exploration of how these values align with the interests of different identified stakeholders is done. Finally, the research delved into the practical application of the chosen water distribution model, its utilization, and an in-depth analysis of the QWAST water distribution model.

Interviews

Interviews were considered to be a suitable way to understand qualitative research. Given that interviews are regarded as a suitable technique for gathering qualitative data, viewpoints, and experiences of individuals (McGrath, Palmgren, & Liljedahl, 2019). In total, nine different actors were interviewed about water distribution during a drought, after reaching out to 25 potential actors. Two representatives from water boards, each providing unique perspectives on water management and environmental considerations, contributed valuable insights. Additionally, engaging with three professionals from Rijkswaterstaat allowed for an understanding of government policies and regulations related to water resources. An advisory representative to the government shared their expertise, shedding light on crucial aspects that influence decision-making processes. Furthermore, a key port authority representative provided insights into the challenges and opportunities associated with managing water-related activities in port areas. Understanding the perspective of the Dutch inland shipping sector was important too, so we talked to them as well. Lastly, a representative from a knowledge institute provided an academic viewpoint, enriching the discussions with research-based insights.

No contact was obtained with the drinking water and agricultural sector, and the field of interviewees consisted mainly of government allies. An interview guideline, outlined in Appendix B, framed the discussions with main open-ended questions, complemented by follow-up questions. This technique allowed for a natural flow of conversation while ensuring that the research objectives were addressed (Alsaawi, 2014). Additionally, Appendix C compiles summaries of the

interviews, offering an overview of the insights gained from stakeholders representing different perspectives and sectors. Despite the challenges encountered in reaching some parties, the semi-structured interview approach facilitated an exploration of the values linked to periods of drought. An overview of the interviewee and the part of the appendix that refers to that interview can be seen below in Table 2.1.

Table 2.1: Stakeholder References

References	Stakeholder
C1	Rijkswaterstaat 1
C2	Waterschap 1
C3	Inland Shipping Association
C4	Knowledge Institute
C5	Advisory to government
C6	Port representative
C7	Rijkswaterstaat 2
C8	Rijkswaterstaat 3
C9	Waterschap 2

However, the most significant drawback of this data collection technique was that it was more difficult to discern throughout the interview if the subject wanted to delve a little further into their answers or that we moved on to the next topic, which may have resulted in a less satisfactory collection of data. Furthermore, the interviewers were urged to go into as much detail as possible on each topic. The interview was conducted in a conversational style, with the opportunity for follow-up inquiries if further information was deemed necessary or complimentary.

2.3. Data analysis

This section presents an overview of the data analysis, organized according to the research questions.

First sub-question

Which aspects play a role in water management due to increasing droughts as a result of climate change in combination with modeling droughts?

Within this sub-question, the emphasis will be on water management, dealing with the water supply, and addressing demand. In the water distribution models stakeholder involvement and collaboration have become central themes (Voinov & Bousquet, 2010). In particular, the focus will be on a form of collaboration when modeling, namely participatory modeling. It is an approach that thrives on involving stakeholders in a collaborative and open-ended process of shared learning Voinov (2017).

So, within this subquestion, an examination will be conducted with the assistance of value theory to ensure an understanding of the dynamics and comprehend how stakeholders operate. Delving into the literature will give an exploration of how values can evolve and how the values of involved stakeholders manifest in the modeling process.

Second sub-question

What are the key components and underlying principles of the existing water distribution model used for a period of drought?

A distribution model that is used by Deltares is the Quick Water Allocation Simulation Tool. The model makes simulations of future drought events, this model will take the central stage in the research as it is taken as the case study of this research. The entirety of drought modeling exists of different components (Mishra & Singh, 2011), as can be seen in Figure 3.2.

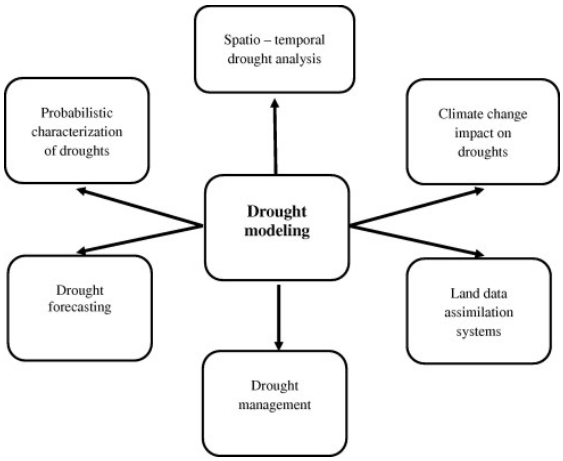

Figure 2.1: Different components of drought modeling

The six elements depicted in Figure 3.2 encompass drought modeling. This research specifically centers on drought management, delving into a deeper understanding of coping strategies. While the study won't delve into the technical details of how climate change precisely affects droughts, it acknowledges that climate change contributes to more frequent occurrences of droughts. The other four elements are excluded from consideration. The model used by Deltares for grasping drought will be employed to understand how drought periods are modeled. This will be elucidated through literature and discussions with the model developers. However, grasping how drought is modeled requires not only the technical aspect but also an exploration of who is involved and to what extent in the development and use of such models.

The inclusion of stakeholders is of great importance in modeling (van Bruggen, Nikolic, & Kwakkel, 2019). An overview of the important stakeholders will be given. Koppenjan and Groenewegen (2005) and De Bruijn, Heuvelhof, and Veld (2010) underscore the significance of involving and consulting stakeholders in the decision-making process. Bryson (2004) further validates this importance by citing a study examining 400 strategic decisions. This study found that half of the decisions failed due to the neglect of stakeholders' interests and relevant information by decision-makers. In a water distribution model, where the interconnected nature of the system involves various stakeholders, no single entity exclusively manages the water. Instead, multiple stakeholders, including individuals, groups, and organizations, are both involved in and affected by the decisions taken.

So, within the second subquestion, the functioning and underlying facets of the QWAST water distribution model will be explained. This will be achieved by analyzing the tool itself running it and observing its operation. Additionally, data will be gathered from policy and company documents to gain insight into its workings. Furthermore, a stakeholder analysis will be conducted based on the model to determine which actors are the most influential and important, and which ones will be included in further research and thus engaged in the interview process.

Third sub-question

What are the stakeholders' perceptions regarding the modeling of droughts, and what are the key concerns?

The last sub-question of this research goes one step further after identifying the aspects that contribute to water modeling focused on water management and -demand and after the principles of QWAST and the key stakeholders are identified based on the water demand. The last sub-question focuses on gaining a deeper understanding of stakeholders' perspectives regarding these models, shedding light on their perceptions and concerns. This phase also entails an exploration of the conflicts that may arise during implementing these values into the distribution model. These conflicts can therefore arise because the identified key stakeholders have different interests and therefore different demands. These demands also have two sides, on the first hand a certain quality may be demanded and on the other hand the water demand can consist of water quantity.

After exploring the perceptions, concerns, and values of the key stakeholders the connection will be made with the distribution model QWAST to get a grip on how well the values of key stakeholders are represented in the model. Due to the different water demands conflicts play a role. It is essential not only to identify these conflicts but also to understand their origins, dynamics, and implications, because to resolve conflicts, you need to understand their origins.

The diverse viewpoints and concerns are the basis for gaining insight into the value and effectiveness of these water distribution models.

The data from the interviews will need to be analyzed through transcription. Transcribing interviews help categorize and organize the generated data, aiding in its interpretation (Halcomb & Davidson, 2006).

3

Theoretical concepts

This chapter delves into two theoretical concepts: values and modeling with stakeholders. These two concepts are not independent, they are interconnected. Each involved actor operates based on a particular mindset, encapsulated by values. In water distribution modeling, models are employed to gain a better understanding of how water can be distributed among the involved actors. As actors are connected to these models, their actions are guided by their specific values. When drought occurs, the perceptions and actions of involved actors can change, influencing the values they pursue. This change of perceptions can lead to conflicts with their values.

The chapter will begin by explaining what values are, how they evolve, and the potential value conflicts that may arise. Subsequently, the focus will shift to modeling with stakeholders. The chapter will conclude with an overview of individual and group values, that can help by identification of the values of the different actors.

3.1. Values, value change, and value conflict

In this research, it's crucial to grasp the nature of values and how they can evolve, as they underlie the actions of actors involved in drought modeling. Figure 3.1 illustrates their interconnectedness. Three distinct steps are distinguishable: the structure of the value itself, the potential for value change, and the possibility of conflict. This section is divided into three parts to maintain this sequence. First, the structure of values will be explained, followed by an exploration of changing values. These changes can arise from five factors, with drought being an incentive for potential alterations. This elucidates why drought holds influence in this value framework. Finally, there will be delved into what leads to conflicts. Initially, this will be discussed in a general sense, followed by a specific examination of how drought can contribute to conflicts in the context of the Netherlands.

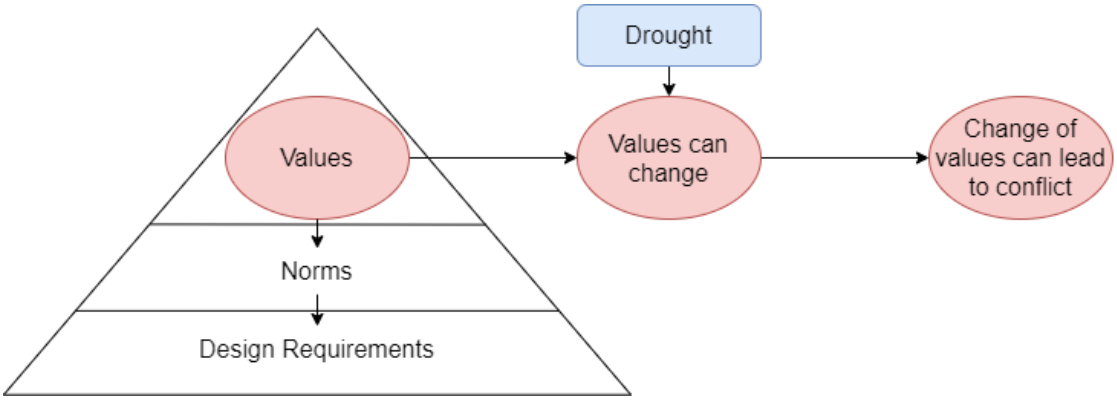

Figure 3.1: Relationship values
(van de Poel, 2013)

3.1.1. Structure of values

The structure of values, as outlined in the study of van de Poel (2013), consists of three distinct levels. At the uppermost tier overarching values are identified. In the middle level, norms delineate actions supportive of these values, encompassing objectives, goals, and constraints that establish boundaries or minimum conditions. The foundation of the value hierarchy rests on the bottom tier, in this bottom tier the core is formed by detailed and specific design requirements as seen in the pyramid in Figure 3.1. In this figure, the arrows are drawn from top to bottom because norms stem from values and design requirements are developed from norms. Values, according to Friedman et al. (2020), entail ”what holds significance for individuals in their existence.” Other researchers have characterized values as ”concepts or convictions regarding desirable outcomes or conduct that transcend specific situations, offering guidance in the selection or assessment of actions and occurrences, organized by their relative significance” (Schwartz & Bilsky, 1987). Alternatively, values can be perceived as ”enduring beliefs or principles that individuals believe should be pursued universally, contributing to a fulfilling life or the establishment of a virtuous society, beyond personal interests” (Poel & Royakkers, 2011). In addition, values are also seen as more universal compared to beliefs, which are assertions treated as factual by individuals (Goyal & Iychettira, 2022). Therefore, this delineates the nature of values. The next paragraph will explore the mechanisms through which they change.

3.1.2. Value change

The literature addressing ethics in science and technology acknowledges that societal values are not fixed and undergo evolution over time (Goyal & Iychettira, 2022). In a broad sense, alterations in values may be instigated by specific events, generational shifts, moral advancements, societal transformations, or technological breakthroughs (Melnyk, 2021). The occurrence of drought is such an event that can alternate values. A period of drought can alter perceptions and lead to changes in values, because without drought, there is an ample water supply, ensuring sufficient water for the involved parties. However, when transitioning to water scarcity, these same stakeholders can perceive the situation differently, potentially resulting in a shift in values. Because the values that actors associate with water distribution during drought and the value they associate with water distribution during non-drought periods can vary, drought can lead to a shift in values. Examining value transformation Melnyk (2021) characterizes it as ”a gradual process that extends the societal functions of values to new dimensions of moral consideration.” To facilitate a methodical examination of value evolution, Poel and Royakkers (2011) formulated

different kinds of value change:

1. the emergence of new values
2. shifts in the relevance of values
3. alterations in the prioritization of values
4. transformations in the conceptualization of values
5. changes in the specification of values through norms and design requirements

So, a period of drought can be the stimulant for a change in values. This research will ask the involved parties how their values change in response to drought.

3.1.3. Value conflict

Conversations indicate that changes in values lead to conflicts in values. For instance, Niet, Dekker, and van Est (2022), in their examination of the impact of digitization on the energy system, observe that emerging values—such as autonomy, power balance, technological control, and equity—may clash with 'anchored' or 'institutionalized' values, such as affordability, (cyber)security, privacy, reliability, and sustainability. Additionally, Dignum et al. (2016) have identified distinctions between conflicts among values and conflicts arising in the implementation of the same value in their analysis of the public discourse surrounding shale gas in the Netherlands. Exploring the research conducted by Dignum et al. (2016) provides a valuable perspective and a practical foundation. Dignum et al. (2016) distinguish between procedural values, which pertain to decision-making processes and rules within a specific context, and substantive values, which relate to the object under consideration, such as a technology.

Incorporating values into modeling requires two essential steps: firstly, identifying the values at play, and secondly, determining which values conflict and cannot coexist in the same design. To determine which values are at play firstly the actors who are incorporated shall be determined. In this particular research, the actors who are incorporated into water distribution modeling during drought are selected. Because the actors involved are determined, it can be determined which values might conflict and which ones can cooperate. To provide a tangible example, consider the design of a car may embody at least two key values, namely safety and sustainability. A trade-off between these values appears inevitable; for instance, a lighter car may be more sustainable in terms of fuel consumption but less safe for the driver and passengers (Poel & Royakkers, 2011).

3.1.4. Water conflicts

Drought can give rise to changes in values, which can lead to conflicts. These water conflicts represent a challenge, ranging from strained international relations to environmental degradation. At its core, a water conflict arises from the competing demands for water among different users, often rooted in disparities in access, use, and the values associated with water resources (Dinar, Rosegrant, & Meinzen-Dick, 1997). Such conflicts can manifest in various forms, each characterized by its unique dynamics and impacts. Different types of conflicts can be identified, and these seven different types of conflicts are explained further below (Angelakis et al., 2021).

1. **Inter-State Water Conflicts:** Inter-state water conflicts transpire between different countries sharing a common water body, such as a river or a lake.
2. **Intra-State Water Conflicts:** Intra-state water conflicts occur within a single nation and are primarily driven by regional disparities in water availability and access.
3. **Urban-Rural Water Conflicts:** Urban centers, characterized by increasing populations and industrialization, often demand a greater share of available water resources, leading to conflicts with rural areas reliant on agriculture.

4. **Water Quality Conflicts:** Water conflicts are not solely about the quantity of water; quality plays a significant role as well.
5. **Transboundary Water Conflicts:** Transboundary water conflicts go beyond borders and involve shared water bodies or aquifers between regions, provinces, or states within a single country.
6. **Ecological Water Conflicts:** These conflicts revolve around the conservation and protection of aquatic ecosystems, including rivers, wetlands, and marine environments.
7. **Climate-Induced Water Conflicts:** The impact of climate change, including altered precipitation patterns, increased droughts, and rising sea levels, can spark conflicts over access to dwindling water resources.

To understand which category applies to what happens when a period of drought occurs in the Netherlands, it is important to recall what happens in times of drought. During a drought, less water is available, turning it into a scarce resource. Many involved parties request water from the river Rhine, but these parties can no longer be fully supplied with their entire water demand delivered by the river. This has the potential to lead to conflicts, as multiple parties strive for a share of the same scarce water supply out of the river basin. The conflict arising among different parties seeking water can be viewed as an intra-state water conflict because sectors such as shipping and agriculture both seek their share of the water demand, which becomes unattainable. However, during periods of drought, another conflict emerges, linked to the intra-state conflict but aligning more with ecological water conflicts. This is due to the conflict between meeting the demands of sectors and addressing the intrusion of saltwater. Thus, during droughts, these two types of conflicts arise, with the awareness that these conflicts are inherently influenced by climate, categorizing them as climate-induced conflicts.

To connect this to the context of values, a period of drought activates potential changes in values. Within the modeling of this drought to gain insights into how to manage it effectively, these values play a significant role. The actions of the involved parties depend on the values they hold in their interests. These values, manifested through interests, find their way back into the water distribution model, as these stakeholders communicate their interests during the development of water distribution models. However, these values in water distribution may differ if there is normal water availability or there is a water shortage. Therefore, identifying the change of values is crucial to determine the extent to which these involved parties differ or align, helping gauge the degree to which they experience an intra-state water conflict. Within the next section, the modeling part will be explained.

3.2. Modeling with actors

Actors are valuable in modeling and this works in two directions, actors contribute to modeling and models can be used by actors (Assaf et al., 2008). In this particular case, drought modeling, different components are defined, as seen in Figure 3.2. The actors that participate in the process of drought modeling have different degrees of actor participation in the different components of a project. This depends on the specifics of the participatory modeling process, including who is involved, what interests they have, their level and type of expertise, legislative requirements and societal expectations, the urgency of the project, constraints or relative freedom in project design, and specific knowledge requirements (Voinov, 2017). It is argued that there is no optimal level of engagement or predetermined components that people need to participate in, and not all modeling activities should necessarily involve participation in all process components (Voinov & Bousquet, 2010). So every problem can be followed differently and is unique to that extent. During the various phases (see Figure 3.2), involvement might lean more towards the

online rather than the physical, indicating an interest or intention to participate rather than active involvement. In any project management process, careful consideration is essential, taking into account both the motivations and intentions driving actors to engage and the motivations and intentions of modelers in suggesting and facilitating actor involvement (Hubacek et al., 2017). It's crucial to explore not only why actors may desire participation but also, significantly, how influential actors might permit, facilitate, or impede the involvement of other actors. Actors have the potential to be engaged in any of the components of the process. However, it's improbable for a particular actor to be involved in all components, as evident in most studies reviewed (Voinov, 2017).

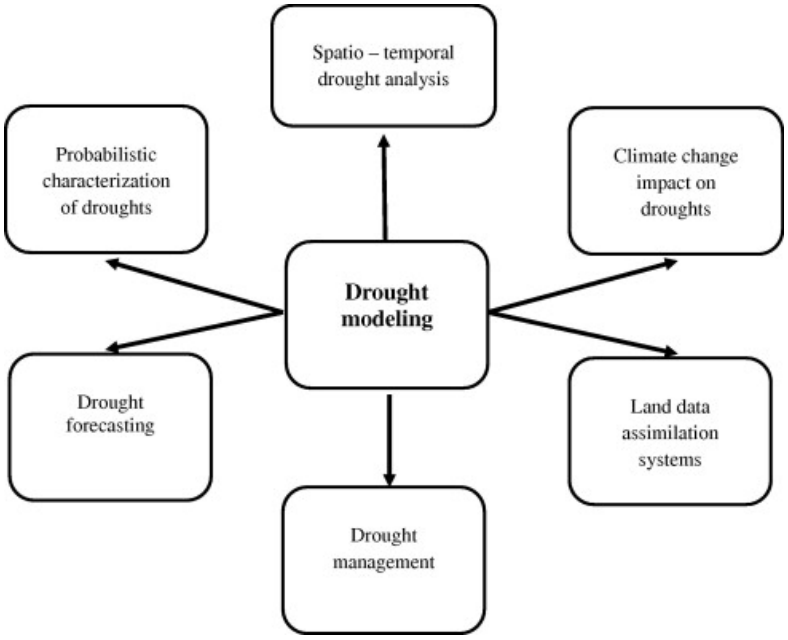

Figure 3.2: Different components of drought modeling

The understanding of aspects of drought models poses a challenge. Therefore, the models chosen are those capable of providing an overview of drought management. As discussed, the involvement of actors varies to some extent in the conceptualization of drought modeling in the Netherlands. The Dutch approach to modeling drought aligns with the collaborative philosophy of pondering. Poldering can be described as a consensus model, a process involving constant negotiation to reach an agreement. Several initiatives in the Netherlands aim to bring together actors to understand how to address drought, for instance, the Integrated River Management (IRM) and Delta Freshwater Program are initiatives where actors such as knowledge institutes, Deltares, Rijkswaterstaat, and sectors convene. These actors are involved in their unique ways, with varying levels of intensity. However, the increasing occurrence of drought due to climate change necessitates a better understanding facilitated by models. As drought becomes more frequent, gaining improved insights through models becomes crucial. Water distribution models rely on actors actively taking part. Consequently, adapting to upcoming droughts will require changes compared to current practices of water management, urging a shift in the approach to effectively cope with impending drought challenges.

Policy analysts have introduced various approaches to formulate or design policy pathways aimed at change of water management (van Bruggen et al., 2019). Participatory approaches are considered ”transformative” when they facilitate participants to transform (Haasnoot, Middelkoop, et al., 2012). Simulation models play an important role in supporting collaborative decision-making, a fundamental element of transformative change, by bridging the gap between societal practices and scientific approaches (Sterman, 1994). This important role of the use of simulation models is recognized because it makes practitioners and advocates claim that the approach will lead to better water management, balancing interests more effectively (Langsdale et al., 2013). Furthermore, to achieve effective water management, decision-making has to include stakeholders which can be enabled by the use of computer-based models, the importance of simulation models is highlighted again here (Basco-Carrera, Warren, van Beek, Jonoski, & Giardino, 2017). The use of these water distribution models is considered an information provision for decision-making. However, there is variation in how these models are employed. Some are directly interpreted as policy outcomes, while others are solely used as informational resources. Within this study, the focus will be on how the current use of the model can be altered to provide information for water allocation during drought across various sectors. This alternation should be kept in mind throughout the research. Effectively supporting decision-making by the use of a simulation model requires a clear understanding of its various forms. In this study, the focus is on the type distinguished by De Bruijn et al. (2010), they have developed a form of decision-making that encapsulated the values of the actions of the parties involved, as illustrated in Table 3.1.

