Learning from the past

The interaction of the social system and the water system in the Netherlands

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Abstract (max 150 words)

Sustainable water management strategies are able to cope with uncertainties in our natural and social environment. Uncertainties in our social environment reflect changing societal perceptions on how water should be used and which objectives should be preferred. Change of these perceptions may lead to a loss of public support for strategies, forcing policy makers to take measures quickly. To explore the social robustness of different water management strategies and identify circumstances in which strategies loose social support we use the perspectives method and a historical case study analysis of the Netherlands as from 1900. Resulting from our historical analysis we present ten aspects that should be included in a future exploration of social robustness. A future exploration provides insight in the risks and opportunities of strategies and on how to respond to and anticipate on events and developments in order to preserve social support.

Introduction

The future is surrounded with uncertainties, nonetheless we try to prepare for it in the best way we can. This involves preparedness for both natural uncertainties (like the effects of climate change on discharges) and social uncertainties (changing values, perceptions and objectives). In this paper we focus on social uncertainties and the extend to which water management strategies can cope with it. A socially robust water management strategy is able to cope with changing societal perceptions and will count on social support. A strategy that lacks social robustness may - under specific future conditions - loose public or policy support, possibly leading to indefensible situations and the urgency to take expensive measures quickly. We use a combination of the perspectives method and a historical analysis of the Dutch water management history as from 1900 to explore lessons about social robustness, support for policy measures and changing human perceptions. Historical analysis offers information for the future, and provides a first analytical fundament indicating what may be relevant aspects to include in a future exploration for social robustness. Besides it functions as a validating component for further research results. Derived from Cultural Theory we distinguish three perspectives to analyze and structure information from the past and to provide first steps towards a future exploration of social support and social robustness for water management strategies. In this article we will first explain the 'perspectives method'. Afterwards we provide an overview of developments in Dutch water management

as from 1900 and we will analyze these developments in terms of perspectives and perspective change, providing insight in the effects of different events on perspectives and support for policies. Finally, we will withdraw lessons for the future by indicating the aspects that should be taken into account when exploring the future social robustness of water management strategies.

Methodology

To classify the broad variety of human perceptions on water, to analyze history in terms of (changing) human perceptions and to gain insight in the social robustness of water management strategies we use the Perspectives method. Perspectives can be defined as: perceptual screens through which people interpret the world (the worldview) and which guides them in acting (the management style) (van Asselt, 2000). They are steering for the content of the response (what do people want to achieve and how do they want to achieve it?) and their support for strategies. The Perspectives method is derived from Cultural Theory (Douglas, 1970; Thompson *et al.*, 1990). The typology has been used to analyze different views on religion (Douglas, 1970) nature and resources (Thompson *et al.*, 1990), uncertainty (van Asselt, 2000; Valkering *et al.*, 2008b) and climate change (Pendergraft, 1998). Furthermore, it is a useful typology to interpret and classify perspectives on water (Hoekstra, 1998; Middelkoop *et al.*, 2004; Valkering *et al.*, 2008b).

Three active, stereotypical perspectives can be distinguished: the *Hierarchist*, *Egalitarian* and *Individualist*. Applied to water (Hoekstra, 1998; van Asselt *et al.*, 2001; Middelkoop *et al.*, 2004; Valkering *et al.*, 2008b; Offermans *et al.*, 2009), the *Hierarchist* believes in controlling water and nature, high government responsibilities, the importance of research and expert knowledge. Water is mainly seen as a threat to human safety. A sustainable water system highlights safety and flood control and leaves space for some economic and natural development. As a consequence, preferred water policy options are: building dikes, leveling up or widening dikes, and channeling. *Egalitarians* on the other hand, prioritize ecological recovery and natural development. They urge for more space for nature, water and natural developments. Humans went too far in controlling nature, or even thinking they are able to control. They call for participatory decision making processes with a more equal voice for everyone. Also the needs of animals and plants should be seriously considered. As a consequence, preferred water policy options are space for the river, decreasing human demands, relocation at higher areas, and precautionary actions. *Individualists* adhere to a more optimistic point of view. They do not see water as being a threat; on the opposite: water offers great opportunities in terms of economy, images, creativity, self development and recreation. They claim for an adaptation approach, great trust in technology and a liberal market. On correspondence with their beliefs, their preferred water management policies focus on innovative projects, like amphibian living[1], living on water, and building off shore islands.

Offermans *et al.* (2009) developed a method to operationalize perspectives and make them measurable (Valkering *et al.*, 2008b; Offermans *et al.*, 2009; Valkering *et al.*, 2009) see table 1. By visualizing perspectives, perspective *change* can be indicated and related to

[1] Amphibian living: buildings or infrastructures follow the dynamics of the water surface. They are suited both to float on the water surface as well as to be on solid ground.

changing public support for strategies. Table 1 contains eight beliefs (left column) with three different, perspectivistic interpretations (second -fourth column). All interpretations for the eight beliefs together form a perspective (for more information see Offermans *et al.*, 2009). In society different perspectives occur, for example because different stakeholder groups have different objectives and interests. Within this broad spectrum of perspectives a dominant perspective and (one or more) undercurrents can be distinguished (Valkering *et al.*, 2008). A dominant perspective consists of interpretations of beliefs upon which the majority of people in a group (family, policy, nation) explicitly or implicitly agree (Valkering *et al.*, 2008). This could be a *Hierarchical* idea of control and regulation, resulting in reinforcing dikes. Undercurrents refer to interpretations of beliefs according to the minority of people in a group or a subgroup, for example an *Individualistic* perspective with focus on opportunities and innovation and a strong preference for amphibian living. Because of perspective's dynamic nature, the interpretation of beliefs may change over time, as well as the distribution between dominant perspectives and undercurrent(s). Eventually, an undercurrent may become dominant at costs of the previous dominant perspective. In our example this would imply a loss of support for further dike reinforcements and growing popularity and attention for amphibian infrastructures. Perspectives and the distribution between dominant perspective and undercurrent change due to surprises (Thompson *et al.*, 1990; Verweij *et al.*, 2006; Valkering *et al.*, 2008b). Surprises are events, developments and occurrences (possibly catalyzed by people or the media) which indicate a mismatch between one's expectations about reality and actuality. For a *Hierarchist*, with great trust in dikes, it would be a surprise to face a dike breach. Besides, events may function as a reproduction mechanism, confirming once expectations about reality and hence enforcing the perspective. An accumulation of surprises may lead to a changing dominant perspective and the social support for a given water management strategy may also change. To avoid protests, indefensible situations and any other difficulties concerning the implementation of a strategy, the social robustness of a strategy needs to be tested in advance. This contributes to make the water system future proof (in stead of only climate proof) (Haasnoot *et al.*, 2009; Offermans *et al.*, 2009).

