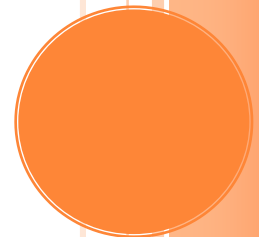


ASSESSING FRESHWATER SUPPLY FOR AGRICULTURAL PURPOSES IN THE SCHELDE DELTA

Case: Horticultural sector on Zuid-Beveland

H.H. van den Berg, A.A. Hak, M.E.R van Huizen, C.C.G van Naarden
6/29/2015



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1. Introduction

After closing off the Scheldt Delta with the world famous Dutch Deltaworks there is more guarantee of water safety for this specific part of the Dutch coast which traditionally lacked any natural protection such as the dunes along the main coast. The closing off created also more economic opportunities for this delta because large valuable investments, which were hardly done before because of the high risk of floods, were possible. One of these stimulated economic activities, was the agricultural sector. More land surface had become available for production of crops, because freshwater lenses were able to grow in size (as a result of inundation control) and the creation of additional freshwater reserves in the form of lakes to sustain large scale production.

Nowadays ca. 80% (=142.000 ha) of the surface area of the province of Zeeland is used for the agri- or horticultural sector (Nolte, 2005). A small part of that, ca. 8000 ha, is currently used for production of high valuable crops, such as fruits. Traditionally fruits require more water than traditional cultivated crops and this can generally be acquired through natural precipitation. A deficit of water obstructs crop growth and reduces crop yields. Occasionally natural precipitation is not sufficient and additional water must be irrigated. This happens both in summer during periods of drought and in early spring when freezing of blossoming trees must be prevented. These practices require more water than is usually used and therefore asking additional water supply from local sources. Especially for the Scheldt Delta, with originally thin freshwater lenses, these additional supplies cannot be provided by local resources.

One of the areas in Zeeland is Zuid-Beveland which is located on the southernmost peninsula of the province and a popular spot for fruit production, mainly apples and pears, because of the optimal growing conditions (among others minimal days of frost, fertile clay). In times when additional water supplies are necessary a total surface of 1600 ha with fruit orchards needs to be irrigated. This cannot be provided locally, because the freshwater lenses are too small and a direct access point to main surface waters is lacking. Nowadays fresh water is supplied via a pipeline between the Biesbosch basins and Zuid-Beveland. Despite the construction of the pipeline adequate fresh water provision on Zuid-Beveland remains an issue. For example, after the dry summer of 2013 almost all fruit farmers on Zuid-Beveland had severe losses in harvest.

Agricultural water demand has become more irregular and in case it peaks the current reserved capacity for the agricultural pipeline is not sufficient. This is becoming a more structural issue, because current contractors already request for more water than normally and also new farmers wish to be connected to the pipeline. Also taking into account future climate change this issue will become more pressing than it now is. A new request by farmers to extend the current pipeline is not received as the desired solution, especially by the authorities, and therefore the issue is not yet solved. New solutions lie on the drawing table, but ems there are some constraints in the decision-process to come up with a quick and effective solution. It's valuable to identify these

constraints and come up with improvements, such that the issue can be solved in a quick and effective way. Aforementioned problem description has led to the following research question:

What improvements can be adduced in the water governing capacity to improve the problem-solving process for fresh water supply issues in the horticultural sector on Zuid-Beveland? 

As a guideline the water assessment method (chapter 2) will be used, whereby different aspects of water governance will be assessed on several criteria (chapter 3). Improvements will be proposed on basis of this assessment (chapter 4).

2. Assessment method

To evaluate the policy regarding agricultural fresh water supply in Zeeland the water government assessment method according to van Rijswijk et al. (2014) is used. The main objective of this method is to develop  an interdisciplinary method and approach grounded in the scientific literature and which approach water issues in a holistic and integral way (van Rijswijk et al. 2014). The assessment method is based on three dimensions and ten building blocks. The dimensions for water management include content, organisation and implementation. For successful water management these dimensions are divided into ten building blocks with their own assessment criteria. The viewpoint is that only when all dimensions and building blocks are taken into account a stable water management can be reached. Building blocks and dimensions are interconnected, for example a good organisation requires knowledge about the system, and strong enforcement requires clear regulations. The structure of the following paper will be based on the ten building blocks. For each building block first the objectives and criteria assessment will be explained and second there will be a case specific discussion about the objectives and the criteria assessment will be answered.