Table 3.1: Design principles of process design described by De Bruijn et al. (2010)

Principle	Description
Openness	All relevant parties are involved in the decision-making process
	No substantive choices made prior to the process
	Both process design and process management are transparent
Protection of core values	The core values of parties are protected
	Parties commit to the process rather than the result
	Parties are not asked to commit to sub-decisions during the process
	The process has exit rules
Progress	Stimulate early participation of all relevant parties
	The process carries a prospect of gain
	There are quick wins
	The process is heavily staffed
	Conflicts are addressed in the periphery of the process
	Tolerance towards ambiguity
	Command and control are used to maintain momentum
Substance	Substantive insights are used for facilitation, using the roles of experts and stakeholders
	The process proceeds from substantive variety to selection

Four principles are discussed. The second category described by (De Bruijn et al., 2010) is important because it encapsulates values. It's important to ensure that parties don't feel stuck in a process where decisions have already been made, and their participation is just for show. Protecting the core values of the involved stakeholders helps prevent this. This way, parties feel assured that they aren't being forced into choices against their will. Parties are only expected to commit to the process itself rather than the outcomes. This can also be linked to what Voinov and Bousquet (2010) emphasize: values must be considered in the decision-making process.

However, the effectiveness of modeling is conditional upon a robust social and qualitative process. In many instances, modeling efforts fail to empower stakeholders to take ownership of the decision-making process essential for transformative change (van Bruggen et al., 2019; Rajablu, Marthandan, Fadzilah, & Yusoff, 2015). This ownership of the collaborative process is particularly crucial in addressing global challenges such as climate change and designing transformative policy pathways (Voinov & Bousquet, 2010). When stakeholders perceive ownership, the model is more likely to add value. While there's extensive literature on participatory research and modeling with stakeholders, the added value that these two aspects contribute to transformative processes is lacking (Voinov, 2017; Haddad, Nakić, Bergek, & Hellsmark, 2022). The research field of modeling with stakeholders is difficult to grasp, with different scientific incentives in place, disciplinary biases, and research fragmentation across academic domains in the social sciences (van Bruggen et al., 2019), This makes it hard to understand how people

cooperate, slowing down progress in the field.

Transformative efforts in coupled socio-technical-environmental systems necessitate a shift, such shifts require a fundamental change in our social reality, including its goals, paradigms, and deep structures. Transformation often emerges from disorienting dilemmas or cumulative events, challenging individuals' core beliefs and assumptions (O'Brien, 2012). This process is followed by critical reflection, which may lead to the development of new meaning perspectives. Collaboration among actors becomes vital when they realize the need for fundamental change that individual efforts cannot achieve (Kitchenham, 2008). Collaboration entails bridging the gap between expert and stakeholder knowledge, and recognizing that expertise exists within a diverse group of stakeholders. Ambiguity, stemming from integrating multiple knowledge frames, plays a critical role in the collaborative process. This ambiguity can lead to various interpretations and can make collaborative processes harder. Shifting systems toward alternative development pathways is a non-linear process, characterized by adaptation and evaluation. Policies formulated to achieve transformative change are conceptualized as evolving pathways that respond to changing circumstances and require continuous evaluation. Not only policies but also water distribution models can be seen as evolving pathways. These models are continually adapting to evolving circumstances. These efforts involve various actors, system components, and external events, highlighting the ethical and procedural questions surrounding the creation of a sustainable future (van Bruggen et al., 2019).

3.3. Interpretation of values

As mentioned, values can be challenging to grasp, especially concerning water distribution models (Bello et al., 2019). Various perspectives exist in the literature on how to describe and name these values. In this section, it will be attempted to identify and describe the most important values as a foundation for conducting interviews to uncover them. Two different approaches will be explained to give an overview of how values are described. Schwartz (2012) and Friedman et al. (2020) have both researched how to describe values. Schwartz (2012) focused more on the personal level, while Friedman et al. (2020) explored values on a group level. These two perspectives were chosen because stakeholders in water distribution models act in the interest of groups, but they are also individuals who can make decisions based on personal values. To merge these aspects, both sides of these values will be considered. As said, Schwartz (2012) values are more related to the personal aspect. There are ten fundamental personal values, as seen in Table 3.2.

(Schwartz, 2012)

Table 3.2: Value Categories, adopted from Schwartz (2012)

Value Categories	Defining Goals
Power	Social status and prestige, control or dominance over people and resources.
Achievement	Personal success through demonstrating competence according to social standards.
Hedonism	Enjoying or indulging in personal pleasure.
Stimulation	Excitement, novelty, and challenge in life.
Self-Direction	Independent thought and action - choosing, creating, exploring.
Universalism	Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature.
Benevolence	Preservation and enhancement of the welfare of people with whom one is in frequent personal contact.
Tradition	Respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide the self.
Conformity	Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms.
Security	Safety, harmony, and stability of society, of relationships, and of self.

On the other end of the spectrum, Friedman et al. (2020) provides an overview of more group-oriented values. This overview is provided in Table 3.3.

Table 3.3: Value Categories, adopted from Friedman et al. (2013)

Value Categories	Defining Goals
Human Welfare	Refers to people's physical, material, and psychological well-being
Ownership and Property	Refers to a right to possess an object (or information), use it, manage it, derive income from it, and endow it
Privacy	Refers to a claim, an entitlement, or a right of an individual to determine what information about himself or herself can be communicated to others
Freedom From Bias	Refers to systematic unfairness perpetrated on individuals or groups, including pre-existing social bias, technical bias, and emergent social bias
Universal Usability	Refers to making all people successful users of information technology
Trust	Refers to expectations that exist between people who can experience goodwill, extend goodwill toward others, feel vulnerable, and experience betrayal

Autonomy	Refers to people's ability to decide, plan, and act in ways that they believe will help them to achieve their goals
Informed Consent	Refers to garnering people's agreement, encompassing criteria of disclosure and comprehension
Accountability	Refers to the properties that ensure that the actions of a person, people, or institution may be traced uniquely to the person, people, or institution
Courtesy	Refers to treating people with politeness and consideration
Identity	Refers to people's understanding of who they are over time, embracing both continuity and discontinuity over time
Calmness	Refers to a peaceful and composed psychological state
Environmental Sustainability	Refers to sustaining ecosystems such that they meet the needs of the present without compromising future generations

Highlighting two types of values provides insight into identifying them in conversations with the actors involved. Recognizing these values offers insight into what these actors deem important.

In this chapter, two distinct theoretical themes have been discussed. Firstly, the concept of values and their relevance in the context of drought, and secondly the relationship actors with water distribution models. Actors pursue specific interests and beliefs derived from these values. The utilization of water distribution models involves these parties by characterizing these interests and beliefs and incorporating them into the model. For these water distribution models to function effectively, stakeholders need to reach a consensus on how their values are represented within them. If not, the model's empowerment is compromised. Therefore, it is crucial to identify the interests encapsulated in values that these stakeholders hold, determining the value of using these water distribution models. This will be explored in the next chapter, where the water distribution model QWAST will be researched. Following this, the interviews can be conducted to assess the values and their corresponding representation in QWAST.

4

National water distribution models

The frequency and severity of periods of droughts will intensify (Hunink & Visser, 2014). The Dutch government embarked on a comprehensive policy analysis, known as the Dutch Delta Programme, to tackle these periods of drought. The Dutch Delta Program for the 21st century in the Netherlands safeguards the country against floods, ensures an adequate freshwater supply, and contributes to a climate-resilient and water-robust infrastructure (Ministerie van I&W, n.d.). This plan seeks to ensure the management of freshwater supply.

To undertake this policy analysis by the Dutch government, it is crucial to quantify the water-related problems. This quantification can enable prioritization and the identification of tipping points and their temporal aspects (Haasnoot, Deursen, et al., 2012). Building upon that, the multi-disciplinary modeling system known as the Delta model was developed. This model serves as the overarching framework, encompassing the distribution model utilized by Deltares, which is the Quick Water Allocation Scan Tool (QWAST). The Delta model distinguishes itself by being one of the pioneering model suites, encompassing the nationwide water system, both surface and subsurface elements, to study fresh water supply (Prinsen et al., 2014). The Delta Model integrates multiple usage sectors, including agriculture, navigation, drinking water, industry, ecology, and energy. This model is designed to enable scenario analysis and exploration of potential adaptation strategies, ultimately garnering support from modelers, regional water managers, and policymakers.

The Delta model isn't entirely novel, its primary objective is to integrate existing models into a framework, encompassing impact assessment models and databases. This integration enhances the integrity and coherence of the Delta Programme, as illustrated in Figure 4.1. Notably, there are only a few comparable nationwide modeling systems identified in the existing literature.

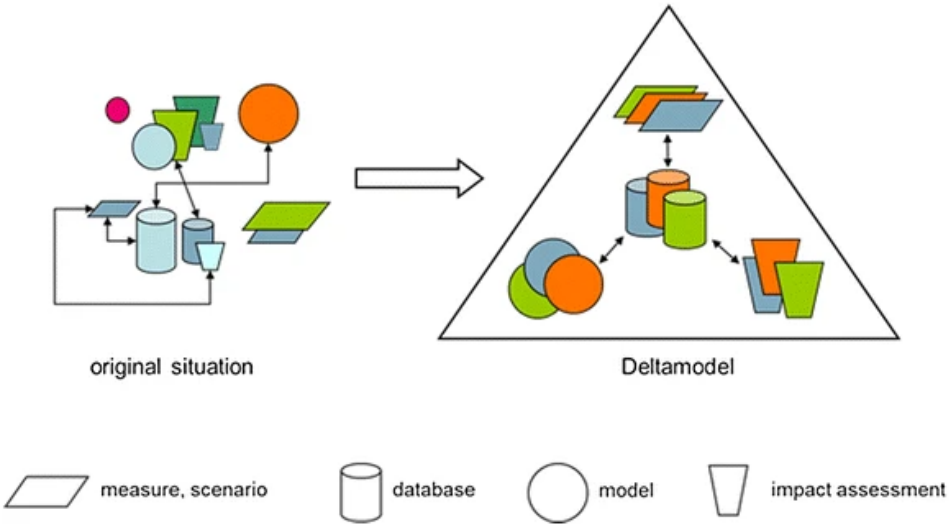

Figure 4.1: Build-up Delta Model
(Prinsen et al., 2014)

In the realm of literature, only a limited number of nationwide modeling systems similar to the Delta model can be located. In the context of the Netherlands, the development of a national water modeling instrument can be traced back to the aftermath of the drought of 1976 (Rijkswaterstaat, 1984). This period led to the creation of the PAWN instrument, a component supporting the Policy Analysis for Water in the Netherlands (PAWN), as documented by Pulles (1985). The PAWN instrument focused on simulating water distribution across the country, taking into account variables such as water availability, water demand, and the capacity of the water system.

4.1. Characteristics of Delta Model

The planning of the Dutch water management system helps to navigate through uncertain developments in the upcoming century. Two factors on the horizon are climate change and socioeconomic growth (Wolters et al., 2018). These factors are autonomous forces, shaped by external factors over which the Netherlands has limited control. The intricate web of water management in the Netherlands is sensitive to a multitude of uncertain developments (Cunha, 2023). Climate change threatens to bring periods of increased drought and erratic river flows. Moreover, in the event of economic growth or a population surge, elevated levels of protection for densely populated urban areas, alongside a reliable freshwater supply, might be demanded (Wolters et al., 2018).

While the general direction of these developments is known, their pace remains highly uncertain, particularly in the case of climate change. Therefore, it is compulsory to account for a wide range of possibilities, especially when looking far into the future (Cunha, 2023). The Delta Scenarios have been crafted to describe this plausible spectrum of developments, their interconnections, and their potential consequences for spatial usage and water management.

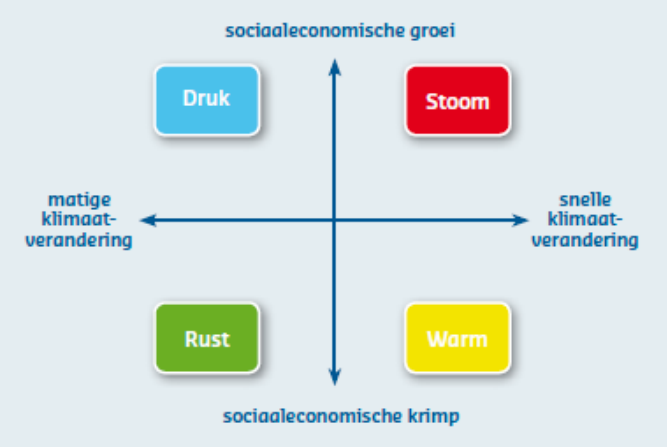

Figure 4.2: Overview Delta-scenarios
(Hunink & Visser, 2014)

Figure 4.2 provides an overview of the Delta Scenarios, including the labels assigned to the four combinations of economic growth and climate change. These combinations are as follows:

- DRUK: High economic growth and slow climate change.
- STOOM: High economic growth and rapid climate change.
- RUST: Low economic growth and slow climate change.
- WARM: Low economic growth and rapid climate change.

Figure 4.2 displays the interaction of global climate change and socio-economic factors, intertwined through increased fossil fuel usage. Uncertainty in climate models broadens expectations (Brink et al., 2019). Referring back to Figure 4.1, it can be seen that scenarios are integrated into the entire Delta model. Yet, it's important to recognize that the Delta model encompasses tools dedicated to generating data on diverse water-related issues. Among these tools is the National Hydrological Instrument, NHI. That will be discussed in the following section.

4.1.1. Netherlands Hydrological Instrument

The Netherlands Hydrological Instrument (NHI) is constructed of five physically distinct models with different concepts, temporal and geographical scales, and for various water domains. Characteristics of surface and subsurface water in the Netherlands are illustrated in **??**, along with the domains that the NHI models cover. (De Lange et al., 2014). At the national level, the primary transportation and storage capacity is managed by a small number of very large canals, rivers, and lakes with weirs, during water shortage and surplus (De Lange et al., 2014). The Rhine River and precipitation are the main sources of water. Secondly, regional water distribution is accomplished at the regional level via intermediate surface water bodies. Sub-catchments of the country's west and north coast are made up of polders (De Lange et al., 2014). And lastly, to increase the land's economic worth, seepage zones have been drained and the majority of brooks and streams in the remaining portion of the nation have been canalized.

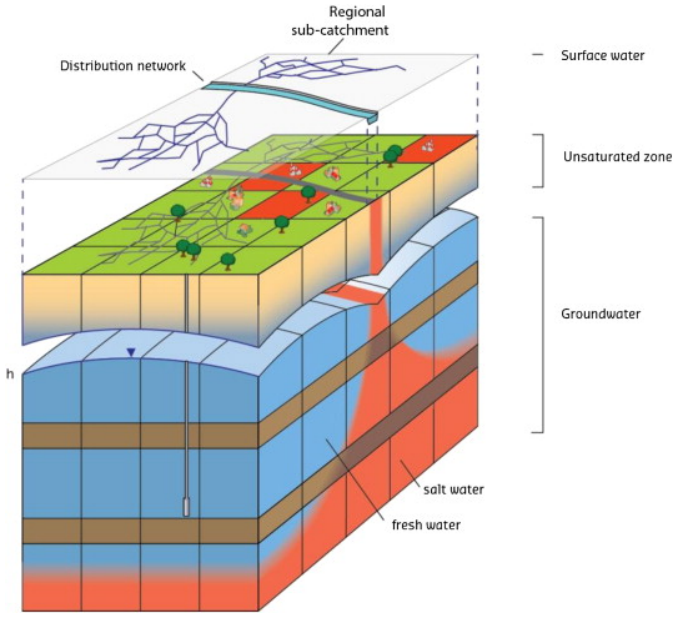

Figure 4.3: Water domains covered by the five NHI model components
(De Lange et al., 2014)

Optimizing the distribution of water throughout the Netherlands during times of scarcity is one of the responsibilities of the NHI. This task is performed by the Surface Water for Optimized Distribution, SWOD, this includes the principal regional surface waterways as well as the primary national surface water system (De Lange et al., 2014). The hinterland's water supply and demand are determined by the Surface Water for Sub-Catchments, SWSC, and are predicated on the equilibrium of water, including both surface and subsurface water (Hughes et al., 2021). The sub-surface water flow is simulated by two parts: the Soil Vegetation Atmosphere for the Transfer of Water, SVAT, and the GroundWater, GW (De Lange et al., 2014). The Surface Water Flow and Transport, SWFT, calculates variations in the surface water's temperature distribution and salt content for practical water management in dry conditions, an overview is given in Figure 4.4.

ID	Domain	Purpose	Scale of process	Present name (www.nhi.nu↗)
SWOD	Surface Water	Optimization of Distribution	Nationwide	DM
SWFT	Surface Water	Flow and Transport	Nationwide	LSM
SWSC	Surface Water	Distribution to users of groundwater & surface water	Sub-Catchment	Mozart
SVAT	Soil Vegetation Atmosphere	Transfer of water in root zone, soil water deficit	Plot, column	MetaSWAP
GW	GroundWater	Flow and transport	Regional	MODFLOW

Figure 4.4: Distinction National Hydrological Instrument

As observed, the description covers five distinct domains, see Figure 4.4. SWOD or Distribution Modeling (DM) is central to this research. The tool employed by Deltares for this purpose is QWAST.

4.2. QWAST

This tool is thus used to model the distribution of water. Importantly, this model is used in the cold phase of drought. The cold phase is the phase preceding a period of drought and the warmer phase is the phase during a period of drought. QWAST was developed during the second phase of the Delta Program, QWAST was created to optimize the distribution of water and evaluation of measures that impact water supply and demand (Horvath, 2020). It takes into account the regional surface water and the primary water system, focusing on the network of major rivers, canals, and lakes in the Netherlands.

It imports water demand data calculated by NHI for users and districts. Then, QWAST initiates the task of simulating water distribution across the primary network branches (Horvath, 2020). QWAST optimizes water allocation over time, dynamically adjusting to regional demands. It has an extensive network and streamlines priorities based on user types across districts.

4.2.1. Data Flow in QWAST

QWAST calculates using data from the Dutch water system, sourced from the database created by Deltares. Figure 4.5 illustrates the step-by-step process of this. Additionally, it's important to note that QWAST is organized into distinct regions known as water management regions. These should not be confused with the areas governed by water boards; the latter are intentionally structured differently to enable a more precise focus on the specific needs of these regions, see Figure 4.6.

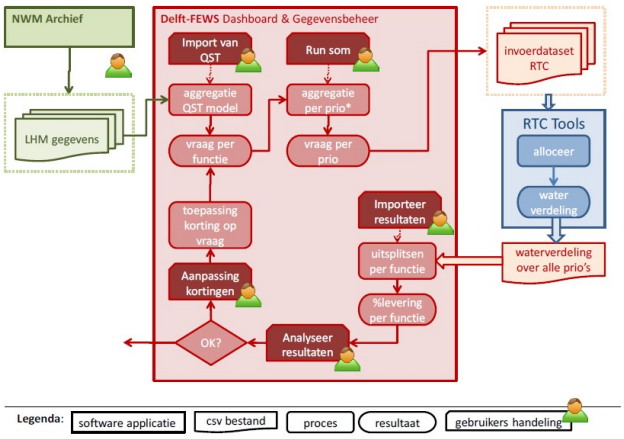

Figure 4.5: Data Flow within QWAST

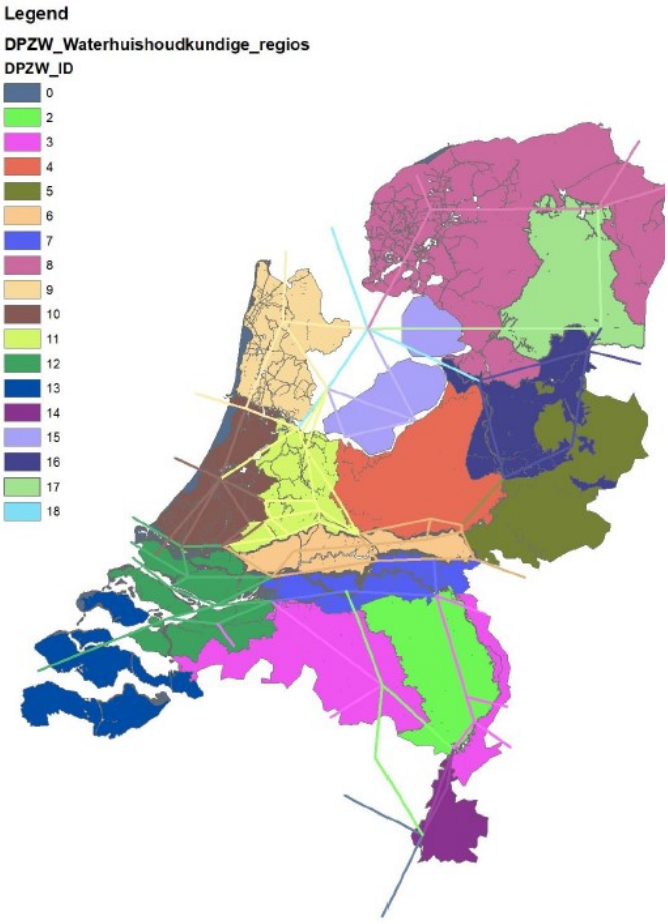

Figure 4.6: Districts QWAST

QWAST uses the following water distribution network in the Netherlands, as can be seen in Figure 4.7. This schematization includes all water supply routes. To reduce network complexity, many physical canals, locks, pumping stations, and other components are combined into a representative point for a corresponding water management unit at different locations.(Horvath, 2020).