We followed a stepwise procedure to select and organize information about the history of Dutch water management. In general, information regarding Dutch water management history is widely available. Approaching this information from a perspectivistic point of view however, is rather new. It is not our purpose to repeat a comprehensive overview of developments in Dutch water management history, but to analyze the most important developments in terms of perspective change and changing social support for strategies. One of the most well known detailed historical overviews about Dutch water management history is Gerard van der Ven's book ' man- made lowlands' (van de Ven, 2004). In van Heezik (2006) historical developments and citizen responses are described in an integrated and detailed way. Besides we used information from Van der Brugge (2009), focusing on transition dynamics in Dutch water management, and from The Netherlands Committee of the International Association of Hydrological Sciences (NHV & IAHS, 1998), providing an overview of human interventions in the natural conditions in the Netherlands. In every book we read the relevant sections (about water management between 1900 and now) and wrote down the topics, developments and events that were discussed in the literature. Later on we merged this list into an extensive table of 16 pages, indicating what happened, when it happened, how the policy and societal responses are described in the literature, and if we

identified the event or development as a surprise or reproduction mechanism. While merging the list, we removed items which were only mentioned in one literature source, unless we had the impression that the mentioned events played an important role in perspective change and changing social support. Later on, we used the perspectives map (see table 1) to categorize and visualize the responses into perspectives.

A historical analysis of Dutch water management

In this section we present developments in Dutch water management as from the 20th century. Changing perspectives in the public and policy field and the consequences of these paradigm shifts for (support for) water management strategies are the central focus point. Of course, it is almost impossible to summarize the Dutch water management history extensively in one article. It is explicitly not our goal be fully comprehensive in our historical description, but to withdraw lessons for changing perspectives and policy support.

1900- 1960 Manipulability, progress and technological optimism

From 1875 onwards, Rijkswaterstaat (the national water authority) realized hydraulic works to improve the discharge of water and ice and the suitability for navigation. The beginning of the 20th century can be characterized by an enormous belief in progress and manipulability of natural systems. With the help of new technologies, human made perfection of the river system would happen in the very near future (van de Ven, 2004). The Zuiderzee project (closing off the IJsselmeer Dam and reclaiming parts of the former Zuiderzee) is an outcome of this mental legacy. Economic growth, prosperity and development were core issues and natural resources could be exploited to maximize prosperity. River related problems could be controlled by means of normalization techniques (van Heezik, 2006). Negative consequences for fishery and agriculture were acknowledged, but did not outweigh the advantages for business, trade, industry and navigation (van de Ven, 2004; van Heezik, 2006).

In 1916 a flood afflicted the province of Noord-Holland; dozens of dikes breached and 51 people died (van de Ven, 2004). Although this event could have functioned as a surprise (see the section about methodologies), it strengthened the dominant perspective. The infantile state of the normalization activities was seen as an explanation for this disaster to happen; the solution was larger scale normalization activities to control water more extensively (van de Ven, 2004; van Heezik, 2006). Besides control and discharge of water, increasing the size and speed of navigation were objectives as well. The latter objectives were catalyzed by major developments of the mine- and textile industries in the South of the Netherlands and the economic importance to ship large amounts of coal and textiles year round (van de Ven, 2004; Offermans *et al.*, 2007). In January 1926 there was again a major flood in the Meuse and IJssel valleys; dikes breached which led to 3000 demolished houses and 10 million guilders (around 4.5 million Euro's) damage. The response was the target to achieve an even more normalized character of the rivers. This flood was –amongst others- blamed to the fact that there were still a lot of curves in the river (van Heezik, 2006). For the second time since 1916, an apparent surprise was explained away as a reproduction mechanism. Both disastrous floods were not seen as results from a failing policy neither as signs to proof the inaccuracy of the control paradigm. On the contrary: they led to increased faith in the dominant perspective of control, normalization and increasing discharge capacity (van Heezik, 2006). Incidental small floods were accepted to a lesser extend than before especially because they

were presented as being medieval in a time that people had the ability to control nature (van Heezik, 2006). Combined with a deficit amount of water which made inundation of the foreland (springtime 1940) impossible it gave rise to an extra impulse to control rivers. L.R. Wentholt (who was director of Rijkswaterstaat in 1940) suggested using the fresh water stock of the IJsselmeer lake to 1. combat salinization and pollution 2. control water levels and 3. function as a source for drinking water (van de Ven, 2004). This was basically the first time water pollution and salinization entered the policy agenda (van de Ven, 2004). Nevertheless, the RIZA institute (institute for the purification of waste water) was founded after the flood of 1916. It however, mainly focused on small channels and streams and the end of the chain (purifying waste water instead of reducing/ combating pollution at its source). These new problems were solved within the traditional framework of control, normalization, manipulability and trust in technological progress (van de Ven, 2004). As from the late 1940s, water pollution became more visible for the general public[2] and RIZA substantially increased the number of purification plants (van de Ven, 2004; van Heezik, 2006).

Increasing prosperity after the Second World War, free Saturdays, paid holidays and increased car use indicated a rise in leisure activities. Visiting natural areas made people feel more connected to the river landscape. In the mid 1950s the natural area of 'de Beer' had to move for the expansion of the Rotterdam harbor. Since the Beer was seen as one of the most valuable nature areas of the Netherlands, a lot of people protested in vain to this idea. The whole issue raised a new societal movement wherein the value of ecological values was increasingly acknowledged (van Heezik, 2006). On a policy level ecology did not play an important role yet. For the water quantity approach, the disaster flood of 1953 was important. After the flood, highly innovative technologies to control water and achieve high safety norms received support from the policy field and society. These innovative plans already existed before the flood took place, however earlier there was no support for such a large scale radical approach. After the flood the fight against water arrived on top of the political agenda again (van de Ven, 2004).