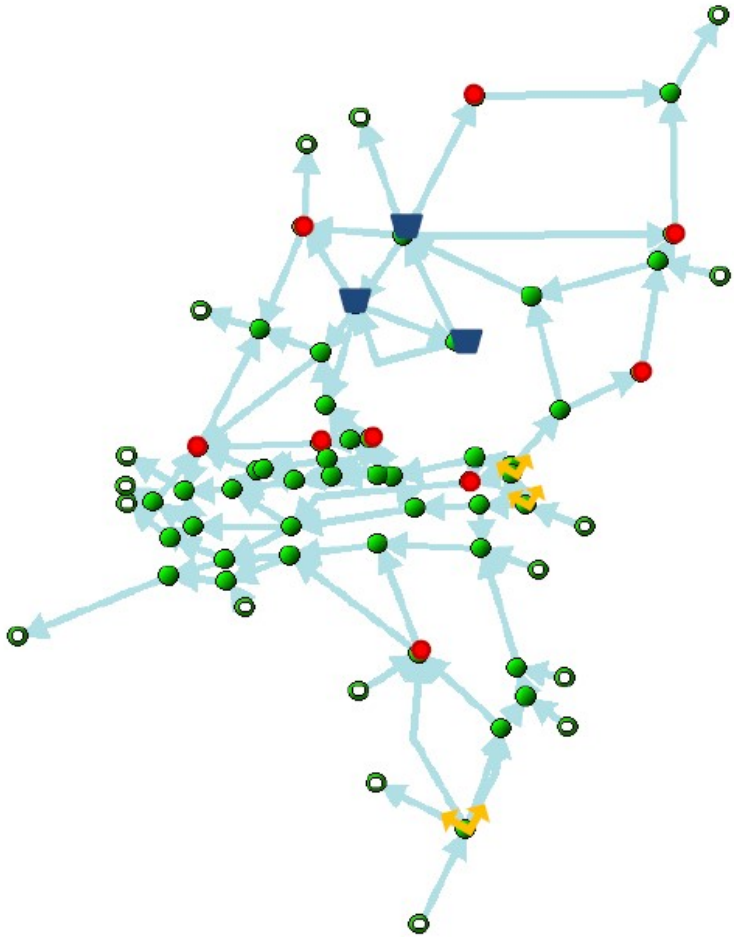

Figure 4.7: Network Schematization

4.2.2. Prioritization

The available water is distributed in QWAST. Distinctions are made between various uses, with some having higher priority than others. This prioritization is implemented in QWAST through a mathematical approach. The problem is formulated mathematically as a set of constraints placed on the flow rates. Each priority level functions as a distinct layer for calculating various priorities to meet diverse water demands. The solution space is systematically refined as priorities progress, guiding the mathematical solution toward the desired state. In Table 4.1 an overview of the priority list used in QWAST is shown. Priorities 1 to 3 address natural losses, channel capacities, and lake levels. Later priorities involve diverse water use functions, particu-

larly lake levels, such as the IJsselmeer. The remaining priorities depend more on the specific water needs of users.

Table 4.1: Priority List in QWAST

Priority	Description
1	Natural Losses
2	Channel Discharge Capacities
3	Lake Level Capacities
4	Water Intake Functions
5	Environmental and Ecological Functions
6	Industry and Agriculture
7	Freshwater Buffer Functions
8	Domestic and Recreation Functions

The diverse priorities identified will be applied in the actor analysis, as elaborated in Section 4.3.2. These varied priorities originate from the priority scale. Consequently, the next step involves creating an overview of the actors involved in water distribution and understanding their relationships. This hierarchy is fundamental to the water allocation process employed in QWAST. Hierarchies are necessary to prioritize water allocation, as certain needs take precedence during droughts. Therefore, employing a hierarchy is crucial. Therefore, the following section will discuss the actors and their relationships with QWAST.

4.3. Actor Analysis

To gain an overview of the actors involved in QWAST, a distinction between actors is necessary. On one side, there are decision-makers determining the allocation of water, while on the other side, there are actors from various sectors. The latter group seeks to secure as much water as possible for their sectors. However, during the development of these models, they are asked for information to ensure a clear understanding of each sector's needs. Actor analysis in this research will be conducted using a power-interest diagram to depict the level of influence and engagement. To provide an overview, it's important to note that in the decision-making process regarding drought, diverse interests and discussion points can occur depending on the specific phase within the overall process.

4.3.1. Decision-making actors

The organization for water management and crisis management in case of water shortage due to drought is comprised of the following actors, involved in the drought column for water management under normal and special circumstances:

- Water managers (water boards, Rijkswaterstaat, and provinces)
- Regional Drought Consultation (RDO)
- National Coordination Committee for Water Distribution (LCW)
- Management Team Water Shortages (MTW)

In the Netherlands, this is linked to the generic crisis column, which includes safety regions and interdepartmental coordination consultations (IAO), the Interdepartmental Crisis Management Committee (ICCb), and the Ministerial Crisis Management Committee (MCCb). However, for this study, these government bodies are excluded as they are only activated in the most severe crises. In Figure 4.8 the interrelations between these actors and levels of action are shown.

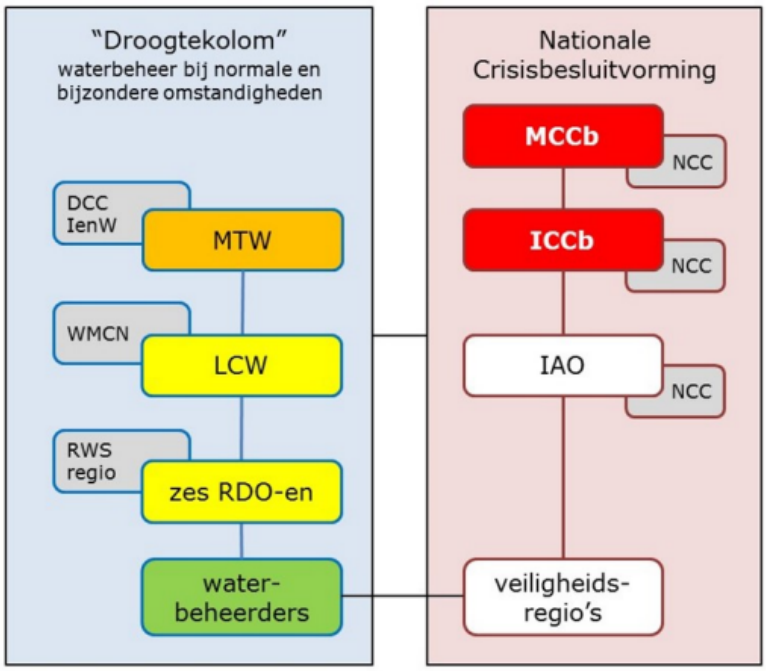

Figure 4.8: Drought column

The colors green, yellow, orange, and red represent different crisis levels, with green being the lowest and red the highest. The various actors discussed in the drought column have different roles at these levels. In the table below, the different organizations, their respective roles, and tasks are discussed in the event of drought in the Netherlands. The table should be read from bottom to top, starting with regular water management.

Active in				Organisation	Task and Responsibilities
		2	3	Management Team Water Shortages (MTW)	Alignment coordination departmental and with partners directorate/management level. The MTW advises the Ministry of infrastructure and Water Management for the water distribution decisions.
	1	2	3	Rural network manager Rijkswaterstaat (LNM)	Determines if there has to be upscaled.
	1	2	3	National coordination committee (LCW)	Monitoring, aligning, and advising nationwide. Creates the national overview.
0	1	2	3	Regional drought consultations (RDO)	Monitoring, aligning, and advising regionally. Makes the regional picture, contributes to the national picture.
Regular management				Rijkswaterstaat, waterboards, and provinces	Responsible for their own areas for water management.

Figure 4.9: Involved actors drought column adopter from Rijkswaterstaat (2020)

This study focuses on the key actors in day-to-day water management. These are provinces, water boards, and Rijkswaterstaat. Provinces can be seen as water managers responsible for various tasks, including swimming water quality, deep groundwater management, extraction of large quantities of water, and, nautical management on regional waterways. Additionally, they are regionally responsible for certain functions from the priority scale, such as nature and economic activities. They make decisions regarding their tasks under normal and special circumstances and handle crisis management. Waterboards oversee water management within their areas. They act as the authority for making decisions related to regular and exceptional circumstances in water management, as well as handling crises. Rijkswaterstaat can be seen as the overarching water manager and makes decisions at the national level. So these three actors are actors who have decision-making authority and will be included in this study.

4.3.2. Sectoral use of water

On the flip side, there are water users who are also actors. The priority scales form the foundation for deciding which sectors of water users are included in the research (Kort & Teunis, 2020). This priority scale prioritizes societal and economic needs during water shortages and this priority scale doesn't apply to groundwater distribution during water shortages. All water managers are obligated to adhere to the priority scale in water shortage situations (Kort & Teunis, 2020). This means they must allocate available water by this sequence. Whether there is a water shortage is determined by the water manager based on the actual circumstances, triggering the application of the sequence in their water management activities. Consequently, the priority scale automatically comes into play during a water shortage.

The priority scales comprise four categories, as can be seen in 4.10, with category 1 having the highest priority, followed by 2, 3, and 4. In essence, during a water shortage, interests falling within category 4 are the first to be reduced. It's the water manager's responsibility, in a specific situation, to determine a priority sequence that minimizes economic and societal harm.



Figure 4.10: Verdringingsreeks

To clarify the different categories are explained:

1. Ensuring flood safety or preventing irreversible damage to category 1 functions is necessary. In such cases, category 1 takes priority over all other categories.
2. Ensuring the security of supply for drinking water or energy is at stake. In such cases, category 2 takes priority over categories 3 and 4. Within category 2, ensuring the supply of drinking water is of higher priority than ensuring the supply of electricity.
3. Preventing significant socioeconomic consequences with a small amount of water is possible for small-scale, high-value uses in category 3 (temporary irrigation of capital-intensive crops and industrial process water). In such cases, category 3 takes precedence over category 4. Within category 3, priority is assigned to needs in a way that minimizes economic and societal consequences.

In conclusion, out of the verdringingsreeks, the following sectors can be taken into account: Shipping, agriculture, nature, industry, water recreation, fishery, drinking water, and supply of energy, Table 4.2

Sector	Implications of Drought
Inland shipping	Reduced water levels in rivers and canals may limit shipping traffic and cargo capacity.
Agriculture	Drought can lead to reduced crop yields, lower quality produce, and increased irrigation demands, impacting the agricultural sector's productivity and profitability.
Nature	Drought may negatively affect ecosystems, leading to habitat loss and endangering wildlife, particularly in wetland areas.
Drinking Water	Water scarcity may impact the supply of clean drinking water, necessitating water use restrictions and conservation measures.
Industry	Reduced water availability can disrupt industrial processes, affect cooling systems, and lead to water use restrictions for manufacturing plants.
Water Recreation	Low water levels in lakes and rivers can limit recreational activities such as boating, fishing, and water sports.
Fishery	Drought can harm fish populations, disrupt spawning.
Supply of Energy	Hydroelectric power generation can be affected by lower water levels, potentially leading to reduced energy production.

Table 4.2: Implications of Drought on Various Sectors

The first four sectors, inland shipping, agriculture, nature, and drinking water, will be explored in more detail within the research. This is because these four sectors have a significant monetary impact on the Netherlands and are of great importance in the case of the distribution of water. Through discussions and research, these four sectors have been analyzed in this specific case, leading to the identification of the following actors.

Inland shipping

Within the Inland shipping sector, two different types of stakeholders can be identified. These are the inland shipping companies and the inland shipping associations. Inland shipping companies have a significant influence on the industry's operations and are directly impacted by its policies and decisions. The associations represent the collective interests of the inland shipping sector. To add more specificity, an examination was conducted to identify the specific actors as presented in Table 4.3.

Stakeholders Group	Stakeholders
Inland Shipping Companies	Wagenborg Shipping, Koninklijke van der Wees Group, VT Group
Industry Associations	Koninklijke BLN-Schuttevaer, Centraal Bureau voor de Rijn- en Binnenvaart (CBRB), Dutch Inland Shipping Platform (Platform Binnenvaart)

Table 4.3: Stakeholders in the Inland Shipping Sector

Agriculture

The same analysis is done for the agricultural scene. Here are also chosen two groups of stakeholders identified. The farmers' organizations and their associations. The farmer organizations have a significant influence on the industry's operations and are directly impacted by its policies and decisions. The associations represent the collective interests of the farmer's organizations.

For a more precise delineation, we have analyzed to pinpoint the exact stakeholders that correspond to these three stakeholder categories. This information is provided in Table 4.4.

Stakeholder Group	Stakeholder
Agricultural Industry Associations	- LTO Nederland (Dutch Federation of Agriculture and Horticulture) - Royal Dutch Grain and Feed Trade Association (Het Comité van Graanhandelaren) - VION Food Group (Meat Processing Company)
Farmers' Organizations	- Nederlandse Akkerbouw Vakbond (NAV - Dutch Arable Farming Union) - Nederlandse Melkveehouders Vakbond (NMV - Dutch Dairy Farmers Union) - ZLTO (Southern Agriculture and Horticulture Organization)

Table 4.4: Stakeholders in the Dutch Agricultural Sector

Drinking-water

A similar analysis for the drinking water stage is done. We also picked three groups of stakeholders that are considered highly interested. The drinking water companies and their respective associations are also included. They perform a similar role as in the two previous sectors, but specifically for the drinking water sector. For a more precise delineation, we have analyzed to pinpoint the exact stakeholders that correspond to these three stakeholder categories. This information is provided in Table 4.4.

Stakeholders Group	Stakeholders
Drinking water companies	PWN Waterleidingbedrijf Noord-Holland, Waterbedrijf Groningen, Waterleidingmaatschappij Drenthe (WMD), Vitens, Waternet, Oasen, Dunea, WML, Evides
Industry Associations	Vereniging van waterbedrijven in Nederland, VEWIN

Table 4.5: Stakeholders in the Drinking Water sector

Nature

Nature can also be looked through, but the difference with the other sectors is that there is no distinction made between nature companies. The difference is that no companies are engaging in economic activities related to nature, unlike drinking water companies whose primary purpose is to produce drinking water to contribute to an ample supply of clean drinking water for the residents of the Netherlands. So only the associations can be described, these are Natuurmonumenten en Staatsbosbeheer.

4.3.3. Power-Interest Grid

In each sector, there are governing bodies that determine matters within the sector, such as the Ministry of Agriculture, nature, and food quality. However, they do not always have a say in the distribution of water, so they have not been included in the analysis conducted here. The government agencies that are considered in this analysis are Rijkswaterstaat, provinces, and water boards. Power versus interest grids help determine which players' interests and power bases are relevant. A high level of power indicates stakeholders have important resources to influence the situation. A high level of interest indicates stakeholders have a high interest in the outcome of the situation, often due to dependency on the decision. Considering these two axes, there are four quadrants a stakeholder can be categorized. Stakeholders belonging to

the ”crowd” must be monitored with minimal effort. ”Subjects” need to be informed with some more effort. ”Context setters” are intended to be kept satisfied, and handled with care meeting their needs. The ”key players” ought to be managed closely due to their high power and interest (Enserink et al., 2022). To give an overview of the different actors that are talked about in this chapter a PI-grid is given in Figure 4.11. The different users of water will be taken into account and not the specific actors because that will give a better view of the situation.

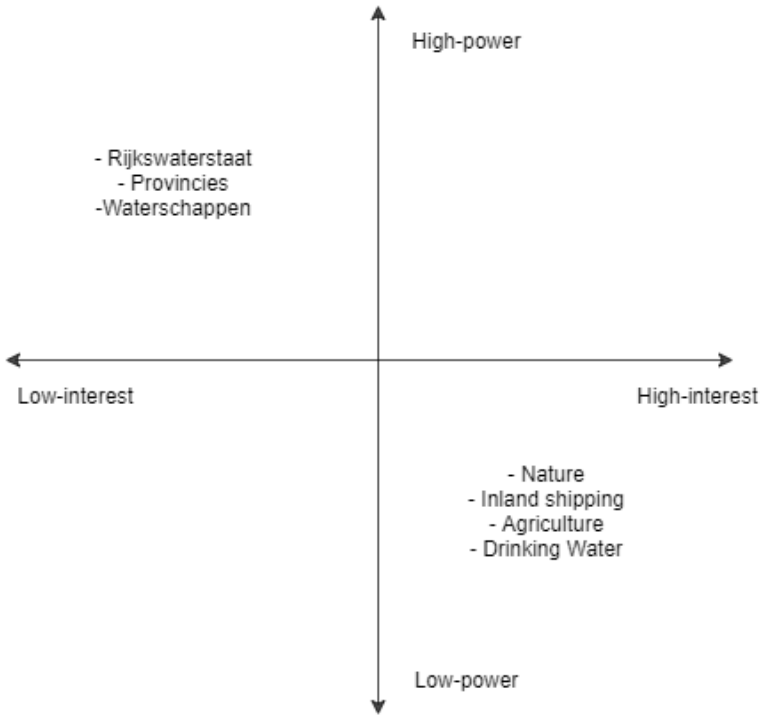

Figure 4.11: Power Interest Diagram

The sectors of nature, inland shipping, agriculture, and drinking water are the ones impacted by decisions on water distribution. These sectors are placed in the section of high interest but low power. The decision-makers – Rijkswaterstaat, water boards, and provinces – will make and implement decisions. These bodies possess high decision-making power but may not have specific sectoral interests, so they are placed in the high-power but low-interest section.

These identified sectors in decision-making bodies are linked to QWAST. To comprehend how these actors are exactly connected to the modeling of decision-making, reconsider the purpose. Deltares primarily employs QWAST as a tool for collecting information on how to distribute water. This information is valuable in assessing how water can be distributed. This information can therefore be given to the decision-makers to make better-constructed decisions. To practically understand how these practices represent their interests, interviews with these decision-makers. This step involves reaching out to different sectors to assess the adequacy of their representation and address their needs. Given the influential role these sectors play in providing valuable information, the policies formulated will have a direct impact on them. To provide an overview, not only the sectors will be made contact but also engage with the policy

side, reaching out to Rijkswaterstaat, provinces, and water boards. This aims to evaluate their viewpoint on this distribution and assess how well they perceive the service to different sectors during drought conditions.

5

Results

In this chapter, the different results will be outlined, starting with the various interests and values, followed by the results related to modeling with actors.

5.1. Interests and values

There has been a shift in the trend regarding drought management. In the past, solutions were predominantly sectoral (C3), but now, there's a notable transition towards cross-sectoral approaches (C3). Unlike before, when opposing interests often dominated discussions, the involved parties are now taking a more collaborative approach (C1). Moreover, there's a noticeable change in water management strategies (C1), with the most notable shift occurring before and after 2018 (C5). Before 2018, ensuring that different parties were aware they couldn't solely rely on their water resources was a challenging task. Since 2018, the involved parties have experienced this firsthand, leading to increased awareness (C5, C2, C9). Furthermore, there's a newfound willingness among these parties to speak up; recognizing that not everything is possible, and choices must be made (C7). This awareness (C2) has also led to the adoption of water distribution models to better understand the situation (C1). This adoption occurs because the models currently used to distribute water under normal conditions serve as an information source for allocating water. However, their function shifts towards allocating water during drought conditions. There is a question being raised about whether these distribution models are capable of allocating water during drought conditions .

This awareness has led to the emergence of cross-sectoral approaches. However, collaboration on tackling drought, while appealing on paper, proves challenging in reality, as indicated by C4, C6, and C5. There's a challenge in how to implement these cross-sectoral approaches effectively. Examples of these cross-sectoral are the Delta Program and Integrated River Management (IRM). According to C3, the Delta Program is more focused on a national level, while IRM pertains more to the management of the Rhine River itself. C7 suggests that the Delta Program is a step in the right direction, considering long-term visions and various agreements. However, there are doubts about how effectively these agreements are being upheld, with a belief that ”who pays, decides” (C7). C5 adds that according to them, there is a question mark raised about IRM, the policy program is referred to as integral, but how truly integral is it in practice is the question that is raised. While other interviewees express optimism, they do not share C7's skepticism to the same extent. There's also a recognition that unclear lines of who has the

power regarding water management hinder collaboration (C4). From a policy perspective, it's essential for the three key actors—water boards, provinces, and Rijkswaterstaat—to engage in better dialogue, as indicated by C2, C4, and C9.

As mentioned in Chapter four, during droughts in the Netherlands, a predefined step-by-step plan involving actors called the drought column is implemented. C6 emphasizes that poor communication within the drought column and between it and other stakeholders hampers collaboration. C5 highlights how organizations in the Netherlands are divided, but actually when it's about sharing water during droughts, working together is crucial. All these separate parts must unite for this matter. Therefore, collaboration is considered necessary, which is why the use of water distribution models is employed. However, to optimize their use, insight into the interests encapsulated in the values of the various sectors is required. This was therefore queried by the interviewees and will be discussed in the next subsection.

5.1.1. Key stakeholders interests

Firstly, the results of the various identified stakeholders will be discussed. What do the interviewees indicate as important stakeholders and how are the different interests identified? Each interviewee was asked how they envision a period of drought and how the various interests of these parties are reflected. These results will first be discussed per identified sector. Then, the various interests will be interpreted based on the values.

Inland Shipping

According to C3, two elements form the basis of the inland shipping sector in the Netherlands. The inland shipping sector is in essence transportation of cargo from point A to B (C3). This involves two critical factors in the process: water depth and the capacity of the locks. However, interviewees (C5, C6) state that inland shipping cannot be seen as one, it consists of different parts of the overall sector. Three different parts can be distinguished (C3, C1), the shippers themselves, the logistics service provider, and the inland shipping entrepreneur.