1960 -1989 Divergence of water quantity and water quality issues

As from the 1960s a general trend wherein policymakers, NGOs and citizens had less faith in the individualistic optimism of progress, technology and growth arose. Besides, a content shift within the water management domain occurred (see also van Heezik, 2006). Different development pathways for the water quality and – quantity domain can be distinguished. Triggers for the shift in the water *quality* domain were calamities with a strong and visible effect on the rivers, increased salinization, and confronting publications. Regarding water *quantity* issues a shift occurred as from the mid 1970s when action groups, NGOs and citizens expressed their dissatisfaction with the dike reinforcement programs. Trigger for change was a widely shared concern about erosion of the typical river landscape (van de Ven, 2004; van Heezik, 2006).

Water quality issues 1960- 1989

Biological and natural values were increasingly recognized (van de Ven, 2004; van Heezik, 2006) and action groups started to protest against the negative consequences of economic

[2] For example in the Rhine in 1949 (starving fish) and in the IJssel and Berkel after the introduction of synthetic detergents causing foam covers.

growth (van Heezik, 2006). The media paid attention to water pollution as well. River water oftentimes had an unpleasant smell and pollution became more visible (foam, dead fish). Together with R. Carson's book 'Silent spring'[3] concerns about the environment (and subsequently water) increased substantially, both on a societal and policy level (van Heezik, 2006). Around 1965 an exponential growth of environmental action groups started, peaking in the 70s when 600- 700 environmental action groups were formed (van der Brugge, 2009) who often focused on preservation of nature areas or ecosystems[4]. They were convinced that the one-sided focus on economic functions caused damage to the functioning of the river; policy should be turned towards quality functions of the river (van Heezik, 2006).

The Endosulfan poisoning of the Rhine in 1968 caused massive fish extinction. Also, the high salt content caused by the kali mines in France offered severe problems for ecology, agriculture and drinking water supply. In 1971 the rock bottom of water quality was reached when the Rhine was almost free of oxygen, resulting in dying fish, problems for bird species and a stop of water extraction for drinking water (van Heezik, 2006). Directly after, In 1972, a group of scientist published their book 'Limits to growth' arguing that if the human race would continue to exploit natural resources at the same rate, the world would run out of resources within the next 100 years. Ministers underscored the importance of water quality problems in the Rhine but only gave orders to investigate the pollution more thoroughly (van Heezik, 2006). This is also true for RIZA who put efforts to get a more complete picture about water quality issues. Nonetheless, it took till the late 1970s before pollution was not any longer approached from a traditional, quantitative and economy focused point of view only, but also from an ecology point of view (van de Ven, 2004; van Heezik, 2006).

To guarantee enough (clean) water for drink water extraction, sluices were built and fresh water reservoirs were created (van de Ven, 2004). Research concluded that water purification companies achieved the end of their technological possibilities. If pollution won't be reduced within a couple of years, millions of people would be left to drinking water of an unacceptable quality (van Heezik, 2006). As from 1973, when elections resulted in a centre-left oriented coalition with environmental protection as one of the core issues (van der Brugge, 2009) attention for natural deterioration increased rapidly. On a policy level it was agreed that interferences should ideally not alter natural dynamics or effect eco-systems in an irreversible way, leading to the decision for a moveable (instead of closed) storm surge barrier (van de Ven, 2004; van Heezik, 2006; van der Brugge, 2009). During the economic recession of the early 1980s attention for environmental issues decreased (van Heezik, 2006). In the late 1980s two calamities brought the attention back to environmental problems. In 1986, fire extinguishing water used to combat the fire in the Sandoz factory in Schweizerhalle (Switzerland) leaked into the Rhine, causing all fish in a radius of 100 kilometers to die; also the explosion in the radio-active plant in Chernobyl had a major influence on people's perceptions of safety and environment (van Heezik, 2006; Offermans *et al.*, 2007). One year later, the Brundtland commission published their report 'Our common future[5]', which again increased public concerns. In the meanwhile, H. Saeijs had become director of Rijkswaterstaat and led the influential report 'Second nota water management'

[3] documenting the detrimental effects of pesticides on the environment
[4] Like the Waddenzee and Oosterschelde
[5] Indicating the urgency to act more sustainably to preserve our natural system for future generations.

and ‘Living with water’ indicating a radical policy shift towards an eco-centric policy approach. The preservation and restoration of a diversity of organisms and living communities in (and around) the water should be as natural as possible (van Heezik, 2006; van der Brugge, 2009).

Water quantity issues 1960- 1989

After the disaster flood of 1953, controlling water with innovative technologies was seen as a necessity. Safety norms, perfection of the rivers and guarantee of fresh water supply were cornerstones in the technocratic water system approach (van de Ven, 2004; van Heezik, 2006). Besides normalization activities Rijkswaterstaat was also engaged in maintenance of the rivers, mainly through dredging. In the second part of the 60s the dike strengthening program (which was one of the responses to the 1953 flood) started. Policymakers, citizens and NGOs agreed that safety was such an important issue that some cultural values (historical buildings or polder landscapes) had to make space for dikes and more safety. The safety norms were no topic of discussion and thinking about alternatives was unthinkable (van Heezik, 2006).

In 1974 the village of Brakel (in the province of Gelderland) was the scene of protests. Apparently, the dike reinforcements and sacrifices which had to be made (demolishing historical and cultural values) were not weighted as carefully as thought before. To prevent erosion of the river landscape protest groups demanded a policy shift towards spatial solutions and revulsion strategies (van Heezik, 2006). Apparently, well over 20 years after the 1953 flood the significance of safety against floods weakened. Although the ministers concluded that safe dikes were important, however not at costs of landscapes, nature and cultural history, polder administrations kept going on with enforcing dikes and demolishing buildings (van Heezik, 2006). All alternatives for dike enforcement (except for lowering the norm) were rejected. Even in case of lower norms, dikes had to be reinforced (van Heezik, 2006). In 1984 Rijkswaterstaat found out that the norms which were taken as starting point for the dike enforcement programs were not high enough because the roughness of the winter bed was not taken into account. Further dike raising and reinforcements seemed inescapable (van Heezik, 2006). After the demonstrations in Brakel, these conclusions set the fat in fire. The media campaign “Atilla at the bulldozer” started, picturing Rijkswaterstaat as driver of a destroying bulldozer. It was even said that Rijkswaterstaat’s bulldozers destroyed more buildings than would ever have been destroyed by a flood (van Heezik, 2006; van der Brugge, 2009). A new development started with the concept of ‘Integrated water management’, focusing on the strong internal coherence between water quality and water quantity. The distribution of water was placed in an ecological context. Safety could also be achieved from a more ecologically point of view (van Heezik, 2006).

1989 – 1994 convergence towards space for the river concept

The global dimension of particular problems and their long term effects (acid rain, green house effect, hole in the ozone layer) became more obvious (van Heezik, 2006). The dominant perspective shifted from trust in economic growth and prosperity towards the belief that economic growth should change in character. The different pathways for the water quality and – quantity domain converged as from the time it was believed that water safety could be achieved through a more ecological point of view (around 1985). In 1986 ‘plan

Stork[6]' was based on coincidental developments in the Oostvaarders which developed spontaneously from a fallow area into a valuable natural area with wild life ecosystems. Spearheads in Plan Stork were restoration of small channels to enable the return of fish species, natural developments and the disconnection of agriculture and nature. High water protection only had a subordinate position. Nevertheless, creating space for the river was explained as an alternative flood protection strategy (van de Ven, 2004; van Heezik, 2006; van der Brugge, 2009). In 1989 the Third nota water management (under the responsibility of Saeijs) identified quality standards based on human risks, flora and fauna (van Heezik, 2006; van der Brugge, 2009). Furthermore, targets focused on rivers as transportation veins, as habitat for salmon and as green ribbons through the landscape. Recovering the rivers into their natural condition without harming socio- economic functions were main policy objectives (van Heezik, 2006; van der Brugge, 2009).

Although actions groups have been protesting against dike reinforcements for more than ten years, inhabitants were not charmed about Plan Stork either. They were mainly concerned about the disappearance of characteristic signs of the Dutch landscape as a result of providing more space to rivers and nature and further dike enforcements (van de Ven, 2004; van Heezik, 2006; van der Brugge, 2009). In 1992 The World Wildlife Fund published their report 'living rivers' which was presented as an alternative to flood protection which served the additional goals of nature development and wild life preservation (van Heezik, 2006; van der Brugge, 2009). In 1993 parts of the Netherlands were startled by a flood. Activists and citizens suddenly strongly agreed with the dike enforcement programs (van Heezik, 2006). In the policy field however, under supervision of K. Boertien lowering floodplains and natural developments were continuously stimulated. High discharges were approached as a natural condition which should be taken into account in human activities (van Heezik, 2006).

1995 A shuffle of roles and movement towards protection

In 1994 commission Boertien II advised the implementation of river widening measures combined with quays (Valkering, 2009). In 1995 parts of the Waal and Meuse valley were flooded again and there was a serious threat of dike breaches causing thousands of people to be evacuated. The government decided to implemented the advises from Boertien II in an accelerated way with a focus on the implementation of quays and limiting public participation[7] (van der Brugge, 2009). The former dike enforcers realized that the alternative ideas for tackling high water were not so strange in the light of expected climate change. The traditional approach could better be combined with space for water and retention (van Heezik, 2006). Citizens on the other hand supported the dike enforcements in the Delta plan. The near flood disaster had a large impact on citizen's feelings of safety and the ecological perspective was given low priority. Activists who used to ask attention for cultural, historical and natural values were scapegoated and even threatened (van Heezik, 2006).

In 1996 concepts like dike ring area, primary protection structure and safety standards were introduced, and the government was held to be responsible for prevention of inland movements of the coastline (van de Ven, 2004). On a policy level, increasing space for the rivers was seen as necessity to achieve sustainable protection; leveling up dikes alone was

[6] Plan Ooievaar in Dutch
[7] The so called 'Delta plan large rivers'

not enough to reach a safe and sustainable river landscape. In the meanwhile however, citizens still had objections against the space for the river measures. This was not only due to the fear of losing historical, cultural and natural values, but also to an increased feeling of unsafety. The latter was also strengthened by the increased pressure on space and the fact that people lived closer to the rivers than they had done before (Offermans *et al.*, 2007).

Four periods

Summarized, in the 20th century 4 periods with different dominant perspectives on water can be distinguished in the Netherlands.

1. *1900- 1960: Manipulability, progress and technological optimism*. Water and nature could be controlled and used by humans which would result in a desirable situation. Problems (floods and droughts) were explained thought the infantile state of the normalization activities. Intensified normalization would offer solutions to problems. On a policy level, water quality problems (mainly salinization) could also be solved within the paradigm of control. After the 1953 flood support for innovative technologies and control increased. During the same period societal attention for nature values increased.
2. *1960- 1989 Divergence of water quality and water quantity issues.* A general trend with less faith in progress and growth is paralleled with different development pathways for the water quality and – quantity domain. Perspectives regarding water quality issues moved earlier towards a more ecology oriented approach than in the water quantity domain.
   - *A redefinition of water quality including ecological parameters.* A number of visible calamities, worrisome publications and increased public involvement led to increased resistance against the paradigm of economic prosperity and control and concerns about the quality of drinking water. A political shift towards a centre- left oriented coalition brought an ecology oriented approach into the policy field. In the early 1980s, the economic recession tempered the attention for environmental issues. However, in the late 1980s, calamities brought the attention back to environmental issues.
   - *Exploring new ways to achieve a safe water quantity system.* Till the mid 1970s, water safety was the main objective within the water quantity domain. Other values (like cultural historical values) had to give way for dike reinforcement activities. Safety norms and dike enforcements were not questioned till the mid 1970s when people realized that dike enforcements and related sacrifices were not weighted as carefully as thought before. Protests arose to protect natural, historical and cultural values. In 1984 Rijkswaterstaat realized that that the norms which were taken as starting point for the dike reinforcements were not high enough. Protests revived making further enforcements impossible. Water distribution was put in a more ecological context.
3. *1989-1994 Convergence towards natural restoration and space for the river.* Plan Stork initiated the restoration of side channels, natural development and a disconnection between agriculture and nature. Initially, the strategy was not seen as a full alternative for dike reinforcements. Inhabitants and action groups feared the loss of cultural, historical and landscape values due to dike reinforcements or providing space to the river. After the 1993 flood, citizens and action groups complied with dike reinforcements. However, political advisor Boertien responded to the flood by continuing lowering the floodplains and developing nature.

4. *1995- 2007 A shuffle of roles and movement towards protection.* The 1995 flood had an impact on the perspectives of the dike enforcers and citizens. On a policy level, however the token path (combination of quay construction and natural development) was continued. The former dike reinforces realized that dikes alone would not be enough to guarantee safety on the long term and were therefore receptive for the new, natural ideas. For citizens safety was priority number one again; the ecological perspective was given lower priority.