The collective interest of the whole sector lies in ensuring or maintaining transport capacity (C3). But there are thus three different components of this sector identified. Besides the overarching interest, these three different components also have their interest in times of drought. The shipper may occasionally have a different priority, merely wanting their cargo transported, whether by road or water (C6). Thus, the shipper may deviate at times from the wishes and interests of the other parties. Additionally, the logistics service provider places less emphasis on water quality and more on quantity (C3, C5).

To gain a broader understanding of the inland shipping sector, the perspective from the port of Rotterdam has also been examined. Because to access the Netherlands through inland shipping, the entry must first be through the Rotterdam port. Drought also impedes operations at the port, negatively impacting the entire logistic chain. The port of Rotterdam serves not only as a transit port but also has an informative role for smaller ports and the inland water system of the Netherlands (C6). Viewed as a facilitator, the port of Rotterdam, during drought, contends with reduced water availability, leading to poorer flow of goods to the hinterland and increasingly crowded terminals (C7). The worst-case scenario involves such extensive delays that storage capacity is filled, compelling ships to divert to Antwerp (C6). It serves as a connector, linking the Netherlands with the rest of Europe/World, and contributes to maintaining and enhancing the reliability of the entire logistics chain (C6).

Agriculture

Contact has been made with direct agricultural sector representatives, but unlike shipping, no contact has been established. Therefore, the individuals who were interviewed have shared their knowledge regarding this sector. The interviewees indicated that the agricultural sector is also one of the key sectors that are impacted during times of drought (C1-C9). During times of drought, the agricultural sector in the Netherlands requires water to nourish the crops (C1-C9). The sector's interest is therefore to generate sufficient income from their activities to sustain themselves, which is accomplished by the cultivation of different crops (C4, C7, C2). Agriculture has a high water demand, but C1 suggests that this water is not of high quality, which is contradicted by C7 and C5. These actors indicate that the high water demand during drought cannot be met, resulting in limited water availability of low quality; ideally, water should be of high quality to reduce the quantity needed and ensure better survival for agriculture (C1). Moreover, within agriculture, it is incorrect to speak of a singular sector, thus agriculture can be broadly categorized into arable farming, horticulture, and livestock farming (C4). So these three different types of agriculture have different water demands, but because direct contact was not made with the agriculture sector, no distinction was made between these three categories, and there is constant reference only to agriculture.

Nature

Nature in the Netherlands ensures the livelihood security of its inhabitants, serving as a fundamental common interest for its residents (C5). Nature positively contributes to human health, a point acknowledged by everyone (C1-C9). However, some emphasize that this contribution is often underestimated because it is the nature sector does not always have a voice, and as a result, it often ends up being the one left out (C4, C5). To make it more tangible, a metaphor is drawn by C4, likening the situation to a large vase filled with beer, where each sector has a straw. The shortest straw is consumed the fastest, and every sector with human interests has the opportunity to lobby for a longer straw, except for nature, despite its essential role (C5). Hence, nature is literally and figuratively at a disadvantage.

During times of drought, they usually have to join the back of the line with their interests. In comparison, agriculture has a significant lobby and thus a clear voice. While nature is only legally protected, some are not happy with the enforcement (C5, C4). Because this legal protection only holds value if it is actively pursued, accurate enforcement is crucial for maintaining nature during drought. The interviewees indicate that nature and agriculture cannot be seen as entirely separate, unlike shipping and drinking water, which can be distinguished (C1-C9). The point here is that nature and agriculture are actually always interconnected and therefore almost inseparable from each other (C2, C4, C5, C1). This means that the distribution of water is complicated by the close interconnection of sectors.

Drinking Water

Contact was not made with drinking water companies initially because literature and expert conversations suggested that the drinking water sector would indeed be impacted, but not to a significant extent. However, discussions with interviewees revealed that the drinking water sector is among the four sectors experiencing the greatest impact during a period of drought (C2-C9), only C1 believes that drinking water falls outside of this classification of the four most important sectors. The drinking water sector ensures an adequate supply of drinking water for every resident in the Netherlands (C3). During droughts, they will also have less water available, making drinking water scarcer. It is recognized that drinking water is a fundamental right that everyone needs, even in times of drought. Therefore, the importance of sufficient drinking water is also included in the hierarchy of the priority scale for surface water allocation.

5.1.2. Key stakeholders values

Interviewing parties to identify sector values has been challenging. Each sector's value perceptions will be overviewed and interpreted using Table 3.2 and Table 3.3 for comparison, leading to potential conflicts discussion, starting with inland shipping.

Inland Shipping

According to C3, just like with interests, there are also slight differences noticeable within the distribution of the inland shipping sector. However, C3 assesses that these sub-parts are less significant in terms of the sector's value, thus concluding that the values of the shipping industry are aligned. On the other hand, C7, C5, C2, and C1, indicate that due to the division of the inland shipping sector into three parts, it is challenging to determine the value attributed to the inland shipping sector. C3 points out that shipping represents a historical value, being a long-established profession. Furthermore, it is noted that the shipping sector also fulfills an economic value (C3, C5). C3 explains this as that the inland shipping sector sustains livelihoods by meeting the demand for both essential goods and luxuries, embodying economic value crucial for a country's vitality by fulfilling basic needs.

Values Inland Shipping

1. Security
2. Tradition
3. Accountability

These are the three overarching values that can be interpreted from the results of the interviews. Starting with the first value concerns how inland shipping aims to sustain itself during drought. Furthermore, this value relates to the fact that inland shipping seeks to maintain a constant flow of logistics, both nationally and internationally. Additionally, the sector values tradition. This involves the pursuit of maintaining the inland shipping sector as a significant player in the overall logistics sector in the Netherlands. Environmental stability can also be placed under this value, as ensuring the sector's sustainability requires development to uphold this tradition. The last identified value is accountability, as indicated by Friedman et al. (2013), a value that suggests the actions of people can be traced back to the sector. What this implies in the context of drought is that inland shipping feels responsible for the maintenance of the logistics sector.

Agriculture

The perspective rooted in tradition or history is also evident in the agricultural sector, as highlighted by C1, indicating that the motivation behind decisions may be influenced by this aspect. C4 emphasizes that agriculture in the Netherlands holds economic value, yet it's also emphasized that the agricultural sector fulfills another crucial role: land management. Thus, agriculture derives its value from managing and maintaining the largest area of the Netherlands. C5 often sees the label "feeding the world" attributed to Dutch agriculture, but doubts arise regarding the accuracy of this statement. Nonetheless, C5 acknowledges that agriculture holds value in food provision, and this aspect shouldn't be overlooked. These claims and interests can be combined into the following overview of values that the agricultural sector, even in times of drought, operates from.

Values Agriculture

- Security
- Sustainability

- Accountability

First and foremost, discussions did not take place with direct stakeholders of the agricultural sector, so the generated values are based on statements from water managers and other involved parties. Beginning with security, the agricultural sector also perceives that it holds value in maintaining both the national and international food chain. They aim to keep this security strong at all times, so even during periods of drought, they demand a large quantity of water to ensure this security remains intact. Furthermore, the parties indicate that sustainability applies to the agricultural sector, and according to the interviewees, this is because the sector's tradition is also preserved. As the agriculture sector is seen as the manager of the largest area in the Netherlands, they also strive for environmental sustainability. It can be argued that the agricultural sector can ensure the smooth operation of their businesses to maintain tradition and security, thus enabling them to be accountable for providing security to the food chain, hence the value of accountability.

Nature

C4 indicates that nature is very valuable because humans cannot live without it. C5 emphasizes once again the value of nature; it forms the basis for human society. If there were no nature, there could be no life, and thus no society. Therefore, nature possesses a fundamental value for the economy in the Netherlands (C8). So, as the natural system provides less stability, it becomes increasingly vulnerable to its impact (C4). Nature offers us a sort of safe margin within which society can live and conduct our economic activities (C5). It is therefore important to keep the natural system as stable as possible to absorb the shocks to which our economic system is sensitive.

Values Nature

1. Human Welfare
2. Universal Usability
3. Environmental Sustainability

The first value that can be linked to nature is human welfare, which speaks for itself because, as the interviewees also indicate, there would be no life possible without nature. So, nature holds great value in the well-being of society. Therefore, even during times of drought, despite the minimal lobbying, nature should still be placed high on the priority list. Next, universal usability can also be linked to the nature sector. This universal usability refers to the fact that nature is the basis for other sectors. However, this value is sometimes overshadowed by the larger lobbies of other sectors. Therefore, identifying this value is important. Lastly, environmental sustainability can be linked to the nature sector. Friedman et al. (2013) states that this value ensures the preservation of ecosystems and meets the needs of the present without compromising those of future generations, which is what the nature sector in the Netherlands aims to achieve. However, as indicated by the interviews, adherence to the conservation of nature sometimes ends up at the bottom of the list. The fourth sector is the drinking water sector. Its values differ because its primary function is to provide drinking water consistently. Therefore, the value of security can be attributed here. Ensuring this constant supply of drinking water is seen as the overarching value.

5.1.3. Conflicts

Overall, conflicts between sectors based on the identified values are manageable and consistent. This can be seen from the fact that the values pursued by the various sectors are very

similar, aligning their interests in the same direction. However, at a more detailed level, conflicts are noticeable, and these have been explored further with the interviewees.

C4 indicates a conflict between agriculture and drinking water. During drought, drinking water companies pump groundwater, leading to lower water levels. However, agriculture also seeks to pump groundwater for crop irrigation during drought, leading to conflict. This conflict, described by C4 as complex, arises because drinking water companies must supply drinking water, while agriculture has the right to use groundwater for irrigation. C4 adds that conflicts can also arise between agriculture & nature, and drinking water because drinking water, just like nature and agriculture, uses water from groundwater, which leads to conflicts. Another conflict highlighted by C5 is between nature and agriculture, as they both draw water from the same source. C5 and C3 argue that nature in the Netherlands is often taken for granted despite being essential for human welfare. C5 further explains that prioritizing water for nature or agriculture presents a complex conflict as it cannot be solely quantified monetarily, emphasizing its importance for human welfare.

There is another conflict between nature and agriculture stemming from the interpretation of Natura2000 areas (C4). Given climate change, questions arise about whether the goals of these areas should be pursued at any cost (C9). Some Natura2000 areas are located in areas where maintaining nature requires significant technological intervention (C4), while these areas could potentially be more efficiently used for agriculture, with new nature reserves designated elsewhere in the Netherlands. This leads to conflict between nature and agriculture. C3 indicates that shipping also faces conflicts, as it is not highly dependent on water quality but rather focuses on water quantity, using available water differently. However, it still conflicts with other sectors. Shipping and drinking water provision can conflict, as stated by C5, particularly at Lobith where water is divided between the IJssel to the north and the Waal to the west. Sending water northward means less water for shipping while sending it westward means less water for maintaining the drinking water supply in the north, potentially leading to conflicts between sectors.

5.2. Modelling with stakeholders

This study utilized the water distribution model QWAST to gain insight into who exactly is involved in water distribution and how this process works. An essential aspect of the interviews was to understand how the various interviewees perceive the contribution of these water distribution models to decision-making regarding water distribution during times of scarcity.

C5 links the model to the priority scale because the water distribution model is based on the priority scale of how to distribute water during droughts. It is suggested that if this scale presents an incomplete picture, the water distribution model is not necessarily incorrect but can also be viewed as incomplete. In a more general sense, C3 indicates that with the water distribution models used in the Netherlands, cumulative costs are not considered. This means that if a lock goes out of operation during a drought, it not only incurs costs by preventing ships from passing through but also affects the costs throughout the entire chain. To illustrate, consider inland shipping where there are scheduled services. If there is a delay and extra ships must be deployed to meet the transportation demand, prices rise, making it significantly more expensive. According to C3 and C6, this aspect of the cumulative costs is often overlooked.

C1 mentions that QWAST, among others, was developed to provide a complete picture of what will happen during droughts. However, as both C4 and C1 point out, this is precisely

the challenging aspect. Even from a modeling perspective, it is difficult to accurately capture everything, and financial considerations will continue to dominate. The continued dominance of financial considerations implies that the quantified effects in the model will be decisive for decision-making. Consequently, nature might suffer the most, because quantifying the effects of nature is extremely challenging (C1). It is also acknowledged by the same that this is challenging but necessary within the QWAST model to provide a comprehensive depiction of water distribution (C4, C1).

C5 provides a critical view of the technology, suggesting that less emphasis should be placed on technical solutions. According to C5, solutions should be approached more practically rather than relying solely on technicalities. However, models are necessary for calculations; otherwise, there would not be knowledge at all. But the effectiveness of a model hinges on its scope (C5). In a broader sense, drought demands both models that calculate and improve processes and clarity in presenting information. Numbers do not stand on their own; they require context (C3). Figures are part of a narrative, and the direction one intends to take is determined by the context in which they act (C3).

5.2.1. Priority Scale

The priority scale, extensively discussed in the third chapter and serving as the basis for water distribution within model applications, was also queried to grapple with the perceptions of the interviewees and their stance on the priority scale.

C1 indicates that the establishment of the priority scale inherently assigns a certain value. The stability of water barriers in the Netherlands takes precedence over the importance of sufficient drinking water, which is quite logical because, without land, there is no possibility of life (C1). On the contrary, C4 suggests that the priority scale is an instrument that largely dictates water distribution, but points out that the uncertainties surrounding aspects not entirely defined complicate water distribution during drought.

Criticism from C4, C6, C9, C5, and C2 indicates that the current policy, reflected in the use of priority scale as currently implemented, does not fully represent the Dutch water system. The priority scale currently in use only applies to surface water, while the Netherlands has two interconnected water systems: surface and groundwater. Thus, employing the priority scale as it is currently done does not reflect reality (C2, C4, C5, C6, C9). Additionally, C4 notes that the interconnections between these two water systems are not adequately addressed, with almost no rules governing them. So, from a modeling perspective, the interconnectedness is not adequately represented, stemming from inadequate policy. C4 provides a concrete example: during the last dry period, it is puzzling that the water board imposed a ban on pumping surface water while allowing groundwater pumping. These systems are interconnected (C9). It is also noted that the permit system is not entirely logical; companies can provide insights into their groundwater usage a year after the drought period, rendering information unavailable during the drought (C8). There is also a certain amount of water that does not require reporting, thus critical insight is lacking (C5, C7, C2). One interviewee even states that there is a complete absence of understanding of how groundwater is managed and that administration is not maintained (C2).

C3 and C6 find the priority scale to be logically defined at first glance but question the prioritization of transported cargo. They advocate for more transparency. However, C7 opposes this view, describing it as unwarranted criticism from the shipping sector because they are categorized in group four while stressing the importance of seeing the bigger picture. Therefore,

according to the interviewees, the priority scale has several shortcomings. It surpasses its goal, as it provides an incomplete translation of the entire water system, including surface and groundwater affected by drought. Furthermore, the priority scale demonstrates that the responsibilities for surface water and groundwater are unclear to the parties involved. To tie this back to the model-based approach, as indicated in Chapter Four, the priority scale is used as the basis for water distribution during drought. However, indirectly, the interviewees suggest that this approach yields an incomplete picture.

5.2.2. Political influence

The ultimate decisions on how to distribute water lie in political governance (C3). These decisions are also influenced by Europe, as the choices regarding water allocation between the Northern- and the Western Netherlands also have European implications (C3). Standards have been agreed upon by Europe on how to handle drought, but each drought period is uncertain and may jeopardize or alter these standards (C3).

Additionally, C4 indicates that the decisions to be made should focus on the long term, as drought periods are expected to intensify. However, Dutch politics often exhibit short-term thinking, which is incompatible with the topic of drought (C8, C4). The political influence is also evident in what C7 points out. It is emphasized that while we may have some control over the next couple of years, it is perceived important to undertake preparations now and make decisions for the next fifty to eighty years. There is a huge task ahead for politics. Unpopular measures will need to be implemented, posing a significant challenge for policymakers (C2, C3, C4, C5, C6, C7). The drought of 2018 not only raised awareness within the sectors but also awakened the political sphere (C5), although drought had been a longstanding issue before 2018. This once again exposes the short-term vision of politics.

5.2.3. Salt Intrustion

During the interviews, there was a notable emphasis on saltwater intrusion. Interviewees stressed that this aspect should not be overlooked when investigating water distribution during droughts.

An example provided illustrates how saltwater intrusion is already complicating current operations (C3). For instance, during the construction of the Blankenberg tunnel, it sank too quickly due to the density difference between freshwater and saltwater (C6). Similarly, during the 2018 drought, the salt concentration in the Rotterdam harbor became so high that a decision was made to mix in tap water, a costly measure highlighting the importance of considering saltwater intrusion alongside water distribution (C3, C6). The interviewees emphasized the need for long-term thinking regarding saltwater intrusion (C1-C9). While newspapers often report on the impacts of droughts such as halted inland navigation, crop failures, and drying ecosystems, they overlook the significant danger of saltwater intrusion, according to the interviewees (C2, C5, C7). So when discussing water distribution during water scarcity, salt intrusion must not be forgotten.

5.3. Overview of results

Before delving into the discussion, an overview of interests and values will be provided to better contextualize the results.

5.3.1. Interests

For inland shipping, the sector is primarily focused on transporting cargo from one location to another. The agricultural sector's primary goal is to generate sufficient income from its activities to sustain itself. This is achieved through the cultivation of various crops. Nature in the Netherlands plays a crucial role in ensuring the livelihood security of its inhabitants. It serves as an interest for all residents. Lastly, the drinking water sector is tasked with providing an ample supply of drinking water to the inhabitants of the Netherlands, even during periods of drought. These interests are essential to remember because they indicate what these sectors need during a drought.

5.3.2. Values

Three values emerge from each sector, however, discussions did not occur directly with agricultural and nature stakeholders, so the derived values rely on statements from water managers and other involved actors. These values are security, sustainability, and accountability.

Inland shipping plays a role in sustaining logistics flow. Ensuring security in operations is vital for maintaining its significance in Dutch logistics while upholding sustainability. This sector also holds itself accountable for maintaining the logistics chain in drought. Similarly, the agricultural sector places a high value on security, ensuring a robust food chain both nationally and internationally. Sustainability is preserving tradition, and environmental sustainability as it manages a big part of the Dutch landscape. This commitment to tradition, security, and sustainability backs accountability in maintaining food chain security. In the realm of nature, human welfare takes precedence, emphasizing its crucial role in sustaining life, particularly during droughts. Despite minimal lobbying efforts, prioritizing nature's well-being is imperative. The sector also underscores nature's universal usability, which serves as the foundation for other industries, although it may be overlooked at times. Additionally, environmental sustainability is a key goal, aiming to preserve ecosystems for future generations, despite not always receiving immediate priority. Lastly, the drinking water sector stands out with its primary function of providing consistent access to clean drinking water. Here, security is paramount, ensuring a continuous supply of drinking water even during droughts. Maintaining this constant supply is seen as the overarching value, underscoring the sector's commitment to public health and well-being.

Overall, conflicts between sectors based on the identified values are not present. This can be seen from the fact that the values pursued by the various sectors are very similar, aligning their interests in the same direction. However, at a more detailed level, conflicts are noticeable as outlined in Section 5.1.3

6

Discussion

This chapter delves into three key aspects. Firstly, it examines the findings of the values and their implications within the existing literature. Secondly, it explores the relationship between ground and surface water, a crucial factor highlighted in the results chapter. Lastly, it delves into the role of QWAST and its connection to the uncertainties inherent in modeling and the uncertainties posed by climate change. Furthermore, during the research process, a policy program, water soil steering, emerged in every interview, which needs further explanation. This policy program needs further clarification as it takes steps in the right direction for better drought management.

Following the exploration of findings, attention will be directed to the limitations of this research. Acknowledging these limitations provides a balanced perspective of the study's outcomes, see section 6.5. To finish the chapter the limitations will be further explained and connected to the methodology evaluation, as can be seen in section 6.6.

6.1. Interpretation of values

On a broad scale, the various identified values of the sectors align. These include security, sustainability, and accountability. Contrary to expectations from the literature, which anticipated value conflicts arising during drought, the results indicate that the values are largely in harmony. So, very few value conflicts are identified in this research. Instead, conflicts arise not between the values but more on a detailed level, on interests, as outlined in the hierarchy pyramid outlined by Poel and Royakkers (2011). It revolves around the diverse interests and stakes pursued by different sectors. In literature, interests are often regarded as encapsulated by values. However, in this research, the interests embedded within these values vary significantly during drought periods. Different sectors demand distinct forms of water in terms of quantity and quality during droughts. This diverse water demand can lead in times of drought to conflicting interests.

Also Poel and Royakkers (2011) suggests that a period of drought can lead to a shift in the values pursued by involved stakeholders. Drought alters the value that sectors hold during dry periods. However, this notion can be challenged because the values pursued by the sectors remain unchanged even during droughts; it is mainly the interests that shift. When transitioning from a situation with sufficient water to meet demand to a period of scarcity, it's not the values but rather the interests that change. Sectors will become more focused on their specific water demand interests. This change was largely brought about by the drought period in 2018, which

can be seen as a turning point. Suddenly, drought became tangible for everyone, and various sectors realized that the water supply was insufficient, and they could no longer rely entirely on meeting their water demands. Consequently, the expectation within this study was that 2018 would bring about a significant change in how drought is perceived about the value the sector pursues. The values pursued by the different stakeholders remained consistent compared to that dry period. However, when compared to a normal period with sufficient water, it was expected that these values would change. Unfortunately, this aspect was not explored by the interviewees.

This implies that the focus on identifying value conflicts may need to be reevaluated. It can be argued that the term ”conflict” within this research carries too much weight, and it might be more apt to scale it down to ”issues,” which implies a less severe impact. Angelakis et al. (2021) suggests that the issue in the Netherlands can be viewed through the lens of intra-state water conflicts. However, upon conducting this research, it becomes apparent that it might be better re-framed as conflicts stemming from variations in interests and goals among different sectors, potentially resulting in issues rather than direct conflicts. The difference between the identification of issues and conflicts lies in the connotation of the term concerning water. Conflicts are associated with violence within the water domain, whereas this is not the case with issues. Looking at the Netherlands, it’s certainly not a violence problem but rather a distribution issue, aligning more with issues than conflicts.