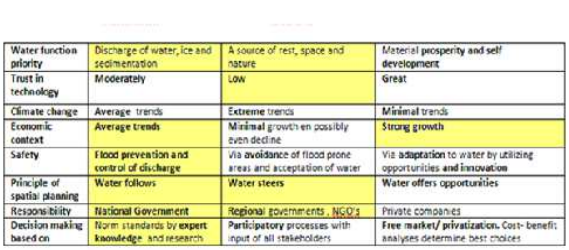
As explained, human perceptions in these four periods can be structured and analyzed through the perspectives method. Table 1 and Figure 1 show a summary of dominant perspectives and provide an overview of the differences between the periods. In figure 2 the divergence in the water quantity and – quality domain can be observed. The water quantity domain has been approached from a traditional, technocratic point of view for a longer period than the water quality domain. After plan Stork the two domains converged again. Insight in the dynamic nature of perspectives and the effects of changing perspectives on public support, allows to explore the social robustness of strategies. Therefore, it is valuable to know what type of events and developments may provoke a change in perspective. Once we know under what circumstances perspectives and public support may change we are able to explore threats of present strategies and gain time to think about adaptation strategies.

Table 1: The perspectives map wherein perspectives from Cultural Theory are translated to water. To measure perspectives one needs to mark interpretations according to ones own beliefs or according to information from the past or present. Since real perspectives tend to be a mix of stereotypes (Thompson *et al.*, 1990; Valkering *et al.*, 2008b) for every belief (left column) people can mark 0,1,2 or even 3 interpretations. The shaded cells refer to the dominant perspective in the period between 1900 and 1960[8]. This interpretation is done by the author of this article. Within the social sciences, a common method to guarantee a minimum level of objectivity is the inter- evaluator reliability test. In this test, a second (and if desired a third or fourth) person repeats part of the analysis done by the first researcher. The interpretations made by the different researchers should match for at least 80% to allow the analysis to be reliable. The inter-evaluator reliability of this analysis is 92 %.

	Hierarchist	Egalitair	Individualist
Water function priority	**Discharge** of water, ice and sedimentation	A source of **rest**, space and nature	A source of material **prosperity and self development**: important for the Dutch' image
Trust in technology	**Moderately**; however I think it is important to thoroughly investigate potential consequences and	**Low**. Risks are too high. We should deal very carefully with technologies. I prefer	**Large**. I mainly see opportunities regarding the use of innovative technologies. Available technologies should

[8] In this table, the short lived effect towards individualism after the 1953 flood is not included. Because of this shift, it was possible to construct the highly innovative Delta works. For a short period the innovative character of these works was highlighted, however, it was mainly approached as a way to dominate and control nature and water (which indicates the continuation of the hierarchistical oriented approach).

	to assure that application is not too large- scale	behavioral changes over the use of technology	be implemented quickly and at a large scale
Climate change	**Average** trends, as predicted and forecasted by experts	**Extreme** trends; climate will change even more drastically than thought right now	**Minimal** trends; I do not think that climate will change clearly
Economic context	**Average trends,** following business as usual patterns. I do not expect deviations from current trends as extrapolated by experts	**Minimal** growth en possibly even decline. I think population growth; economic growth and pressure on space will stabilize and possibly even decrease after a while.	**Strong growth.** I think that population numbers in the Netherlands will increase sharply, as well as demand for space and economy
Safety	**Flood prevention and control of discharge**	Via **avoidance** of flood prone areas and acceptation of water	Via **adaptation** to water by utilizing opportunities **and innovation**
Principle of spatial planning	**Water follows**; water follows functions, preservation of existing space	**Water steers**; functions follow water. Give up space if necessary	**Water offers opportunities**; functions utilize water. Creation of space on and around the water
Responsibility	**National Government**	**Regional** governments and NGO's, in fact everybody contributes its own mite	Private companies and in risky areas (for example in flood plains) individuals
Decision making based on	Norm standards by **expert knowledge** and research	**Participatory** processes with input of all stakeholders	Functioning of the **free market and privatization.** Cost-benefit analyses determine best choices

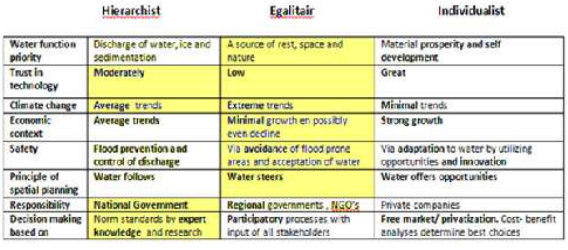


	Hierarchist	Egalitair	Individualist
Water function priority	Discharge of water, ice and sedimentation	A source of rest, space and nature	Material prosperity and self development
Trust in technology	Moderately	Low	Great
Climate change	Average trends	Extreme trends	Minimal trends
Economic context	Average trends	Minimal growth en possibly even decline	Strong growth
Safety	Flood prevention and control of discharge	Via avoidance of flood prone areas and acceptation of water	Via adaptation to water by utilizing opportunities and innovation
Principle of spatial planning	Water follows	Water steers	Water offers opportunities
Responsibility	National Government	Regional governments , NGO's	Private companies
Decision making based on	Norm standards by expert knowledge and research	Participatory processes with input of all stakeholders	Free market/ privatization. Cost- benefit analyses determine best choices

1960- 1989 water quality domain

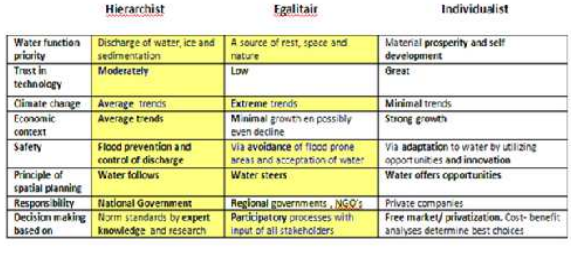
	Hierarchist	Egalitair	Individualist
Water function priority	Discharge of water, ice and sedimentation	A source of rest, space and nature	Material prosperity and self development
Trust in technology	Moderately	Low	Great
Climate change	Average trends	Extreme trends	Minimal trends
Economic context	Average trends	Minimal growth en possibly even decline	Strong growth
Safety	Flood prevention and control of discharge	Via avoidance of flood prone areas and acceptation of water	Via adaptation to water by utilizing opportunities and innovation
Principle of spatial planning	Water follows	Water steers	Water offers opportunities
Responsibility	National Government	Regional governments , NGO's	Private companies
Decision making based on	Norm standards by expert knowledge and research	Participatory processes with input of all stakeholders	Free market/ privatization. Cost- benefit analyses determine best choices

1960- 1989 water quantity domain



	Hierarchist	Egalitair	Individualist
Water function priority	Discharge of water, ice and sedimentation	A source of rest, space and nature	Material prosperity and self development
Trust in technology	Moderately	Low	Great
Climate change	Average trends	Extreme trends	Minimal trends
Economic context	Average trends	Minimal growth en possibly even decline	Strong growth
Safety	Flood prevention and control of discharge	Via avoidance of flood prone areas and acceptation of water	Via adaptation to water by utilizing opportunities and innovation
Principle of spatial planning	Water follows	Water steers	Water offers opportunities
Responsibility	National Government	Regional governments , NGO's	Private companies
Decision making based on	Norm standards by expert knowledge and research	Participatory processes with input of all stakeholders	Free market/ privatization. Cost- benefit analyses determine best choices

1989- 1994



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Decision making based on	Norm standards by expert knowledge and research	Participatory processes with input of all stakeholders	Free market/ privatization. Cost- benefit analyses determine best choices

1995- 2007

Figure 1: small representations of the dominant perspectives in the different time slots. The shift from one period to another does not represent a stochastic movement. Perspectives change gradually. The end and beginning of a period are therefore approximately chosen in the middle of the line between two dots in figure 2.

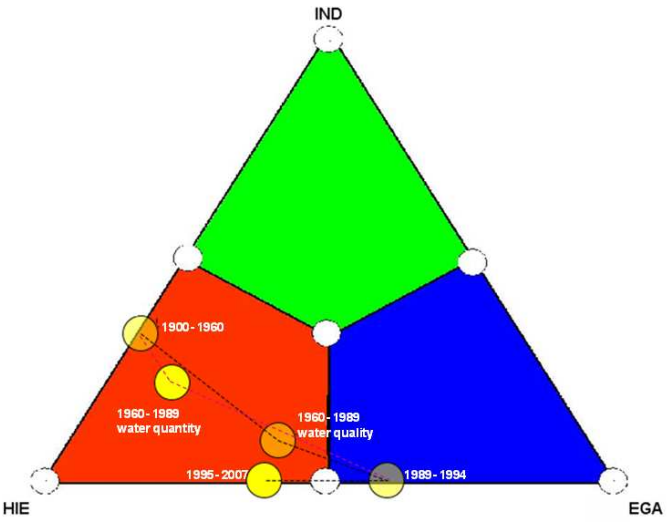

Figure 2: Perspectives triangle with hierarchism (Hie), Egalitarism (Ega) and Individualism (Ind) and the transition path of the dominant perspective in the Netherlands from 1900 till 1997. The dots are gained through summing up the scores per column in the perspectives table (see Table 1), normalize them to three and transform them to x and y-values on a triangle.

Lessons for the future

We started this article indicating that changing perspectives may result in decreased (or sometimes increased) public support for strategies. When public support goes lost it may be impossible to continue policies. Therefore the strategy may lack social robustness. In this historical overview we have seen that the technocratic strategy of control and dike enforcements lost public support under influence of events and developments in the 1960s and 1970s. This led to indefensible situations and weakened social robustness. We used the perspectives method to structure and analyze changing perceptions and public support. A number of general lessons about future social robustness can be translated from insights derived from this historical analysis:

1. *Social change can be initiated by individuals or the policy arena*. Changing social support for strategies and resulting policy changes can be initiated by individuals or by policy makers. Changes occurring in the 1960s are an example of the former: people protested against the bad ecological quality of the water system, which they perceived as inevitable output of the policy. Protest groups put more pressure on the policy arena, and policy makers realized that there was only very little social support to continue the then policy. Saeijs wrote a new style policy document with attention for the ecological quality of rivers, natural restoration and water as starting point in the spatial planning. This new

policy path[9] could count on more social support. After the 1953 disaster flood, it were policy makers who convinced individual stakeholders about the necessity of highly innovative ways to combat the water. This is an example wherein the policy arena took a leading role in perspective- and policy change.

2. *External events play an important role in changing perspectives on water*. Events, developments and people (the 'Al Gore' effect) outside the water system and/ or the chosen case-area (in this example the Dutch delta) may have major impact on people's perspectives towards water issues and the way water should be managed[10]. For example, water quality problems around the Sandoz factory had an important effect on the way Dutch perceived their waters. Other examples of external events and developments that had an effect on the Dutch water perspective are publications regarding the human use of natural resources, the Chernobyl explosion, and increased leisure time (free Saturdays). These developments lead to a more egalitarian oriented perspective in general, but also to a more egalitarian perspective on water which lead to increased demand for more naturally oriented policy with space for water and nature and decreased support for dikes. The water management field is not an isolated field within society. It is influenced by (and will possible influence) other policy domains, hence there is a necessity to closely monitor developments in other policy fields and resulting changes in perspectives, because they may also change perspectives on water and hence social support for strategies.

3. *The role of the media should not be underestimated*. The media may have a great influence on the way people perceive developments and situations within the water system. By paying attention to certain aspects, and ignoring others, they influence the popularity of the dominant perspective and the attractiveness of the undercurrent. In the 1970s the media paid a lot of attention to the bad ecological quality of that moment and the destroying power of the bulldozers of RWS, contributing to strengthening the egalitarian undercurrent and decreasing the popularity of the hierarchical dominant perspective.

4. *Visible events contribute to change*. Hypothetically we argue that visible events are more likely to induce a perspective change than events that are hardly visible to the general public. In our historical analysis we saw that water pollution problems gained increased attention when the pollution became visible by means of dying fish, foam etc. Also, the destroyed appearance of the landscape after removing natural areas (like the Beer) or after removing buildings to make space for dikes seemed to induce an unfettering of passions. Events that are not visible, but noticeable also seem powerful (for example the unpleasant *smell* of surface water, or the strange *taste* of drinking water). Visible and noticeable events and developments also seem to attract media attention (see bullet point

[9] For the time being, activities within the policy arena are approached as a 'black box' with a certain input (for example protest from action groups) and a certain output (for example the development of a new policy plan). This does not mean than activities within the policy arena (how do policy makers work together, what is the role of power and how and why do policy makers react to responses from individual stakeholders or protest groups) are not important. This will be the topic of future research.