The focus was on how these values are represented within the model. However, as discussed in the following section, steps of incorporating the whole water systems of the Netherlands in the development of the model are not present making it difficult to retrieve the representation of these values. Therefore, before delving deeper into the representation of the values in the water distribution modeling aspect, the following sections identify the current shortcomings within water management during drought.

6.2. Incorporating groundwater into water distribution during drought

The water system in the Netherlands comprises two connected parts: the groundwater system and the surface water system. Water can be extracted from both water systems in times of drought and extracting water from one system affects the other. During the interviews, this dependency between the two water systems was frequently highlighted in discussions with stakeholders, who indicated a lack of consideration for the interconnectedness of these surface and groundwater. There is a tendency to compartmentalize, as conversations revealed a thought to think of surface water and groundwater as separate systems, despite their close interconnection. Additionally, the lack of coordination at the governance level can be attributed to the differing responsibilities associated with these two water systems, which lie with the water boards and the provinces. Groundwater naturally falls under provincial jurisdiction due to its size, as groundwater areas transcend the territorial boundaries of water boards. Nonetheless, this doesn’t dismiss the lack of communication between these two parties, as was emphasized.

To clarify, in the Netherlands, it is regulated as follows. Permission for activities such as groundwater extraction or water infiltration into the soil may be required from the water board or the province, in the form of a permit. Alternatively, a simple notification of the activity may suffice. Yet, there remains a gray area where no notification or permit is obligatory, a matter particularly debatable during periods of drought. These are the current legislation concerning groundwater extractions for industrial, agricultural, construction, remediation, and private use (up to 150,000

m3/year), and water boards hold jurisdiction (I&W, 2023). Generally, a permit is mandatory for extractions exceeding 60 to 100 m3/hour in non-protected areas, while notifications suffice for those surpassing 10 m3/hour (I&W, 2023). Small extractions (< 10 m3/hour) usually have no notification or permit requirements, often involving groundwater withdrawals for irrigation and livestock watering. Due to the absence of notification or permit requirements for groundwater extractions, water boards, and provinces lack an overview of the number and locations of these extractions. This lack of information poses a challenge, especially during periods of drought.

Not having a complete picture of what and where water is being extracted during drought is a shortcoming in addressing water scarcity. This is considered a necessary step towards improving the management of water scarcity during drought periods. In addition to the lack of coordination between the two water systems, another deficiency in water management during water scarcity is the absence of a priority scale for groundwater. This is essentially an extension of the lack of coordination. It is known that under Article 7.13 of the Environmental Management Decree (I&W, 2023), the province can also declare the hierarchy of categories 3 and 4 applicable to groundwater. Thus similar verdringingsreeks will have to be produced just as they exist now for surface water.

The development of such a priority scale for groundwater is not yet in an advanced stage, primarily because, as with other drought-related matters, the involved actors did not feel a sense of urgency because droughts are not very common in the Netherlands. Due to this lack of urgency, the current priority scale has not been sufficiently reflected upon. As discussed, provinces can apply the priority scale for groundwater through the use of the Water Act (I&W, 2023). However, due to insufficient information available to the provinces about how and where groundwater extraction occurs, this provision can not be utilized. Insufficient information and understanding hinder effective action. As long as there is inadequate attention given to the lack of knowledge of where and when groundwater is extracted during drought, no change can occur. Detailed mapping of extraction provides clarity, reducing uncertainty and giving actionable perspectives for all actors involved. The following section will delve into addressing this uncertainty in water management during drought.

6.3. Uncertainty and QWAST

Before delving into how QWAST has been assessed, it's important to discuss how the current water distribution is perceived by the various involved parties. An important concept attached to this is uncertainty. The future brings uncertainty, particularly in the context of climate change. The question that the interviewees grapple with is: What is our action perspective in the face of these uncertainties? Thus the uncertainty, strongly present in the context of the climate change crisis, makes distributing water even more difficult. The existing uncertainty introduces an element of ambiguity among stakeholders, encouraging thinking about how they each approach the situation.

Hence, the sharing of information can help better manage uncertainty and promote greater transparency (Osman, Heath, & Löfstedt, 2017). When there is a connection made with the expressions of the interviewees, something pressing emerges. Some actors indicate that this level of transparency is lacking in the Delta program for freshwater and integral river management. As mentioned earlier, the quote "how integral is integral" was discussed. It is noted that there is an advancement for an integrated approach to drought, yet in practice, this integration does not always align with reality. Sometimes, the interests of one sector outweigh those of others,

leading to this question arising. This creates ambiguity for the involved parties regarding where responsibilities lie, resulting in an unclear perspective on the actions taken. The meaning of uncertainty in the use of QWAST lies in the variation that model-based projections of climate change's impact on water resources can make. Therefore, water managers cannot have confidence in any single scenario or projection for the future. Efforts have been made to enhance this confidence in the overarching delta model by incorporating various scenarios. In addition to uncertainty about what exactly the perspective on action should be, there is also uncertainty about the future,

So, there is difficulty in how to effectively communicate uncertainty to stakeholders in situations where projections of climate change impacts are uncertain, hindering their ability to determine courses of action. This is challenging, and it is not only experienced within this research but Aven (2013) also indicates this. Kundzewicz et al. (2018) has also investigated how to convey this and concludes that approaches need to be developed since the standard options currently used are no longer adequate. To reduce uncertainty, there is a need to better understand how stakeholders interpret uncertainty and respond to it to improve communication (Hart et al., 2019).

Behavioral and decision-making research shows that perceptions of uncertainty may differ, and people use various strategies to cope with it, including searching for additional information and preparing to avoid or confront potential risks (Kundzewicz et al., 2018). Ultimately, it is the policymakers who make the decisions. They face the challenge of making choices amid conflicting options, often relying on scientific information with uncertainty. Thus policymakers, faced with conflicting options and uncertainty, shall make decisions informed by scientific information, understanding that perceptions of uncertainty vary and individuals employ different coping strategies.

Despite indicating how uncertainty can be translated to inform stakeholders, two approaches are proposed to make that more efficient. One approach involves the careful filtering of policy-relevant uncertainty information and the effective communication of uncertainties. It is crucial to recognize that not all uncertainties to scientists hold equal relevance for policymakers (Hansson, 2018). When advising on climate policy, experts need to be careful in how they talk about uncertainties. They should highlight the uncertainties that matter and have an impact on the overall evidence. Given the variability of the climate system and the limitations of our understanding as discussed, surprises always happen in the climate. The second approach goes about the critical issue of how uncertainty is conveyed and communicated. Effective uncertainty communication should align with the intended purpose of such communication (Budescu et al., 2012). Since much climate decision-making involves risk management, uncertainty reports should do risk analysis (Kunreuther et al., 2013). This involves presenting reports that encompass all sources of uncertainty and available evidence. Emphasizing the overall balance of evidence can provide valuable insights, especially when uncertainty surrounds a particular issue. This is also something that was given by the interviewees, incorporating the context to sketch the full picture. For instance, if there are limited definitive assertions about the likelihood of a specific drought but it cannot be ruled out as a realistic possibility, this nuanced uncertainty should be the central message that stakeholders get delivered. Because this could be how the desired perspective for action can be provided.

According to (Aven, 2013), uncertainty has become politicized, with policymakers potentially manipulating it to suit their agendas. This political influence was also observed in this research, as interviewees indicated that final political decisions are sensitive and may be refrained from discussing openly for fear of misinterpretation, highlighting the role of politics. Thus, it can be

concluded that climate change and its impacts on water resources are inherently uncertain due to knowledge gaps and a lack of understanding of complex processes and their interconnections.

Starting with the delineation of QWAST, regarding the delineation of the water system. In the development of QWAST, the choice was made by the developers of Deltares and Rijkswaterstaat to focus on surface water. By focusing solely on surface water, an incomplete picture is formed. To utilize QWAST for water distribution during drought, it can be argued that by solely delineating surface water, this presents an incomplete picture. Therefore, the model is considered incomplete for water allocation during drought. It is important to note that when using models, as (Haag & Shokoufandeh, 2019) indicates, there is always a need for delineation, which inevitably simplifies reality. However, the crux with QWAST lies in its limitation to only surface water delineation, causing it to not be perceived as added value for distributing water during drought by the involved actors.

In addition to the incompleteness, the lack of quantified effects represented by the model is raised. It was also discussed in the results that quantifying nature is challenging, which can lead to nature being overlooked. This indicates that as long as it cannot be expressed in monetary terms, incorporating it into the model presents a challenge. This highlights the concern that the monetary aspect is underrepresented. Specifically, the cumulative cost aspect is mentioned, referring to the impact when, for example, a farmer does not have enough water for crops during a drought, leading to a failed harvest. However, this doesn't just affect the farmer, it affects the entire chain. For instance, if it's wheat, processing companies reliant on this crop will also suffer losses, adding to the total costs. These costs accumulate, so these cumulative costs can be seen as chain costs. If this can be represented in the model, more targeted and effective measures can be taken to ultimately be of more added value to the involved stakeholders.

In conclusion, regarding QWAST, the model is not flawed, but rather perceived as incomplete, as actors viewing it as having no added value for water allocation during drought. This is due to its focus solely on surface water and the inadequate consideration of the cost aspect.

6.4. Policy Recommendations

Several policy recommendations emerge from the results and discussion, which can be categorized into two main directions. Firstly, improving understanding of extractions from both water systems, which could be recommended at the policy level of provinces, water boards, and Rijkswaterstaat. Secondly, establishing a priority scale for groundwater that integrates monetary aspects. This recommendation should be advocated at the governance level, but its development should involve expertise and practical knowledge, making it suitable for all actors involved in water allocation during drought.

Addressing the relationship between groundwater and surface water, knowledge about all water extractions occurring during periods of drought forms the basis. The absence of a complete picture regarding the types and locations of water extractions during drought constitutes a limitation in addressing water scarcity effectively. This underscores the need to enhance water management strategies. Typically, small-scale extractions, particularly those under 10 m3 per hour, such as groundwater withdrawals for agricultural irrigation and livestock watering, are not subject to notification or permit requirements. Consequently, both water boards and provinces lack comprehensive data on the number and distribution of these extractions. This information gap poses a challenge. From a policy standpoint, it becomes imperative to report all water ex-

tractions and to shorten the reporting timeframe. Currently, people can wait a whole year before they have to report how much water they've taken out. However, stricter enforcement of legislation surrounding water extractions is necessary. By ensuring timely reporting, both provinces and water boards can better monitor water extractions and address potential unsustainable use. Enhancing insight and transparency in water extractions not only mitigates uncertainty but also provides more accurate inputs for model-based solutions like QWAST. Therefore, streamlining reporting requirements and enforcing tighter regulations are steps toward more effective water resource management in times of drought.

Adding to this, once information is provided about total water extractions, decisions will be made on how the water is distributed. The priority scale for surface water needs to be complemented with one for groundwater. This requires engaging stakeholders to develop a priority scale for groundwater, which will contribute to better drought management. This can be achieved by initiating a discussion on how to use this priority scale for groundwater and how eventually to use it in QWAST. Following this, consensus should be sought on establishing a priority scale for groundwater, considering monetary aspects. In the ongoing development of QWAST, it is acknowledged that there is a policy rationale driving its development, aimed at water management.

However, sectors predominantly view it through an economic lens. Therefore, stronger connections between the model, policy considerations, and economic perspectives need to be established, since it has been noted that drought extends beyond attempting to resolve it from a hydrological standpoint. Integrating QWAST with an additional economic component related to drought can enhance its value for stakeholders, ensuring a more holistic understanding and facilitating both water management and economic aspects of the water distribution.

6.5. Limitations

Moreover, this study acknowledges and addresses limitations associated with the chosen research methodology. Practical constraints such as time constraints and limited availability caused only a relatively modest number of participants to be included in this investigation (Alsaawi, 2014). While it is recognized that a larger sample size might have given richer data and enhanced data quality, the study's findings are nonetheless influenced by the composition and timing of the interviews. Additionally, it is acknowledged that respondent interviews may be influenced by their perspectives (Bergelson, Tracy, & Takacs, 2022). Yet, such perception biases are inherent to qualitative research methodologies, particularly those employing case studies with a limited number of participants.

Another limitation pertains to the researcher's interpretation of the collected data. While every effort was made to maintain objectivity, the process of selecting and categorizing relevant data for analysis inevitably involved some level of interpretation. Given the qualitative data, certain pieces of data may have been overlooked, potentially affecting the application of specific theories. This inherent subjectivity in interpretation is commonly referred to as interpretive bias (Bergelson et al., 2022).

Furthermore, a limitation arises from the selection of data, which may introduce selection bias. During the data analysis phase, a balance was required between determining the most pertinent data for inclusion in the study to provide structure and direction, and ensuring that crucial points of interest were not overlooked. This consideration necessitated careful deliberation regarding

what to incorporate and exclude from the analysis.

6.6. Methodology Evaluation

This research was a case study examining stakeholders' perceptions of water distribution models, with a focus on the Quick Water Allocation Scan Tool (QWAST) used by Deltares to distribute water during drought periods in the Netherlands. Literature research was conducted to explore the values relevant to water distribution and how they can be translated to key stakeholders. These key stakeholders were then identified based on their water demands. Interviews were conducted with these stakeholders to understand the values influencing their water demands and their perspectives on water-related issues.

It became apparent both during the interviews and after the research that determining values is challenging. An alternative approach to identifying these values could have been chosen. This could have been done, for example, through surveys or experiments. Surveys involve gathering data from a sample of stakeholders through questionnaires, aiming to collect information about their attitudes, opinions, and behaviors (Yin & Heald, 1975). Experiments involve modifying one or more independent variables to observe their effect on a dependent variable and to establish causal relationships between variables. Nevertheless, the Q-method is considered a better method for capturing values.

6.6.1. Q-method

Q-methodology is a research approach that combines qualitative and quantitative techniques to study subjectivity, opinions, and perspectives (Shinebourne, 2009). It is often used to explore the diversity of viewpoints within a specific domain. Q methodology is utilized to examine subjectivity, subjective opinions, values, or beliefs, to address questions about 'what' or 'how' (Baker, Thompson, & Mannion, 2006). Q methodology facilitates the identification and description of shared viewpoints regarding a topic, revealing areas of consensus and disagreement among these perspectives (Shinebourne, 2009). There are two fundamental components to any Q study. Initially, participants rank a set of opinion statements on a grid. Subsequently, factor analysis is conducted to pinpoint clusters of shared viewpoints, which are then interpreted accordingly.

The first strength of the Q methodology is the power of mixing detailed information from interviews with careful statistical analysis. This integration enables researchers to grapple with collective viewpoints on a topic while also discerning subtle, often hidden, and differences among them. Importantly, this is achieved in a structured, systematic, and reproducible way (Dziopa & Ahern, 2009). Recognizing the viewpoints of people and their differences is crucial for understanding their actions (Petrie & Weinman, 2012). Q methodology, due to its ability to enclose diverse perspectives, is an inclusive approach. However, a drawback is that the process of conducting a Q study can be time-intensive.

Overall, the Q methodology offers a systematic approach to exploring subjectivity. Therefore, it could be a valuable alternative to conducting interviews when seeking to better understand the subjective interpretation of values.

7

Conclusion

The uniqueness of this study lies in its innovative approach, which utilizes value theory as a guide to gain insights into the perceptions of water distribution among diverse stakeholders and the underlying values shaping their perspectives. Positioned as a case study, this research delves into how stakeholders perceive water distribution models, with a specific focus on the Deltares QWAST model as a case study for understanding water distribution during drought periods in the Netherlands. Within this case study, literature research has been conducted, primarily focusing on the QWAST water distribution model and its role in water allocation, particularly in drought. This literature research also delves into exploring values and their translation to key stakeholders, crucial for identifying and addressing their water demands. In addition, interviews were conducted with identified key stakeholders. These interviews were aimed at comprehending the underlying values influencing their assertions regarding water demands and their perspectives on water-related issues. This chapter concludes the research by addressing the research questions.

7.1. Sub-questions

First sub-question

Which aspects play a role in water management in combination with modeling droughts?

The core focus of drought modeling lies in comprehending water demand and its management. Different sectors each have distinct demands for water, varying in quality and quantity. The selection of these four sectors— inland shipping, agriculture, nature, and drinking water— is based on the magnitude of their water demand during drought periods. In addition to these sectors, there's another set of actors within water management: the decision-making authorities such as water boards, provinces, and Rijkswaterstaat. While decision-making authorities typically formulate policies for sectors, what sets the Netherlands apart is the involvement of the decision-making authorities and sectors in shaping the water distribution during drought. This collaborative effort among actors is unique, particularly in the Netherlands, where drought is still a relatively unexplored weather extreme. So, the aspect of these varying water demands in terms of quality and quantity forms the foundation for the different involved sectors and serves as the basis for drought modeling.

Second sub-question
> What are the key components and underlying principles of the existing water distribution model used for a period of drought?

The chosen central model for water distribution in this study is QWAST. While the Delta Model serves as an overarching framework in the Netherlands, it encompasses various tools, including the National Hydrological Instrument (NHI). The NHI comprises five distinct models used for different water-related aspects, with a focus on optimizing water distribution during scarcity. Within the NHI, the Surface Water for Optimized Distribution (SWOD) handles this task, covering both regional and national surface water systems. QWAST, developed by Deltares, operates within this SWOD, utilizing prioritization principles to allocate water according to the priority scale for surface water. Thus, the key aspects of QWAST are its integration within the Delta Model, its prioritization mechanism, and its reliance on the priority scale for surface water allocation.

Third sub-question
> What are the stakeholders' perceptions regarding the modeling of droughts, and what are the key concerns?

In general, every involved actor recognizes the value of drought modeling, primarily for gathering essential information. Without the use of models, it's impossible to anticipate the development of drought or understand the effects of policy decisions. However, it's crucial to acknowledge that while model-based approaches are valuable, they shouldn't be solely relied upon, as sometimes less technical solutions can have more effective results. Nevertheless, there are concerns regarding the use of such models. Firstly, it's evident that the context is extremely important, yet it's often overlooked. The context influences the robustness of model outcomes. Secondly, in the development of QWAST, the decision was made to concentrate on surface water. However, focusing solely on surface water creates an incomplete picture. Given the interconnected nature of the complete water system, comprising both ground and surface water, stakeholders consider the delineation of only surface water as incomplete. This limited scope has led to an incomplete understanding that diminishes the added value of QWAST. Moreover, there are also concerns regarding the monetary aspect of the model. The quantification of effects can be seen as insufficient, resulting in unequal representation of sectors within QWAST. Even when some effects are quantified, they are considered incomplete as they fail to capture the monetary aspect, resulting in complete inaccuracies.

7.2. Main Research Question

> How do water distribution models that could be used to prepare for and allocate water during times of drought align with key stakeholders' values?

After answering the subquestions, the main research question can be answered. It can be observed that the values that the different key stakeholders hold with water distribution models are largely overarching. These values include security, sustainability, and accountability. Contrary to expectations, the values are corresponding, thus the expectation of emerging value conflicts does not align with the literature. It is noteworthy how conflicts are formulated within this research and how they can be scaled down to the terminology of issues.

When setting up the research, it was thought that the development of the model was advanced enough to facilitate a water distribution that would generate outcomes recognized by the involved sectors. With this in mind, the direction of the research was determined. However, it

can now be concluded that due to the fundamental shortcomings of the model, the discovered values have been discovered but not at the level of detail expected beforehand. The main shortcomings include the lack of insight into groundwater extractions. This means that the involved sectors seek to understand this aspect before imposing any restrictions on their extractions. This lack stems from a lack of importance given by the involved policymakers and developers of QWAST to the surface and groundwater system. In this delineation of QWAST, the relationship between groundwater and surface water is not considered, resulting in the model only considering surface water. The importance of the interconnectedness of surface and groundwater is overlooked, resulting in an incomplete picture. This leads to the involved sectors not seeing any added value in the outcomes of QWAST. Expanding the delineation to include groundwater remains insufficient because to allocate that groundwater, a priority scale for groundwater is necessary.

All in all, QWAST falls short in its application for distributing water during drought periods, thus diminishing its perceived value among stakeholders. While the model incorporates the values, the exact correlation with outcomes remains unexplained due to incompleteness. As a result, QWAST is viewed as having limited added value, not as incorrect, but rather incomplete and deficient.

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A

Appendix A

As discussed, values can give rise to conflicts as they may stand in opposition to each other. It is also possible that focusing on one value may lead to consequences that contradict certain values while aligning with others. For instance, the pursuit of achievement values might conflict with benevolence values, where seeking success may hinder efforts to enhance the well-being of others. However, simultaneously pursuing achievement and power values tend to harmonize. Striving for individual success can reinforce actions to elevate one's social standing and authority over others. Therefore, a form of connection exists among values; Schwartz (2012) has attempted to link them together and represent these ten basic values in a circular form. This can help identify which values are closely related, distant from each other, or even opposing. This information is valuable when exploring how the identified values manifest themselves.