[10] Of course, exceptions are possible. For more information about the role of perspectives regarding different topics or themes, please see (Offermans, 2010)

three) which reinforces the power of these events for perspective change. It is interesting to approach the effects of climate change in this prospect. Climate change as such is an invisible process. Events resulting from climate change (flood, drought etcetera) are the visible manifestations of a phenomenon. Because events (and especially the more visible ones) may have an important influence on people's perspective, future climate variability may be even more important than climate change (also see Haasnoot *et al.*, 2009).

5. *Events and developments can always function as surprise and reproduction mechanism*. In the literature, the role of events as surprises is well explained (Thompson *et al.*, 1990; Verweij *et al.*, 2006), sometimes the role of events as reproduction mechanism is acknowledged (Valkering *et al.*, 2008b), but only little information on the exact role of surprises for perspective change is available. In our historical analysis we found examples of events that functioned as surprise (publication of 'limits to growth' and the 1995 flood) and as reproduction mechanism (the 1916 flood and the 1926 flood). We conclude that it is not so easy as to say that a dike breach is a surprise for a Hierarchist in all cases. In general, perspectives tend to be resistant for change. Surprises therefore, will likely be ignored or explained in such a way that it still fits within one's expectations. It is for example not the dike itself that failed, but the organization that is responsible for its maintenance, or the infantile state of the normalization activities. However, this resistance is only tenable up to a given point at which reality can not be denied any longer and the perspective will change.

6. *Dominant perspective, undercurrent and timing are important factors to determine an event to be a surprise or reproduction mechanism*. Whether an event is approached as a surprise or reproduction mechanism depends on: A) the dominant perspective and present undercurrents. Undercurrents –sometimes with help from appealing persons or the media- can seize the opportunity of an event to decrease support for the dominant perspective and increase support for its own (hence using the event as a reproduction mechanism for them selves and as a surprise for the dominant perspective). Of course, the dominant perspective needs to be receptive of being surprised. A dominant egalitarian perspective for example, won't easily being surprised by a dike breach since it does not have much trust in dikes anyway. B) The timing of an event or accumulation of events. Both the 1916 and 1926 flood were recognized as solvable and explained thought the infantile state of the normalization activities at those times, hence reinforcing the dominant perspective and increasing the demand for more control. The sooner an event occurs after implementation, the smaller the chance that it will function as a surprise; it will be used as argument to justify the taken measures. The 1993 and 1995 floods were approached as a surprise; people started to realize that –especially if climate change would be taken into account- dikes won't be sufficient to guarantee safety. Also an accumulation of events (like we saw in the poison calamities) tend to change one's perspective. After the first event, people may explain it away, the second event already increases concerns and every next event makes more and more people change their perspective.

7. *The direction of change depends on present undercurrents and the type of surprise occurring*. If undercurrents got nurtured by means of events, they have the tendency to

grow and may later on become dominant. In general it can be said that certain types of events, nurture certain undercurrents. For example, events regarding ecology, environmental pollution or biological values tend to reinforce the egalitarian perspective. Floods or threats to human safety tend to hierarchism. Examples of events resulting in strengthening of the individualist perspective were rather limited in recent water history. The 1953 flood can be seen as an event indicating that hierarchism is not sufficient enough to guarantee safety, resulting in more individualistic ideas about innovation.

8. *Perspectives may change in different velocities for different domains*. Changes in different domains (in our case study for the water quality and – quantity domain) may develop differently. In our historical analysis we saw both domains moving into an egalitarian direction, however not simultaneously. The shift in the water quantity domain started later than in the water quality domain. In our case study, it took around 50 years between the rise of an undercurrent (as from the 1940s) and a totally new dominant perspective (late 1980s, early 1990s). With 'totally new' we refer to a change from perspective (e.g. from dominant hierarchical towards dominant egalitarian) as opposed to a change within one perspective.

9. *Ingredients for perspective change*. The question what is needed for perspective change is difficult to answer, because it is highly dependent on a specific context with a specific history, dominant perspective and undercurrents. However, in general the following ingredients contribute to perspective change: A. Events or calamities with a visible and large impact are more likely to induce a perspective change than invisible events with a small impact. B. Icons which can be people (like Saeijs or Al Gore), media figures (like Atilla at the bulldozer), a group of persons (like the Club of Rome) and even reports (like plan Stork). C. Available alternatives which can be thrown into the public mindset right after a surprise (for example the Delta plan which already existed before but was thrown into the public right after the 1953 flood) and D. Media attention. Oftentimes, an accumulation of aspects mentioned under A-D seem successful in leading to perspective change (for example an accumulation of events). Also, the combination of some aspects mentioned under A-D seems successful for perspective change. The response to the 1953 flood (high impact and visible event) for example nicely coincided with an alternative (the Delta work plans already existed before, however had no public support) and an icon (Lely who was well known as innovator and competent person).

10. *Four general future situations can be distinguished.* Water management deals with a natural water system and a social system. Both systems should ideally be taken into account by the water management sector. Events may possibly lead to changing perspectives, which on their turn may lead to changing public support. Public support and the extend to which policy objectives are reached play an important role in changing, continuing, or intensifying strategies. This offers four different situations: 1. A situation wherein water policy makers reach their targets and wherein society is satisfied with the chosen strategies and outcomes (in general this was true in the first decade of the 20th century). In such a case it is likely that the chosen strategies will be continued. 2. A situation wherein the policy makers reach their targets but wherein society is not satisfied (like in the late 1960s). Dependent on the intensity of dissatisfaction and the (prospected

time) of it, strategies may have to be changed. 3. A situation wherein the policy makers do not reach their targets, but wherein society is still satisfied (like in the 1920s), in these cases it is likely that the chosen policies will be intensified or that additional measures will be implemented. 4. A situation wherein neither policy makers, nor society is satisfied (in the late 1980s) in such a case changing strategies are likely.

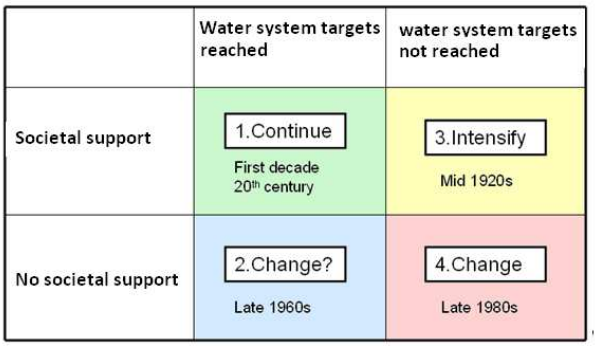

Figure 3: Focusing at results in the water system (e.g. are the policymakers satisfied with the reached results?) and societal support, we can distinguish four situations. All of them occurred in Dutch water management history as from 1900.

Towards socially robust water management

It is always easy to be wise after the event, but would things have gone differently in the 20th century with the knowledge we have today? And if so, could those developments be labeled better or more positive? One thing is clear: by making use of the perspective method we could have foreseen that the technocratic approach of the early 20th century would not be robust under an egalitarian future. Especially since the late 1940s when the first egalitarian undercurrents started to grow, the likeliness of an egalitarian future increased, hence increasing the risk for the technocratic strategies to loose public support. A world wherein water and nature are controlled and wherein people believe in guaranteeing absolute safety, works well in a hierarchical world. However, in an egalitarian or individualistic world this leads to problems (Offermans *et al.*, 2008). According to the individualist, hierarchical measures are too traditional and reactive. For them it would be better to use innovative techniques and approach water as an opportunity instead of a threat. Egalitarians (as is also proved by history) would reject to the regulation of nature and water, because they deserve more space and should be taken into account when developing policy. Besides, they would argue, it is better to focus on prevention instead of controlling the consequences of for example climate change.

To explore the future from a perspectivistic point of view with the focus on the social robustness of different water management strategies would have given the opportunity to think about ways to anticipate on these egalitarian undercurrents. For example, instead of increasing the number of purification plants, it would have been wise to also focus on preventive measures. Also, the disappearance of the natural area of the Beer for the benefit of the harbor of Rotterdam could have been tackled in a different way, for example with assurance to compensate the lost ecological values and protect these values in other areas. Regional projects to protect valuable natural areas would have sat minds on rest, providing

protesters with less reason to worry and protest. Of course, the perspectives method would not have prevented all disturbances or worries and it is very hard (if not, impossible) to identify a single strategy which will be robust under all possible climate scenario's and all possible perspectivistic futures. However it provides us with insight about the risks and threats of different strategies, hence giving the opportunity to anticipate on possible futures and keep different options open (being flexible enough to adapt). This method will be further developed to more specifically indicate risks attached to the present dominant perspective and possibilities, opportunities and threats for the future.

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References

Douglas, M. 1970. *Natural Symbols*. New York, Random House.

Haasnoot, M, Middelkoop H, van Beek E, van Deursen W. 2009. "A method to develop sustainable water management strategies for an uncertain future." *Sustainable Development* **DOI: 10.1002/sd 438**.

Hoekstra, AY. 1998. *Perspectives on Water, an integrated model-based exploration of the future* Utrecht, International Books.

Middelkoop, H, Van Asselt M, Van 't Klooster S, Van Deursen W, Kwadijk J, Buiteveld H. 2004. "Perspectives on flood management in the Rhine and Meuse rivers." *River Res. Applic.* **20**: 327-342. DOI 10.1002/rra.782.

NHV, IAHS. 1998. *Water in the Netherlands*. Rotterdam, the netherlands Hydrological Society (NHV).

Offermans, A, Valkering P, Haasnoot M, van Beek E, Middelkoop H. 2008. "Advies van de Deltacommissie vergt breder perspectief." *H2O Tijdschrift voor watervoorziening en waterbeheer* **20**: 36-40.

Offermans, A, Valkering P, Lieshout Mv, Rijkens N. 2007. *Learning from the past; the Meuse from a historical point of view, workshop report [in Dutch]*. Maastricht, ICIS/ Pantopicon.

Offermans, AGE. 2010. *History of Cultural Theory; a summary of historical developments regarding Cultural Theory*. Maastricht, ICIS.

Offermans, AGE. n.y. *The history of Cultural Theory*. Maastricht, International Centre for Integrated assessment and Sustainable development.

Offermans, AGE, Haasnoot M, Valkering P. 2009. "A method to explore social response for sustainable water management strategies under changing conditions." *Sustainable development* **DOI: 10.1002/sd 439**.

Pendergraft, C. 1998. "Human dimensions of climate change: cultural theory and collective action." *Climate change* **39**: 643-666.

Thompson, M, Ellis RJ, Wildavsky A. 1990. *Cultural Theory*. Boulder, Westview Press.

Valkering, P. 2009. *Toddling 'long the river Meuse; Integrated Assessment and particpatory Agent-Based Modelling to support River Management*. Maastricht, Datawyse.

Valkering, P, Offermans A, Lieshout vM, Rijkens N, Brugge vdR, Haasnoot M. 2008. *Anticipating change, towards a robust and flexible strategy for water management [in Dutch]*. Maastricht, ICIS.

Valkering, P, Offermans A, Van Lieshout M, Rijkens N, Van der Brugge R, Haasnoot M, Middelkoop H, Van Deursen W, Beersma J, Buiteveld H, Volleberg K. 2008b. *Anticipating change, towards a robust and flexible strategy for water management [in Dutch]*. Maastricht, International Centre for Integrated assessment and Sustainable development (ICIS).

Valkering, P, Tabara D, Wallman P, Offermans A. 2009. "Modelling Cultural and Behavioural change in Water Management: An integrated, agent based, gaming approach." *The Integrated Assessment Journal* **9**(1): 1-28.

van Asselt, MBA. 2000. *Perspectives on Uncertainty and Risk : The PRIMA approach to decision support*. Dordrecht, The Netherlands, Kluwer Academic Publishers.

van Asselt, MBA, Middelkoop H, van 't Klooster SA, van Deursen WPA, Haasnoot M, Kwadijk JCJ, Buiteveld H, Können GP, Rotmans J, van Gemert N, Valkering P. 2001. *Development of flood management strategies for the Rhine and Meuse basins in the context of integrated river management. Report of the IRMA-SPONGE project 3/NL/1/164/991518301*.

van de Ven, G. 2004. *Man-made lowlands. History of water management and land reclamation in the Netherlands*. Utrecht, Stichting Matrijs.

van der Brugge, R. 2009. Transition dynamics in social- ecoogical systems. The case of Dutch water management DRIFT. Rotterdam,
Erasmus Universiteit Rotterdam.

van Heezik, A. 2006. *Strijd om de rivieren. 200 jaar rivierenbeleid in Nederland (in Dutch)*. Den-Haag, HNT Historische producties

Verweij, M, Douglas M, Ellis R, Engel C, Hendriks F, Lohmann S, Ney S, Reyner S, Thompson M. 2006. "Clumsy solutions for a complex world: the case of climate change." *Public Administration* **84**(4): 817-843.