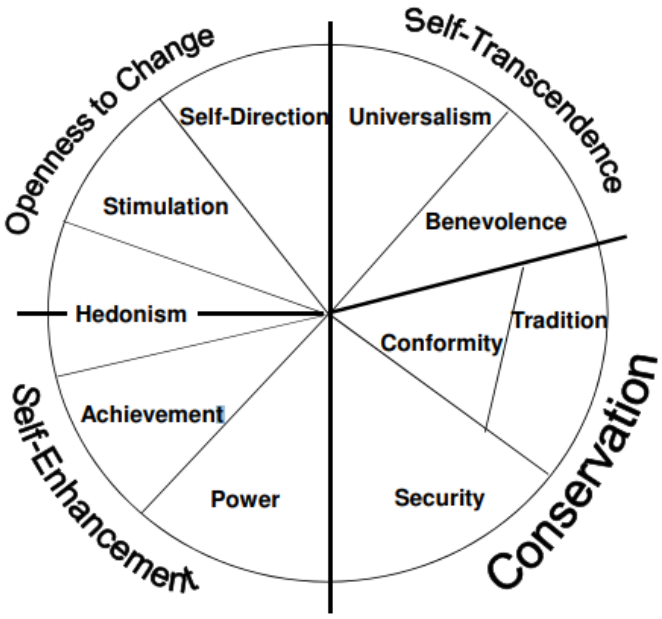

Figure A.1: The circle of values

This connection is illustrated by putting them in a circular form, see Figure A.1. Tradition and conformity share a wedge due to their common overarching motivational goal, with conformity positioned more centrally and tradition towards the periphery. The placement suggests that conventional values present a more noticeable clash with opposing values. Values can be categorized into two opposing dimensions to summarize the conflicts between them. Illustrated in Figure A.1, one dimension contrasts 'openness to change' and 'conservation' values, reflecting the tension between values promoting independence, readiness for change, self-direction, and stimulation, versus those emphasizing order, preservation of the past, and resistance to change (security, conformity, tradition). The second dimension contrasts 'self-enhancement' and 'self-transcendence' values, highlighting the conflict between values emphasizing concern for others, universalism, benevolence, and values emphasizing the pursuit of one's interests, relative success, and dominance over others, power, and achievement. Hedonism, in this context, shares characteristics with both openness to change and self-enhancement.

To conclude this crucial step in the process, the following table is provided this table will function as the analytical framework to determine which interests and beliefs belong to which value. This table combines the findings of two theorists who have researched values, see Table A.1.

Table A.1: Analytical framework

Category	**Values**
Social and Personal Values	Power, Achievement, Hedonism, Stimulation, Self-direction, Universalism, Benevolence, Tradition, Conformity
Stability and Security Values	Security
Human Well-being and Interaction Values	Human Welfare, Ownership and Property, Privacy
Ethical and Fairness Values	Freedom from Bias, Universal Usability, Trust
Autonomy and Responsibility Values	Autonomy, Informed Consent, Accountability
Interpersonal Values	Courtesy
Psychological Values	Identity, Calmness
Environmental Values	Environmental Sustainability

As seen in Table A.1, the identified values from (Friedman, Kahn, & Borning, n.d.) and (Schwartz, 2012) have been added. This table will serve as a starting point for further identifying the values that come into play within drought among the involved actors.

B

Appendix B

Within this appendix, the interview questions have been plotted. This is built up into four categories. These questions have been drafted for the water distribution model QWAST work and what is the role of the water distribution model in water scarcity. The first category tries to discover the interests and what might be contradictions. The second category tries to draw out the conflicts. In the last part, the modeling of drought concerning water distribution and water scarcity is asked.

B.1. Category 1:

How do you recognize conflicts of interest?

Question 1.1:
”In the context of discussions on water allocation during droughts, how do you recognize the presence of conflicts between stakeholders? What are the main signals or indicators you look for?”

Question 1.2:
”Can you describe cases where the different perspectives of stakeholders became clear during negotiations on water allocation during a drought?

Question 1.3:
”What are the most pressing underlying thoughts among the stakeholders?”

B.2. Category 2:

What conflicts are there?

Question 2.1:
”Can you give examples of the most common conflicts of interest you have encountered during inter-state water consultations on drought water distribution? Which values or principles usually come into conflict?”

Question 2.2:
”How do you categorize different perspectives and resulting views when distributing water during droughts? Are there any specific typologies or classifications that you use to understand the nature of different views better?”

Question 2.3:
”Are there instances where you have observed the emergence of new opinions as a result of new trends or changes in perspectives?”

Question 2.4:
”What are the biggest changes that will occur if this drought period, as predicted, intensifies? So that it no longer becomes an exception but a habit?

B.3. Category 3:
How do you deal with conflict?

Question 3.1:
”In your experience, what strategies or mechanisms have proved effective in managing or resolving disagreements or conflicts related to water distribution during droughts? Can you give examples of successful processes to resolve conflicts?”

Question 3.2:
”How do you balance technical and scientific considerations when making water allocation decisions? Are there strategies to balance these aspects, how do you arrive at solutions?”

Question 3.3:
”What are the main developments noticeable in the whole drought issue?

B.4. Category 4:
What is the role of water distribution models?

Question 4.1:
What do you think about the use of water distribution models to manage drought in line with water distribution and water scarcity?

Question 4.2:
Are there things that are missing in the current way of modeling drought?

C

Appendix C

C.1. Interview 1

Gevraagd: Nou, Laten we dan beginnen In de context van de waterverdeling tijdens droogte. Hoe herken je dan meer? De aanwezigheid van verschillende belangen? Wat zijn belangen die je opvallen en hoe ga je daarmee om?

Een uitleg over het concept droogte, wateraanbod bestaat uit drie kanalen namelijk grondwater, aanvoer vanuit grote rivieren en neerslag. De tijdsfactor is altijd belangrijk als er wat gezegd wordt over de waterbeschikbaarheid, eveneens de kwaliteit van het water. Scheepvaart hecht bijvoorbeeld minder waarde aan de kwaliteit van het water maar meer aan de hoeveelheid, terwijl dat bij landbouw een stuk anders is. De waterproblemen die ontstaan in Nederland is natuurlijk ook anders per gebied. Landbouw vraag veel water maar heeft niet per definitie hele hoge kwaliteit nodig, maar klimaatverandering zorgt voor een verschuiving. De verschillende belangen komen goed tot uiting in het verzilting vraagstuk. Drinkwaterproductie is niet echt een knelpunt, die gebruiken niet zoveel water en daar is altijd wel water voor beschikbaar.

Lobith maakt Nederland anders van andere landen, want er kan door middel van schuiven met het water gekozen worden hoe het water verdeeld wordt. Dat is iets uniek in rivierenland. De stuw bij Driel is daarbij een belangrijke factor. Constante keuzes maken tussen de verschillende belangen, meer naar drinkwater, meer naar landbouw of ervoor zorgen dat de waterdiepte gehandhaafd wordt.

Gevraagd: Wat zijn nou conflicten? Merk jij Als je dan bij het LCW het LCB aan tafel bent, merk je dan ook onderling conflicten of merk je dan dat er een bepaalde eensgezindheid is?

In een crisis wordt er dan al snel gekeken van wat is de basis. Wat zijn gewoon de basisafspraken. In categorie 4 is er bewust geen rangorde opgenomen omdat de water regio's dit zelf invullen. Alleen bij hele extreme komen directeuren, het MT, in de droogtekolom zichtbaar in geschakeld.

Voorbeeld op een kaartje naar Lobith. Je wilt eigenlijk niet dat het zoutwater de Lek optreed want dan ontstaan er problemen. Het dilemma ontstaat dus door de constant veranderende bodemhuishouding waar de laagste vaardiepte is. Waardoor het heel erge gevolgen zal hebben voor de vaardiepte van de rivieren (MGD, minst gepeilde diepte). Het verdelen van water zal altijd eerst via regio's verlopen. Dat zijn dus waterschappen en regionale bestuursorganen die op

operationeel niveau en waterschappen aan de slag gaan met draaiboeken. Als het flink droger wordt zal dit een abstractieniveau worden opgeschaald. Als het binnen de LCW overleggen echt geen beslissing gemaakt wordt dan zal het een worden opgeschaald en dan zal het MTW hier beslissingen over gaan maken.

Gevraagd: Jouw werk speelt zich voornamelijk af in de warme fase, maar in de koude fase ziet u daar veranderingen optreden doordat droogte van incidenteel naar structureel verschuift?

Onderscheid tussen korte- en langere termijn. In korte termijn is dat de koude fase gewoon plannen maken is, en uitzoeken. Hoe werkt het systeem en wat zijn de handelingsperspectieven die op ieder moment verschillend zijn. Het is voornamelijk belangrijk om in de koude fase goed voorbereid te geraken op de warme fase. Er is veel meer rust, een periode van droogte wordt nu gezien als business as usal. De langere termijn is natuurlijk een stuk minder voorspelbaar, wat als scenario's. Een belangrijke shift die gaande is, is dat er steeds meer wordt geïnvesteerd in mogelijkheden om water vast te houden in de hoge gronden. "We gaan van Nederland geen vergiet meer laten maar een spons van maken". Ook worden structurele infrastructurele maatregelen genomen.

Gevraagd: Wat zijn nou dingen die bij jou persoonlijk optreden waar je denkt van hè? Daar moet eens wat meer over nagedacht worden. Of dit zijn punten waarvan je denkt. Dit zou wel interessant zijn om te bekijken of heb je nog persoonlijke dingen?

Een belangrijk iets is de zeespiegelstijging, wat betekent dit nu voor Nederland. De waterbeschikbaarheid en verzilting problematiek zal met de zeespiegelstijging enorm gaan toenemen. Verzilting zal in de komende jaren steeds belangrijker worden. Voor drinkwater zal het ook van belang worden om meer/grotere buffers aan te leggen. Dynamiek van de rivier de Rijn mag niet ondergesneeuwd worden, gletsjers smelten en het lijkt er op alsof het van een gemengde rivier naar een rivier gaat die puur alleen op neerslag leeft. Een stuk bestaanszekerheid zit hier ook achter, hoe houden we het land leefbaar.

Gevraagd: Wat zit hier achter, zijn er verschillende waarden die bij jouw opspelen die achter het handelen ligt van verschillende stakeholders.

Eigenlijk de manier waarop de verdringingsreeks is opgesteld geeft al bepaalde waarde aan. De stabiliteit van de waterkeringen in Nederland staat boven het belang van drinkwater, want als het water in het land staat dan kan er niemand leven. In Nederland blijft waterveiligheid, het gevoel van veiligheid heel belangrijk. Tevens Nederland van oudsher een landbouwland, dus er zal ook een historisch gevoel achter zitten. Er wordt geduid op de motivatie achter beslissingen dat dat van historische waarde kan zijn. Ook moet er meer bewustzijn voor het feit dat het tegengaan van verzilting en waterspiegelstijging voor een andere inpassing van de ruimte gaat zorgen (ons leven). Het is essentieel van het snappen van het totale plaatje. Dit ook omdat andere partijen zoals verzekeraars en ander instanties zich ermee gaan bemoeien wat ervoor zorgt dat de implicaties groter wordt en het voor de Nederlander lastiger wordt.

Gevraagd: Zijn er bepaalde punten, ideeën of suggesties voor de modellen die hedendaags worden gebruikt ?

Als samenleving sta je ervoor om zoveel mogelijk de negatieve impact van droogte te beperken. En Je moet dus om dat goed te kunnen doen. Wil je eigenlijk volledige informatie hebben over

die over die impact. Alleen volledige informatie is lastig te krijgen. Kosten is en zal daarbij de belangrijkste blijven. Stel dat scheepvaart het niet aankan door te laag water, wat zijn de kosten voor heel de keten. Heel belangrijk is een idee krijgen van de totale logistiek kosten. En het nog meer kwantificeren van kosten, want er wordt ook aangegeven nogmaals dat de kosten bijna altijd de leidraad zullen zijn.

Gevraagd: En vind je dat dat dat Nederland nu goed in staat is om op basis van bepaalde modellen bepaalde keuzes kan maken?

Terugkijkend naar de droogte van 2022 is dat eigenlijk best wel gebleken dat dat goed kan. We zijn een heel eind gekomen in dat jaar. Het doorreken van alle implicaties zal het lastigste blijven, maar vergeet natuurlijk ook niet of er überhaupt handelingsperspectief is. Zijn het zaken waar je iets aan kan doen of is het gewoonweg niet regelbaar.

C.2. Interview 2

Gevraagd: Wat zijn de belangrijkste belangen die spelen ten tijde van droogte?

Dat is heel erg breed, onder andere scheepvaart, natuur, landbouw en drinkwater. Ook het stedelijk gebied moet niet vergeten worden. Binnen het waterschap zijn er nauwe belangen bij de landbouw en natuur. Het waterschap ziet dan belang in twee facetten, de waterkwaliteit en de water hoeveelheid. Het waterschap is in die mate in actie geschoten sinds de droogte van 2018. Er werd voor de periode van droogte wel wat gedaan maar dit is eigenlijk alleen maar geïntensiveerd sinds toen. Voor het waterschap zijn er twee zaken het belangrijkst, het fruitteelt gebied is een zeer intensieve vrager van water. Om te groeien maar ook om in de zomer te koelen. Gevraagd: Is er verschil te merken met de periode voor de droogte en in de periode erna? Zeker te weten, in 2020 is er daarom ook een motie aangenomen waarin de urgentie uit gesproken is. Er is bewustwording gekomen van dat er nu echt wat gedaan moet worden. Er wordt dan ook geprobeerd om met de betrokken partijen aan tafel te gaan en goed te communiceren dat het waterschap niet meer kan voorzien in alle waterbehoeften van de landbouw, en dat de landbouw dit ook goed in hun oren moet knopen.

Gevraagd: Gezien de expertise van jou in klimaatadaptatie, wat zijn de grote veranderingen die er volgens jou zullen plaatsvinden op de korte en lange termijn omtrent droogte?

Op korte termijn, vaak snel het gebruik aan passen. En op de lange termijn zal water bodem sturend een veel belangrijkere rol gaan moeten spelen. Er moet veel meer worden gehandeld vanuit het oogpunt van de bodem. Er zal een omslag ook in de landbouw moeten gaan plaatsvinden, hoeveel water heb je beschikbaar en dan kijk je naar het gewas. Niet lukraak alles gaan verbouwen (water intensieve landbouw) maar juist kijken wat kan de bodem aan.

Gevraagd: Hoe sta je tegenover de bestaande verdringingsreeks, dus degene die voor oppervlaktewater en niet voor grondwater?

Het ontbreken van een verdringingsreeks voor grondwater is geen goede zaak. Maar het is wel iets waar nu al over wordt nagedacht en gepraat. Vanuit waterschap is er door het bestuur ook vastgesteld dat er grip op inzicht moet komen. Het nu in beeld krijgen van waar en hoeveel grondwater wordt er daadwerkelijk onttrokken. Er is momenteel geen beeld hoe er met het grondwater wordt omgegaan. Administratie wordt momenteel niet goed bijgehouden en

gemonitord, alles moet gewoon gemeld gaan worden. Ook de onttrekkingen die nu niet gemeld worden. Overigens wordt er gemeld dat er wel positief wordt gekeken naar de samenwerking tussen provincie en waterschap. Omdat in sommige zaken het gewoon speelt dat het waterschap overstijgend is. Waardoor er een orgaan nodig is die het overzicht houdt.

Gevraagd: Wat zijn de belangrijkste conflicten?

Op het gebied van landbouw, en dan voornamelijk fruitteelt. Voornamelijk het koelen van het fruit vergt veel water en dat ook nog op piekmomenten in de dag. Deze willen gewoon heel veel water en hier ontstaan dus conflicten in omdat er niet aan voldaan kan worden. Ook bij de natuur ontstaan er conflicten, vooral bij de Natura2000 gebieden. Sommige van deze gebieden zijn afhankelijk van grondwaterstanden en landbouw wil dus ook het grondwater gebruiken, dus dit leidt ook regelmatig tot conflicten.

Gevraagd: Welke rol speelt verzilting?

Een steeds belangrijkere rol. Inlaat van ons waterschap ligt bij Kinderdijk, aardig in het westen. Er wordt momenteel ook gekeken naar alternatieve routes. Zo het verplaatsen naar het oosten van de waterinlaat zou een optie kunnen zijn.

Gevraagd: Wat is het belangrijkste conflict voor jullie?

Het gebruik moet gewoon naar beneden, er moet duurzamer met water worden omgegaan. In de bedrijfswereld moet de knop om, niet alles kan meer! Het is niet meer vanzelfsprekend dat er genoeg is voor iedereen.

Gevraagd: Wat zijn voor de partijen die belang hebben binnen de droogte waarden die achter het handelen liggen?

Binnen het waterschap zijn de meeste mensen doeners, die willen zorgen dat het allemaal zo goed mogelijk gaat. De landbouw heeft hun belang dan ook gevestigd in het BBB dat in het bestuur zit en van oudsher zit er bij het waterschap en dergelijke een grote lobby achter. Het houdt een keer op. Er wordt ook veel waarde gehecht aan een lange termijn visie, die wordt nu nog veelal gemist.

Gevraagd: Welke belang heeft de politiek hierin?

Het is wel van invloed maar wordt niet zozeer gevoeld. Allen met de uitslag van de huidige verkiezingen is het wel lastig in te schatten om dat de heer Wilders aangeeft weinig met het klimaat te doen. Maar het gaat pas spannend worden als daadwerkelijk de beslissingen worden gemaakt dat we bepaalde partijen niet meer kunnen bevoorraden. Dan kan het wel zo zijn dat het politieke spel, de lobby, op gang kan komen .

Gevraagd: Wat zijn verbeterpunten of prangende zaken die zouden moeten worden toegevoegd aan modellen die momenteel worden gebruikt voor droogte?

Een belangrijk iets is, wat is nu eigenlijk de rol van het waterschap? Hier is het waterschap nu zelf ook zoekende naar. Behoefte aan maatwerk voor de gebruikers. Een rol als informatieverstrekker en facilitator kan het waterschap aannemen. Het kan de landbouw helpen met infor-

matie en keuzes die gemaakt kunnen worden met betrekking tot de klimaatverandering. Maar het waterschap kan zeggen wat ze willen maar de boer staat nog altijd vrij om te beslissen. Het is belangrijk om iedereen mee te nemen, je mag in heel deze transitie niemand verliezen. Er zal een gezamenlijke verantwoordelijkheid moeten zijn.

C.3. Interview 3

Gevraagd: Context waterverdeling tijdens droogte, wat zijn dan conflicten die opspelen in jouw oogpunt? Wat zie jij gebeuren als er wordt gepraat, hoe merk je dan er dan conflicten ontstaan?

Belangrijkste is het onderscheiden van twee fasen. 1) De beleidsmatige fase, 2)Warme fase, de fase wanneer een periode van droogte echt aanwezig is. De gesprekken die dan worden gevoerd zijn compleet anders. Binnen de beleidsmatige kant is KBN betrokken bij bijvoorbeeld het Deltaprogramma Zoetwater en het programma Integraal Rivierenmanagement. Binnen IRM zijn er vijf verschillende belangen gedefinieerd die in ogenschouw genomen moeten worden. Dat zijn: (1) waterafvoer (t.b.v. bescherming tegen overstromingen), (2) zoetwaterbeschikbaarheid en drinkwatervoorziening, (3) natuur en ecologische waterkwaliteit, (4) bevaarbaarheid en (5) regionale economische ontwikkeling en ruimtelijke kwaliteit. Bij het Deltaprogramma Zoetwater geeft geen helder inzicht in hoe de rivier in detail moet worden ingericht. Dat ligt meer bij IRM. Het Deltaprogramma én IRM gaan beide in op de waterverdeling op het landelijke niveau, de trade-off. KBN zit binnen beide programma's aan tafel maar er wordt wel aangegeven dat zij vrij staan om input te geven maar dat de overheid uiteindelijk de beslissende actor is. Als het gaat om waar de meeste tijd aan besteed geeft Geert aan dat bij de keuze tussen twee programma's het merendeel van de tijd in IRM zit.

Gevraagd: Als je dan bijvoorbeeld mee mag praten en je input mag geven. Wat zijn dan dingen die je ziet voorkomen? Zijn er bepaalde conflicten in je hoofd die je denkt, hé, hier loop je wel eens tegenaan, heb je voorbeelden?

Iedereen weet in zulk soort gesprekken eigenlijk wel wat het belang is van ieder en heeft respect voor elkaar. Er wordt aangegeven dat IRM moet zorgen dat er eenduiding komt in het te maken beleid. Er is sprake van nieuwe tendens, vroeger waren er veel meer sectorale oplossingen, IRM zorgt dus hiervoor dat het bij elkaar komt. Het laat daarom ook zien dat er tegengestelde belangen zijn. Je kan op de tegenstelde belangen gaan focussen maar dat is niet de insteek van de partijen, er wordt veel gespeeld op erkenning van elkaars belang en het samen tot een oplossing komen. Uiteindelijk liggen de besluiten bij de politiek. De ambtenaren zullen zo neutraal mogelijk alle belangen in kaart brengen en uiteindelijk zijn dit dan ook gewoon politieke bestuurlijke beslissingen. Verder ingaand op het politieke overweging erachter, dat vanuit de besluitvormende organen bestuurders ook gewoon mensen zijn die vanuit een bepaalde denkbeeld keuzes maken.

Gevraagd: Hoe wordt daar dan de rol van de scheepvaart in gezien, in het proces van besluitvorming omtrent beleid in tijde van droogte? Wat zijn ook nou echt belangen/waarden die bij de scheepvaart hangen?

Twee zaken vormen hier de basis, maar er is één belang. Namelijk lading/spullen van A naar B brengen en dat liefst het hele jaar door. En daarbij zijn twee zaken gewoon heel belangrijk, dat is waterdiepte enerzijds en capaciteit bij de sluizen anderzijds (daarnaast is het natuurlijk belangrijk dat die sluizen ook gewoon werken). De zoutindringing waarover gepraat wordt heeft meer

impact op de internationale zeevaart en minder op de binnenvaart. Binnenvaart is onderdeel van een grote logistieke keten, en zoutindrining (en daarmee schutbeperkingen of andere maatregelen) heeft impact op het functioneren van de logistieke keten. Een groot deel van die verstoring ligt bij de zeesluizen. Daarnaast kan ook de binnenvaart last hebben van het bijv. situationeel sturen (het sturen van water wat gevolgen heeft voor waterstanden). Daarnaast zijn er ook sluizen waar binnenvaart gebruik van maakt wel eens gestremd om zoutindrining tegen te gaan (denk aan sluizen in de afstluitdijk of in Terneuzen). En als de binnenvaartschepen moeten wachten kost dat tijd en tijd=geld. Maar dit is misschien niet meteen een kostenpost van de individuele scheepvaartondernemer maar dit zal uiteindelijk voor de kostenpost van het totaal van Nederland komen. Kijk de totale logistieke keten krijgt de kosten voor zijn rekening.

Gevraagd: Als je scheepvaart opdeelt in de drie verschillende categorieën? Wat zijn dan voor hen de belangrijkste belangen?

Nou in principe de transportcapaciteit, deze moet in zekere zin gegarandeerd worden of blijven. Het zijn niet die individuele categorieën maar het is het hele systeem bij elkaar. De verlader wil dat, de logistiek dienstverlener en de binnenvaartondernemer willen dat ook, ze willen gewoon dat de transportcapaciteit blijft bestaan. Dus intern in de scheepvaart valt eigenlijk te concluderen dat de waarden en belangen dezelfde kant opstaan. Als je dieper in detail gaat kan het wel zo zijn dat er kleine verschillen ontstaan maar op deze grote hoofdlijnen zoals droogte staan de neuzen dezelfde kant op. Wat er wel kan gebeuren is dat verlader soms met een ander belang in zijn hoofd zit, die wil gewoon dat zijn lading vervoerd wordt, als is het over de weg of over water. Dus de verlader kan af en toe afwijken van de wensen en belangen die de andere partijen binnen scheepvaart Nederland hebben. Verduurzaming speelt in de binnenvaart een grote rol, het belangrijkst is bijmengen van biobrandstoffen. Aan bijv. elektrisch varen of varen op waterstof wordt veel onderzoek gedaan, maar Die zijn nog niet breed toepasbaar al zal dat in de toekomst uiteraard steeds meer gaan gebeuren.

Gevraagd: Wat zijn belangrijke strategieën die er vanuit de binnenvaart worden gevoerd in overleggen met verschillende stakeholders. Wat zijn waarden die bij jou opkomen?

Deze insteek is zeer interessant en ook nodig, er wordt aangegeven dat het bijna nooit hierover gaat maar dat dit juist wel nodig is. Het zou juist heel goed helpen om de waarde achter het handelen naar boven te halen wat ervoor zorgt dat het allemaal logischer wordt. Deel is er gewoon een historische waarde, niet in de gehele sector maar bij een groot deel daarvan. Generatierederijen = historische waarde. Als je wat dieper ingaat op de diepste waarde van de binnenvaart en logistiek, kom je erop uit dat je bij wilt dragen aan de mogelijkheid om te leven. Er is nu eenmaal behoefte aan het vervoer van noodzakelijke goederen en genotsmiddelen en deze wil de binnenvaart dan ook voorzien. Hier ligt dan ook meer de economische waarde achter, niet zozeer euro's maar de waarde van de economie en van levensvatbaarheid van een land. Het is dus ook levensbehoefte vervullend.

Gevraagd: Wat zijn dan bepaalde criteria die moeten worden meegenomen in afwegingen omtrent droogte? En dan niet zozeer de voor de hand liggende zoals waterdiepte maar wat ligt erachter?

Lastig uit de drukken in iets is de betrouwbaarheid van het systeem, maar wel zeer belangrijk. Hoe houdt je je logistiek systeem betrouwbaar, in de zin van hoe hou je het zo dat het altijd functioneert. Wat hierbij mist is stel dat een sluis niet werkt, wat kost dat dan? Niet zozeer

voor het schip dat moet wachten maar wat zijn de cumulatieve kosten die hiermee bemoeid zijn. Hoe gaat dit totaal worden berekend. Aantal voorbeelden, binnen de binnenvaart zijn er lijndiensten, stel er is oponthoud en er moeten extra schepen worden ingezet om te blijven voldoen aan de vervoersvraag, dat drijft de prijzen op > daarom wordt het duurder. Je ziet dat dit helaas in de onderzoeken nog niet altijd goed genoeg naar voren komt. Het kan bijvoorbeeld zo ontstaan dat een producent zijn productieproces moet stilleggen waardoor hij ook kosten misloopt, de cumulativiteit aan kosten. Het vraag dus twee dingen, enerzijds die modellen die dingen uitrekenen en deze verbeteren, en aan de andere kant moet het gewoon duidelijk worden getallen staan niet opzichtzelf, dat vraag om context. Cijfers maken deel uit van een verhaal. Een bepaalde richting die je op wil wordt bepaald door de context, en er wordt dan ook vanuit de binnenvaart op gehamerd dat zo'n model harstikke leuk is en deze zal ook nieuwe dingen moeten modelleren maar het gaat erom hoe past dat in het groter geheel. Algemene notie: Het ligt voornamelijk in het waterbeheer, stuur je het naar het noorden of naar het westen. Dus de Waal en IJssel. En hou in je achterhoofd dat Europa hier ook een stem in heeft, handel naar het achterland van Duitsland is van gigantisch belang. Je hebt een algemene OLA en ORL (overeengekomen lage Afvoer en Overeengekomen Lage Rivierstand) dat wordt dan ook gezien als een norm. Overheden hebben in NL een inspanningsverplichting om bij de OLA een vaardiepte te garanderen van 2,80m op de Waal. Houd dan ook in je gedachten hoe die normen weer in relatie staan tot waarden.

C.4. Interview 4

Gevraagd: Als je kijkt naar de droogte context van de waterverdeling en ten tijde van droogte. Hoe herkent u de verschillende belangen of hoe ziet u het spelletje wat gespeeld wordt?

Dat spelletje wat hedendaags wordt gespeeld is al aardig vastgelegd met spelregels. De verdringingsreeks legt dit spelletje al enigszins aan banden. Maar een hele belangrijke noot die gemaakt moet worden is dat de bestaande verdringingsreeks bestaat voor alleen oppervlaktewater en niet voor grondwater, terwijl deze twee systemen heel erg aan elkaar verbonden zijn. Dit is momenteel slecht geregeld, de samenwerkingen verlopen slecht en er moeten hier duidelijk regels voor komen. Kijk naar Landbouw en Drinkwater, in tijde van droogte pompt Vitens grondwater weg om te kunnen voorzien in drinkwater, dit leidt dan tot nog lagere waterstanden voor de boeren waardoor hun gewassen het niet overleven. Hier ontstaat zeker te weten wel een conflict. De belangrijkste belangen zijn van de gebruikers (Landbouw e.d.) en vergeet daarom ook niet de dingen die geen water gebruiken maar het dus wel nodig hebben, zoals heel het dijkensysteem van Nederland. Onderschat de grootte van het gebruik van zoetwater voor doorspoeling. Binnen de landbouw zijn de verschillende belangen wel degelijk te onderscheiden zijn in relatie tot het gewas dat er verbouwd wordt. Al zeker ook onderscheid te maken met de hoge en lage gebieden in Nederland, hoog bij het veen en laag in Zeeland bijvoorbeeld. In periode van droogte is het voor deze gebieden heel lastig om water vast te houden en water te gebruiken. Irrigeren wordt aardig dom gedaan momenteel, veel loos water wordt verspild waardoor de efficiëntie gewoon laag blijft. Meer naar tuinbouw kijken hoe zij irrigeren.

Gevraagd: Maar wat zijn nou een beetje de achterliggende conflicten die niet echt naar boven komen, maar wel belangrijk zijn om te snappen en mee te nemen?

Conflicten die spelen omtrent de afhankelijkheid van grondwater. Daar hebben drinkwater bedrijven een leveringsplicht maar de landbouw en natuur hebben ook een recht om grondwater te gaan gebruiken. Tevens zijn er veel natura 2000 gebieden, en deze zijn gewoon onder Ned-

erlands en Europees wetboek beschermd. Dus hier zie je heel sterk het conflict van Landbouw en Natuur ontstaan met drinkwater. Gevraagd: Hoe zit het precies met de afhankelijkheden tussen oppervlaktewater en grondwater? Het is eigenlijk een beetje bizar dat een waterschap een verbod oplegt voor het pompen van oppervlaktewater en tegelijkertijd pompen van grondwater nog steeds toestaat. Het zijn gewoon systemen die aan elkaar vastzitten, dus op moment jij veel grondwaterpomp. Ja, dan gaat je sloot echt wel achteruit en wordt droog. En dit heeft te maken met verschillende bevoegdheden, want oppervlaktewater ligt bij waterschappen en grondwater bij de provincie. Hier mist een stuk essentiële samenwerking. En hierdoor is natuur vaak de kind van de rekening. Die heeft niet altijd een stem, zeg maar, hè? De landbouw heeft een duidelijke stem, drinkwater heeft een stem en natuur heeft geen stem, behalve dan dat die wettelijk beschermd is. Alleen ja, dan moet iemand ze wel handhaven. Belangrijk om ook deze effecten te kunnen kwantificeren, daar doet de WUR ook onderzoek naar. Ook een tool voor ontwikkeld die schade probeert te objectiveren, wat is de huidige schade van het klimaat en wat zijn toekomstige schade kosten. Als dit in kaart is dan kunnen er ook beter onderlinge afspraken gemaakt worden.

Gevraagd: Wat is uw visie op de toenemende frequenties van periodes van droogte?

De gemakzucht waarmee er nu wordt gedacht als er teveel water is wordt het wel weggepompt en als er te weinig is komt er wel bij. Dit gaat ophouden, waterschappen gaan aan de gebruikers steeds vaker nee moeten verkopen. Transitie in de landbouw zal zijn dat de waterbeschikbaarheid wordt niet meer gegarandeerd. Een hele belangrijke norm die er gesteld moet gaan worden is diversifieer, weet op welk land je teelt. Ga uit van de kwetsbaarheden die de bodem met zich meebrengt. De waterschappen, provincies en Rijkswaterstaat zullen beter in overleg moeten want er worden soms dingen gedaan die gewoon niet meer kunnen, synchroniseren van beleid. Binnen de natuur is de grootste verschuiving dat er veel meer techniek moet worden gebruikt om die natuurgebieden in stand te houden. Allen hierbij is de crux, is het het nog wel waard? Hierbij wordt als suggestie gegeven ga die natura 2000 gebieden herzien. Sommige gebieden bevinden zich op bodems die gewoon uitermate ongeschikt zijn om natuur op te houden. Deze zouden ze eigenlijk moeten afstaan en ergens waar het voor de bodem veel logischer is om natuur te hebben daar op te starten. “Ik denk Ik denk dat dat op alle moment goed is, want anders ga je misschien bepaalde gebieden met heel veel geld en kunst en vliegwerk ga je in stand houden. Maar je maakt die gebieden eigenlijk nog steeds nog meer kwetsbaarder, want ze zijn afhankelijk van hele hoop techniek.” Nederland gaat naar een land waar water een schaarste wordt, iets wat wij nog nooit hebben meegemaakt. Bouwen in lage polders, in risico gebieden, Nederland maakt zichzelf alleen maar kwetsbaarder. Steeds kwetsbaarder voor rampen. Kijk naar Limburg, veel schade ontstaan. Alleen hieruit had een les moeten worden getrokken. Maar tot verbazing is alles weer opgeruimd en weer op dezelfde plek begonnen. Deze ramp zou juist voor een ommekeer moeten gezorgd hebben dat er naar de rivier geluisterd moest worden!

Gevraagd: Wat zijn belangrijke punten om het land anders in te richten?

Maak logische keuzes. De bodem bepaalt wat er gebeurd, niet andersom. Schrijnend voorbeeld van het datacentrum op Flevoland, de meest vruchtbare landbouwgrand. Zet het neer op de Maasvlakte! Nogmaals benadrukt, diversifieer je gewassen. Denk na over de inrichting, nu ook met de zeespiegelstijging, een dijkdoorbraak zou desastreus zijn voor Nederland.

Gevraagd: Wat zijn verschillende waarden die hier achter liggen?

Hier wordt wederom benadrukt dat dit heel belangrijk is maar lastig te duiden. Landbouw wordt de economische waarde naar voren gehaald, tevens ook de sector die moet zorgen voor het land. Maar je gaat er een beetje aan voorbij maar de landbouw is de grootste gebiedsbeheerder van het land. Denk ook na wat de toegevoegde waarde is van de landbouw in Nederland voor de BV Nederland. Ga hier je landbouwsysteem op inrichten. De politieke waarde speelt hier ook een rol, dit omdat de urgentie voor lange termijn plannen harstikke groot is, maar het in de politiek zo werkt dat het korte termijn visie is. Terwijl dit voor dit onderwerp gewoonweg niet mogelijk is. Natuur heeft daarbij een levens toevoegingswaarde. En biodiversiteit is eigenlijk gewoon een levensbehoefte, zonder kunnen we eigenlijk niet leven. Een oplossing om de natuur er meer in te betrekken is bijvoorbeeld door Landbouw en natuur samen te gaan voegen, niet zozeer meer in hokjes te denken. Maar het zien als een sector die samen hoort. Het is ook belangrijk om in te zien hoe mensen met onzekerheden omgaan. In de hedendaagse maatschappij is men niet meer gewend om met onzekerheid of tegenslagen om te gaan. Kijk naar Limburg, iedereen ging weer aankloppen bij de overheid om geld. En dat wordt normaal gevonden. Zeker in Limburg houdt dit een systeem in stand dat niet houdbaar is, er wordt niks geleerd van verstoringen. Er wordt dus geen lering getrokken uit de extremen. De watersnoodramp was ook zo iets extreem, maar daar is wel meteen lering uit getrokken. De weerbaarheid van heel de samenleving gaat drastisch achteruit. Eigenlijk kan dit gezien worden als een “anti-fragile” systeem, een systeem dat beter wordt van tegenslagen. Zo’n incident zoals droogte wordt dan ook wel als een “Black Swan” gezien, wat dan weer betekent dat het niet aan zag komen. Iets wat je jezelf niet kunt voorstellen gebeurt uiteindelijk. Dat is als je om met onzekerheden omgaat is van ja je moet hier aan denken, dus Je kunt je slecht voorbereiden op die Black Swans. Omdat je niet weet wat er gaat gebeuren. En nu zitten we in een wereld dat we alles proberen te voorspellen en daarop ons gaan inrichten. Staar jezelf niet blind, zorg voor weerbaarheid, niet alleen bij het droogte probleem maar ook in het algemeen. Voor droogte geldt dit dus ook, je kunt maatregelen treffen, maar je moet wel meerdere mogelijkheden hebben. Meerdere gewassen types, niet blindstaren op één. De grote boodschap is dus eigenlijk, we weten steeds minder de wereld wordt steeds complexer. Dus eigenlijk weten we steeds minder maar denken we dat we een hele hoop weten.

C.5. Interview 5

Gevraagd: Wat zijn in de context van droogte de belangrijkste zaken die meespelen in de afwegingen die dan spelen? Of wat zijn überhaupt de belangrijkste belangen die spelen.

Natuur wordt hier genoemd als van groot algemeen belang. De landbouwsector merkte sinds het eerst in jaren dat er te weinig water was om het groeiseizoen door te komen. Bij de scheepvaart waren de waterstanden gewoonweg te laag om te varen. Voornamelijk impact op de transportketen en opdrachtgevers, niet zozeer voor de schippers (economisch belang natuurlijk). Ook speelt de drinkwater sector hier een belangrijke rol, die ook vanuit algemeen belang handelt. Tevens mogen de industriële watervragers ook niet worden vergeten.

Gevraagd: Is er verschil merkbaar tussen de sectoren/belanghebbenden in de koude en warme fase?

Het allerbelangrijkste verschil is voor en na 2018. Voor 2018 was het een enorm “gedoe” om ervoor te zorgen om de verschillende partijen bewust te maken van het belang. En sinds 2018, doordat de belanghebbenden dit hebben meegemaakt, is dit totaal verschoven. Iedere

groep belanghebbenden is na gaan denken over de wat als scenario's. Iets wat daarvoor nog niet denkbaar is. En dit heeft meer betrekking op de koude fase. Voor de warme fase is er een verdringingsreeks voor oppervlaktewater die goed werkt. Wat hier ook opvalt is dat er geen verdringingsreeks voor het grondwater is. Voornamelijk speelt dit in de hoger gelegen gebieden van Nederland. Er is gewoonweg minder water beschikbaar. En dan zou een verdringingsreeks voor grondwater top zijn. Maar de crux ligt het hem juist in het gebrek aan kennis over het grondwater. Men weet niet hoeveel grondwater er wordt gebruikt en voor wat. Provincies en waterschappen weten het gewoonweg niet, de een heeft grond(oppervlakte)water in het beheer terwijl de provincie kijkt naar het diepere grondwater. Hierin ligt ook een discrepantie. Twee organen die beiden over dezelfde bron beheerder zijn. Tevens wordt er hier aangehaald dat de manier van het vergunningenstelsel niet helemaal logisch is, bedrijven kunnen een jaar naar dato hun inzicht in gebruik van grondwater geven terwijl dat al een jaar na de periode van droogte kan zijn. Dus ten tijde van droogte is er geen informatie beschikbaar. Er is dan ook nog een X hoeveelheid water waar niets over gemeld hoeft te worden. Dit zorgt dan ook weer voor extra gebruik waar niemand iets van af weet. Wat hierbij ook vermeld moet worden is dat dus doordat er weinig kennis is over het grondwater dat de natuur sector aan het kortste eind trekt. Er wordt een vergelijking gemaakt met een grote vaas van bier waarbij iedere sector een rietje is. Waarbij degene die het kortste rietje heeft het snelst is uitgedronken. En alle humane activiteiten in Nederland, die hebben de mogelijkheid om een lange rietje te lobbyen of aan te schaffen. Maar ja, als je wortels hebt zoals een boom of een plant, die maak je niet even een stuk langer. Dus dan trek je letterlijk aan het kortste eind.

Gevraagd: Wat zijn de belangrijkste conflicten die je kan onderscheiden?

Een heel belangrijk conflict is natuur en landbouw omdat deze hun water uit dezelfde voorraad halen. Natuur wordt in Nederland gezien als een luxe goed terwijl het een noodzakelijk goed is om te leven. Het vormt de basis waardoor wij kunnen leven. En deze realisatie is essentieel voor onze gezondheid en dat is een lastig conflict, hier geldt dan ook weer bij dat dit niet een conflict is waar een euro aan gehangen kan worden. Dus ja, alles van waarde is weerloos, zeggen we in een gedicht. En dat is ook in dit geval echt wel een belangrijke realisatie.

Gevraagd: Hoe zit het dan met het conflict tussen scheepvaart en landbouw?

Het belang van scheepvaart hoeft niet direct te conflicteren met het belang van de landbouw. Want de vaarwegen zijn voornamelijk gestuwd dus kunnen lang hoog blijven staan. Maar als er op lange termijn gefocust wordt, wordt het gewoon droger waardoor de hoeveelheid water op de Rijn gaat afnemen en dus de zout indringing op de loer ligt.

Gevraagd: Wat zijn prangende kwesties die rondom de zoutindringing in Nederland plaats vinden?

Het is een groot probleem dat je niet in de kranten terugziet. Het is bijna voor heel Nederland een groot probleem, voor gewassen, polders en voor bodems. Als er lange termijn gedacht wordt dan zou er eigenlijk een sluizencomplex in Rotterdam moeten worden aangelegd om ervoor te zorgen dat het zoete water langer zoet te houden. En er wordt gedacht dat dit er op een gegeven moment gewoon gaat komen, want niet alleen droogte maar ook zeespiegelstijging ligt op de loer waardoor het niveau van het "buitenwater" steeds hoger komt te liggen. Vanuit het politieke spelletje wordt er hier gedacht dat hier niet heel veel achter ligt.

Gevraagd: Wat voor waarden liggen er achter de belangen/wensen van de stakeholders? Wat zijn de achterliggende gedachtes?

De achterliggende gedachte van drinkwater is dat iedereen altijd toegang heeft tot schoon drinkwater tegen een aanvaardbare lage prijs. De landbouwsector is te verdeeld om hier wat over te zeggen, maar je hoort veel dat Nederlands landbouw sector Nederland en de wereld voedt. Maar de vraag hierbij is meteen dat in het totale conglomeraat LANDBOUW dezelfde waarde overal speelt. Er wordt aangegeven hier liever geen bindende uitspraak over te doen, door het diverse pallet aan achtergronden. Scheepvaart wordt lastig gevonden om te duiden, hierbij is er ook gewoon weer sprake tussen een breed pallet aan verschillende actoren. Wat er wel voorbijkomt is ook de waarde in voedselvoorziening. Het belang van natuur wordt hier nog maar eens benadrukt. Maar het belang van Natuur haal je ook weer uit het totale bodem natuur watersysteem. Als het waterbodem natuur systeem ontzettend stabiel blijft kan je daarop een optimaal economisch systeem draaien. Maar naarmate dat natuurlijk systeem minder stabiliteit geeft wordt het steeds gevoeliger voor de impact daarop. De natuur biedt ons dus een soort veilige marge waarop wij kunnen leven en onze economische activiteit kunnen uitvoeren. Het dus van belang om het natuursysteem zo stabiel mogelijk te houden om de schokken op te hangen waar ons economisch systeem dus gevoelig voor is.

Gevraagd: Wordt het natuurlijk systeem in Nederland onderbelicht?

Ja, absoluut! Droogte van 2018 liet zien dat als het impact heeft op de kosten/opbrengsten van bedrijven dat het weer groot op de agenda ging staan terwijl droogte voor de natuur al lang en breed speelde voor 2018.

Gevraagd: Wat moet er dan nu gebeuren? Wat zijn kwalijke punten waarop actie moet worden ondernomen?

De wet van kees: wie knipt moet plakken. Alles is in Nederland georganiseerd in eigen organisaties, ministerie I&W, LVN enz. Maar voor dit moet je gewoon samenwerken, plak al die delen weer aan elkaar voor dit integrale onderwerp. Er moet met elkaar gezorgd worden voor het systeem. Er moet minder individualistisch gedacht worden, maar meer vanuit het collectief. Anders gaat het gewoon niet lukken. Ook een kritische noot op de techniek, er moet minder technisch over de oplossingen worden nagedacht. Er moet minder technisch worden opgelost maar een stuk praktischer.

Gevraagd: Hoe wordt er dan gekeken naar modellen?

Kijk modellen heb je nodig om te berekenen anders zouden we helemaal niks weten. Maar alles hangt of staat bij de afbakening van een model. Ook wordt er een vraagteken gezet bij de aanpak van Integraal Rivieren Management, hoe integraal is integraal? In modellen wordt er interactie tussen oppervlaktewater en grondwater. Modelleer eens wat de bijdrage van het vasthouden in de bodem en modelleer ook eens wat de impact is van verschillend bodemgebruik. Meer inzicht te krijgen in hoe land wordt beoordeeld.

C.6. Interview 6

Gevraagd: Wat zijn de belangrijkste belangen (in tijde van droogte) voor de haven Rotterdam.

De belangrijkste is de vaarwegen verbinden met allerlei bestemmingen door Europa. Droogte zal zorgen voor een belemmering van dit gehele proces en zal daarom dan ook doorwerkingen hebben over de gehele keten. Het havenbedrijf Rotterdam speelt de rol als facilitator. De directe impact door droogte in de haven van Rotterdam is dat er gewoonweg minder zoetwater beschikbaar is en dat het zeeschepen last krijgen van dat er geen doorstroom mogelijk is naar het achterland. Terminals worden steeds drukker. Maar aan de andere kant wat zijn dan alternatieven zoals trein en over de weg. Maar dat zit dus eigenlijk ook al helemaal vol. En het ergste wat zou kunnen gebeuren is dat er zoveel vertraging ontstaat dat op een gegeven moment de opslagcapaciteit helemaal vol geraakt. Dan zouden schepen moeten uitwijken naar Antwerpen. Om droogte dus voor te zijn wordt er al eerder gekeken naar hoe lading kan worden gediversifieerd over verschillende locaties. Effecten worden hier ook maar gezien als keten effecten. Wat zijn de kosten die meewegen met het keten effect. Fabrieken kunnen minder goed draaien, medewerkers zitten thuis, al dat soort zaken.

Gevraagd: Hoe zie jij dat dan Als je andere actoren ook meeneemt, zoals een landbouw, zoals een drinkwater zoals andere industrie? Hoe dat water een beetje verdeeld wordt?

Eerst en vooral moet er gezegd worden dat de haven Rotterdam hier geen directe invloed op heeft. De haven heeft meer een informatieve functie naar kleinere havens en het binnenwatersysteem van Nederland.

Gevraagd: Hoe zit het met de steeds pangender wordend probleem van zoutwater indringing.

Dit heeft hele nautische invloeden zoals bijvoorbeeld bij het afzinken van de Blankenberg tunnel dat die te snel zonk door het verschil in dichtheid tussen het zoete en zoute water. Binnen de industrie in de haven is er ook sprake van zoetwatervraag. Fabrieken gebruiken water in hun productieprocessen of gebruiken het voor koelwater. Naar aanleiding van de droge periode in 2018 was door de lengte van de droogte uiteindelijk de keuze gemaakt om kraanwater bij te mengen in het water. Dit was een uiterst noodzakelijke handeling die ontzettend duur is gebleken. Om hier in de toekomst gestructureerde oplossingen voor te vinden wordt er gekeken naar een inlaat die een stuk oostelijker zal liggen, dus verder van de zee af.

Gevraagd: In welke mate is het haven bedrijf in conflict met ander partijen die ook om het water strijden?

Eigenlijk niet echt, want het havenbedrijf heeft in die zin niet met die andere partijen te maken. Kijk het havenbedrijf heeft natuur in eigen beheer en zoals eerder besproken is er veel industrie die in een bepaald watervraag heeft. Hierin zitten af en toe wel tegenstrijdige belangen maar dat valt eigenlijk wel mee.

Gevraagd: Met betrekking tot het modelleren van de verdeling van droogte, zijn er dan nog specifieke zaken die moeten worden meegenomen naar uw beleving?

Verdringingsreeks is logisch gedefinieerd, maar wat mij dus heel erg opvalt is hoe zit de prioritering van de vervoerde lading. Als scheepvaart bijvoorbeeld voedsel vervoerd, hoe zit het dan? Behoren ze dan opeens bij de eerste prioritering. Ook als zijn kolen vervoeren voor de noodzakelijk energie voorziening, zou hier dan ook een voorrangsregeling op moeten komen. Verschaf duidelijkheid naar alle partners. En verduurzaming van de gehele vaart is noodzakelijk,

maar hierbij is toch wel drang naar instituties ofwel vanuit Europa ofwel vanuit Den Haag om ervoor te zorgen dat er een incentive achter zit waardoor er wel echt geïnvesteerd wordt.

Gevraagd: Wat zijn de waardes die achter het handelen van het havenbedrijf Rotterdam zitten?

Het is iets lastigs maar wel heel belangrijk. De haven is er om processen die de maatschappij vraagt te helpen, faciliteren en organiseren. En eigenlijk kan je de haven van Rotterdam zien als een gebiedsontwikkelaar. Je bent verbinder van de mensen die in Nederland en in het achterland van Duitsland en verder woont, je probeert die zo duurzaam mogelijk te doen maar je moet ook betrouwbaar zijn. Je hebt als haven niet alles zelf in de hand, je kan niet alles zelf bepalen maar door de magnitude qua haven is er wel een grote sturingsrol. Een belangrijke incentive die de haven hanteert is een beloningsstructuur, hoe duurzamer hoe meer korting je krijgt. Alleen, hier moet wel meteen bij worden vermeld dat dit label niet meteen staat tot verduurzamen. Het is een deel van de puzzel, andere prikkels moeten er ook bij komen om uiteindelijk de stap te zetten. Wat ook echt niet vergeten mag woorden zijn politieke waarden. Want daar komt het eigenlijk op neer. Belangrijke beslissingen zullen vanuit het Europese orgaan moeten worden gemaakt. Zolang dat niet gebeurd worden duurzame beslissingen niet opgelegd en dat is juist wel nodig om de switch te maken. Wat nog toegevoegd wordt is dat de droogtekolom beter gecommuniceerd moet worden. Er zijn bepaald vaste waarden ingesteld, die waarden staan gewoon vast. Het orgaan dat dit in de gaten houdt en aan het voorspellen is in tijde van droogte kan met de bedrijven/instellingen die er eventueel mee te maken krijgen eerder contact opnemen. Meer mee in overleg gaan van wij denken dat over een termijn dit gebeurt waardoor de bedrijven maatregelen kunnen treffen, dan kunnen er al aanbestedingen worden gedaan voor alternatief vervoer bijvoorbeeld. Een stuk meer transparantie en perspectief te bieden. Al moet dit wel institutioneel worden vastgelegd. Want anders gaat er achteraf met vingers worden gewezen.

C.7. Interview 7

Gevraagd: In de context van de droogte, wat zijn nou de belangrijkste belangen die voorkomen binnen zulk soort overleggen, wat zijn de meest prangende dingen die in het gesprek komen?

Er wordt al snel gewezen op de verdringingsreeks, maar dit is in de warme fase natuurlijk al lijst die de verschillende belangen aangeeft. Na aanleiding van de evaluatie van de afgelopen perioden van droogte kunnen er enkele dingen onderscheden worden. Door heel het land wordt er zoetwater gevraagd. IJsselmeer dient als buffer voor eigenlijk heel het noorden van Nederland. De splitsingspunten bij Lobith zijn van groot belang. En via het Amsterdam-Rijn Kanaal zijn er ook opties om zoetwater aan te voeren naar het noorden. Bij het Noordzee kanaal is het belangrijk dat de sluis goed zijn werk doet om juist het zoute water buiten Nederland te houden. In die periode van droogte is het belangrijk om te kijken hoe je het water verdeeld over Nederland.

Gevraagd: Wat zijn de meest prangende zaken die u kunt opnoemen, van dit gaat echt veranderen binnen de dynamiek? Doordat de frequentie van droge periode zal verhogen.

Er wordt veel werk verricht in de klimaatadaptie. De grootste verandering die er nu gaande is, is dat er eensgezindheid komt in het feit dat mensen nu durven te roepen dat niet alles meer kan. Dat er keuzes gemaakt moeten worden. En dat is eigenlijk wel de grootste, grootste verandering. Tot nu toe was het wel een beetje belangen afwegen maar toch wel heel vaak. Iedereen dient

een wensenlijstje in en we probeerden het water zo goed mogelijk te verdelen. Dat iedereen op zijn eigen moment in zijn behoefte werd voorzien. Dat gaat op termijn niet meer lukken, dit heeft twee oorzaken, aan de ene kant wordt de vraag groter en aan de andere kant komt er gewoon weg minder beschikbaar. Deltaprogramma is een hele goede stap in de richting, dit zorgt voor het meer kennisdelen en duidelijker naar elkaar uitspreken hoe en wat. 2018 is daarom ook een jaar geweest waar ontzettend veel lering uit is getroffen.

Gevraagd: Wat is het belangrijkste belang?

Er valt onderscheid te maken tussen een kort- en lange termijn visie. Op lange termijn moet het totale systeem gewoonweg betrouwbaar zijn. Korte termijn visie is wat er gebeurt als er een periode van droogte is. Dan water laag, prijzen omhoog, gewoonweg marktwerking. Op korte termijn lijdt dit tot veel verdienen maar er zal wel degelijk gestreefd moeten worden naar een lange termijn robuustheid. Veranderingen vinden ook plaats tussen de modaliteiten. Tussen weg en water bijvoorbeeld. Grondstoffen en dergelijke ook, als het laag water is zal de gehele economie hier gevolgen van hebben. Rondom de Rijn route werd al vorens de periode van droogte door de grote bedrijven risico gespreid door fabrieken door middel van verschillende aanvaarroutes aan te laten komen.

Gevraagd: Wat hangt er nu precies achter deze verschillende wensen en belangen?

Is een lastige vraag om te kunnen beantwoorden maar wel van heel groot belang. Vergeet niet dat het Nederlandse (hoofd)watersysteem aardig complex is. De regio is heel afhankelijk van op welk tijdstip van het jaar en welke sector je bent om welke watervraag er dan is. Vroeger was heel erg de tendens dat in de water het water maximaal moest worden afgevoerd en dat het juist in de zomer kan vasthouden, alleen door ook de klimaatverandering is dit niet meer altijd zo. Fysieke belangen spelen ook een rol in het totale watersysteem. Het waterpeil zakken, niet boven dit komen, terwijl je eigenlijk voor al die onverwachte situaties meer marge zou willen hebben om op een juist moment extra water te bergen, bij hoge afvoeren of bij heel veel regen of juist om het om het vast op te slaan voor droge periodes. Die marges zijn in ons gereguleerd systeem heel erg krap en dat komt natuurlijk ook gewoon door de fysieke omstandigheden. Die polders en superlaag land, je kan het daar niet lager pompen, want pompje ongeveer de Noordzee ook omhoog en je kan het ook niet horen laten staan, want er staan de huizen met hun voeten in het water. Dat is een beetje een beetje het spel dus, en dat is op zandgronden natuurlijk weer compleet anders. De vraag in Nederland is dus super divers.

Zijn er naar aanleiding van de afgelopen droogte perioden veranderingen geweest in de perceptie van mensen?

Een groeiend bewustzijn is wel te merken. Bedrijven, instanties, personen die in aanraking geweest zijn met de afgelopen perioden van droogte zijn zich er heel erg bewust van, maar kunnen ook geen 50 jaar vooruit plannen door middel van de onzekerheden die eraan hangen. In de onderzoekkant komt dit ook heel erg naar voren, onzekerheid gaat een hele grote rol spelen. We kunnen niet meer het leven gaan leiden dat we hebben gedaan. Binnen onderzoekswereld en beleidsmakers komt ook steeds meer kennis waardoor werken ten tijde van deze crisissen beter wordt. Aantal beleidsbrieven ook echt aan de kamer geschreven dat niet alles kan meer en we echt anders om moeten gaan met het beschikbare water. We kunnen er niet meer voor weglopen, de nood is aan de man. Je moet luistern naar de bodem alvorens je wat doet, ga geen dingen meer in lage gronden zetten.

Gevraagd: De situatie in Lobith, kan dat als trade-off worden gezien?

Dat is interessant en lastig te duiden. Deltaprogramma Zoetwater denkt na over lange termijn maatregelen. Er zijn binnen dan de belangen tussen scheepvaart en landbouw duidelijke afspraken. Er zijn daarbij normen opgesteld, maar deze normen stel je vast, maar het gaat er natuurlijk om wat kan je er nog meer mee? Ook voor het tegenhouden van zoutwater door die sluizen is er daar ook gewoonweg veel zoetwater nodig om ervoor te zorgen dat dit niet geheel Nederland binnenstroomt. Momenteel heel erg bezig om in kaart te brengen hoe en wat precies rondom deze afwegingen, en het lastigste is. Niet alles is in geld uit te drukken. Er wordt vanuit de scheepvaartsector op kritiek gestuit of de verdringingsreeks. Maar er wordt gedacht dat het niet terecht is. Er mag eigenlijk niet geklaagd worden vanuit die sectoren want zijn zie het te gechargeerd omdat ze in categorie vier staan. Terwijl je dit in context moet zien. Tussen het Deltaprogramma en IRM zit nog wel een verschil. Maar bij IRM groot aantal stakeholders, en als snel wordt het lastig, wie neem je mee en wie betaalt (die bepaalt).

Gevraagd: Hoe wordt het verschil gezien tussen privaat en publiek belang? Hoe wordt dat afgewogen of hoe wordt dat gecombineerd? Wat zijn zaken die in modelstudies zouden moeten worden meegenomen?

Meer context, staar jezelf niet blind op kuub, waterdiepte enz. Kijk naar het diversifiëren? Kunnen bedrijven naar ander locaties? Dan wordt zo'n model meer dimensionaal genomen. En durf harde beslissingen te maken, Zeeland bijvoorbeeld wordt heel erg veel moeite om zoetwater naar toe te voeren om gewassen te laten groeien. Terwijl met logisch nadenken en robuuste besluitvorming hier de stekker moet worden uitgetrokken en gewassen uitkiezen die op zilt water kunnen leven.

Gevraagd: Zijn er nog zaken die extra aandacht verdienen?

De komende vijftien jaar gaan we nog wel overzien, maar het is van heel erg groot belang dat nu de keiharde voorbereidingen moeten uitvoeren en de keuzes moeten maken voor de komende vijftig a tachtig jaar. Politiek is er een giga slag te slaan. Er zullen impopulaire maatregelen moeten worden getroffen en dat is voor de politiek gewoon heel erg moeilijk. Politiek moet beter gaan luisteren. Uiteindelijk wordt er in de politiek beslist hoeveel geld er besteed wordt aan wat. Tevens ligt er een grote vraag bij het kabinet, hoe gaan mensen zich duurzamer gedragen? "Geef ons heden ons dagelijks brood en af en toe een watersnood" Dit om de bewustwording te vergroten en het belang ook.

C.8. Interview 8

Gevraagd: In de context van droogte, wat zijn de belangrijkste belanghebbenden en hun belang ten tijde van droogte?

Drinkwaterbedrijven zijn hier heel belangrijk in. Scheepvaart is hiernaast ook een zeer belangrijke partij, tevens ook de landbouw. Je hebt ook nog de industrie die het als koelwater bijvoorbeeld gebruikt. En als laatste natuurlijk nog natuur. Gevraagd: Zijn er bepaalde belangen voor natuur en landbouw ondervertegenwoordigd?

Wat je dus ziet dat is dat natuur niet echt een partij is. Waardoor als er daar iets mee aan

de hand is niet meteen een vertegenwoordiger op de stoep staan van zullen we dit eens anders gaan aanpakken. En de verdringingsreeks is een zeer zwaarwegend instrument wat belangrijk is. Gevraagd: Wat zijn de conflicten die kunnen ontstaan in tijde van droogte?

Zoutindringing is een groot probleem, dit moet worden tegengegaan en kan ervoor zorgen dat de vaardiepte voor de scheepvaart zal afnemen. Er wordt hier geopperd dat het conflict van scheepvaart met de overige sectoren het meest prangend is. Hier wordt ook de verdringingsreeks weer naar voren gehaald, om soort van te laten zien dat hoe en waar iedereen vertegenwoordigd zou moeten zijn. Gevraagd: Hoe vind je de opbouw en omvang van de verdringingsreeks?

Het is belangrijk dat tie der is. Omdat hij wel heel duidelijk prioriteiten stelt voor bepaald onderwerpen boven andere onderwerpen. Maar er zitten binnen die verdringingsreeks veel grijze gebieden, dan spelen er zaken die niet precies kunnen worden toebedeeld aan specifieke sectoren. Gevraagd: Hoe sta je tegenover een verdringingsreeks voor grondwater?

Je zou daardoor wel duidelijkheid verschaffen, zeker met de wetenschap dat grondwater een steeds belangrijkere bron wordt. Dus er wordt gedacht dat dat zeker een goed idee is om eens te onderzoeken hoe dat systematisch verdeeld kan worden. Gevraagd: Wat is volgens jou een belangrijke waarde voor de verschillende eerder genoemde belanghebbende?

Economische waarde voor landbouw, drinkwater zou meer richting leefbaarheid en veiligheid van de drinkwatervoorziening gaan. Scheepvaart zal meer richting de kant op gaan ook van verminderde belading en dergelijk dus zal richting geld gaan. Maar voor natuur om dat de monetaristen naar geld is en blijf lastig. Dus zal die ook meer richting leefbaarheid gaan. Gevraagd: Wat zijn belangrijke zaken die volgens jou moeten gebeuren?

Keuzes maken waar welk gewas te verbouwen. Gewassen gaan gebruiken die minder water nodig hebben of die tegen zilt water kunnen. Hier wordt ook net zoals eerder het voorbeeld van de data centrums aangehaald. Gevraagd: Hoe zie jij het politieke belang?

Uiteindelijk is dat er gewoon wel, er zullen afwegingen vanuit hen gemaakt worden wat is belangrijk en wat niet. Natura 2000 wordt hier wederom aangehaald. Natura 2000 gebieden zijn gebaseerd op doelen en je kunt jezelf afvragen of je dit met klimaatverandering en temperatuur verhoging moet doorzetten, moeten deze niet eens bijgesteld worden? Gevraagd: Wat zijn verbeterpunten voor de huidige modelstatistieken?

Lange termijn perspectieven, zorgt voor voorspellen van langere termijnen waardoor entiteiten meer handelingsperspectief kunnen krijgen.

C.9. Interview 9

Gevraagd: Wat zijn de belangrijkste partijen die een rol spelen in tijde van droogte?

Dat is natuurlijk afhankelijk van hoe je de situatie bekijkt. Er zal met elkaar moeten worden afgestemd hoe het te verdelen. Binnen het waterschap gebied is dat natuurlijk de gebruikers. Dat is onder andere de agrarische sector. Ook deze is onder te verdelen in verschillende sectoren. Tevens speelt drinkwater een grote rol. Ook de recreatievaart en scheepvaart moeten niet vergeten worden. En natuur hoort daar ook bij.

Gevraagd: Wat zijn de belangrijkste conflicten die ontstaan volgens jou?

Er wordt aangegeven dat de droogte van 2018 en 2022 belangrijke momenten zijn geweest. Het gaat bij de periode van droogte gewoon op het toepassen van de verdringingsreeks. Wat kan gebeuren is dat door het nemen van maatregelen de recreatievaart gestremd wordt. Als waterschap kan je natuurlijk verboden opleggen om niet te beregenen voor de agrarische sector en dat zou kunnen leiden tot conflicten. Verboden van water gebruik zou beter via de gehele overheid gaan en niet van de waterschappen zelf.

Gevraagd: Wat wordt er gedacht over de vedringingsreeks?

Verdringingsreeks is een instrument waarbij de spanning die het veroorzaak en de daarbij economische impact niet helemaal op toegespitst is. Er wordt ook aangegeven dat onderscheid in vervoerde lading iets is waar over nagedacht moet worden.

Gevraagd: Wat is de gedachte tegenover een verdringingsreeks voor grondwater?

De vraag is wel natuurlijk wat het waterschap hier kan doen. Maar hier wordt ook weer aangegeven dat er informatie mist.

Gevraagd: Is er een politiek belang dat hier speelt?

Daar wil de respondent graag van wegblijven. Maar de suggestie wordt gegeven als de situatie eens wordt omgedraaid stel dat het opnieuw gaan inrichten. Dan zouden we Nederland heel anders inrichten. Dan zou het land veel beter worden geluisterd naar de bodem. Maar er wordt wel aangegeven dat politiek toch niet ver genoeg vooruit kijkt. Hier zou de Deltacommisaris een belangrijke rol in kunnen spelen omdat deze een lange termijn kan benadrukken.

Gevraagd: Wat zijn belangrijke waarden die gekoppeld kunnen worden aan de partijen die betrokken zijn bij droogte?

Agrarische sector heeft een hele belangrijke economische waarden. Binnen dit antwoord wordt er geschakeld naar aan te raden van de agrarische sector in diversificatie. Voor de scheepvaart wordt de economische waarde boven gehaald. Drinkwater voorziening wordt gezien als een nutsvoorziening voor de gehele samenleving.

Er wordt nog aangehaald dat er institutioneel iets kan gaan veranderen om ervoor te zorgen dat er minder zoet water wordt gebruikt.

Gevraagd: Wat zijn gebreken of verbeterpunten voor distributie modellen?

Een grotere tijdshorizon is iets wat ons heel erg zou helpen. Maar daar zit natuurlijk wel een hele grote onzekerheid aan.