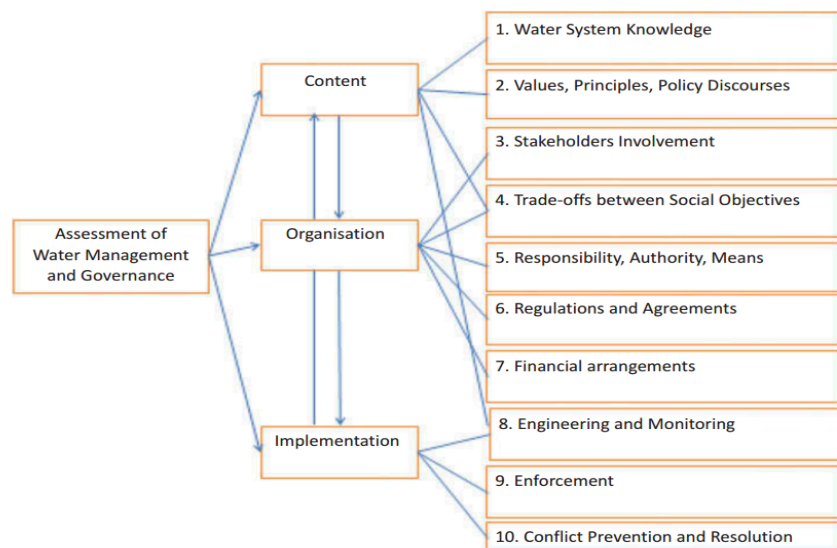


Figure 1 – The assessment scheme with different dimensions, including ten building blocks, of water management and governance 

3. Assessment

3.1 Water system knowledge

Assessment of the water system knowledge is based on the following criteria:

Is there sufficient knowledge of the existing water system in order to deliver the required service level of societal functions; if not, what are the gaps; is sufficient knowledge available to assess the impact on the water system because of changes in environment and societal functions (Rijswick et al., 2014)

A river basin management plan 'Zuidwestelijke Delta' have been drafted for the Scheldt Delta, which requires scientific knowledge to assess the current situation of the system and to determine what approaches are necessary to meet set objectives (Ministerie van Infrastructuur en Milieu, 2014). It is known from the Scheldt Delta that freshwater lenses are relatively thin compared to lenses in other areas in the Netherlands. As a result of the high influence from the sea and low infiltration rates at the surface, the freshwater-saltwater interface is close to surface level (Pauw et al., 2015; De Louw et al., 2015; Oude Essink et al., 2014). To protect current freshwater lenses, especially for agricultural production, groundwater usage is very limited. Most of fresh water consumption by agriculture comes from surface waters that have been created by the construction of the Deltaworks (Stuurgroep Zuidwestelijke Delta, 2014).

Rising water demands by horticultural industry on Zuid-Beveland and lack of connections with main surface waters resulted in an agricultural water pipeline that was connected to the nearest surface water source: Volkerrak-Zoommeer. Eutrophication of the lake led to the abandonment of it and new connection to the industrial pipeline which connects to the surface waters of the Biesbosch area (Stuurgroep Zuidwestelijke Delta, 2014). Nowadays during normal conditions sufficient fresh water is available for irrigation, but during frost nights in spring and dry days in the summer demand for water peaks and the capacity of the pipeline is exceeded (Stuurgroep Water uit de Wal, 2012; Geiske et al., 2009). Future climate change, with the expectation of less precipitation events and longer periods of drought during summer will lead to more peak demands which subsequently increase the pressure on the regional water system (Stuurgroep Water uit de Wal, 2012;). Therefore in the future more water will be demanded from the system.

Current water demand for advanced horticulture is 100 mm/ha and will rise to 105 mm/ha in 2050 (Nolte & Otter, 2005). Total demand will rise from 8 million m³ to 17 million m³ in 2050 (Nolte & Otter, 2005). Potential sources for freshwater are the agricultural pipeline, groundwater, run-off water from Belgium and Volkerrak-Zoommeer (if purified) and the 'Brabantse Wal'. Groundwater that is seeping upwards in polder areas in front of the Brabantse Wal flows towards Zuid-Beveland, but remains unused today (Geiske et al., 2009). These sources could provide in total 15-20 million m³ of fresh water, and thus satisfy expected demands up to 2050 (Nolte & Otter, 2005). Nowadays only 0.5 million m³ is used from groundwater and the agricultural pipeline (Nolte & Otter, 2005). There is already quite some knowledge available about these resources,

and more studies are in their way on how to use them in a sustainable (for example fresh water project: storing more water in creek ridges in the 'Zak of Zuid-Beveland' (Oude Essink et al., 2014) and cost-effectively way. The horticultural industry on Zuid-Beveland also acknowledges the limitations of the regional water system by optimizing their production process as much as possible, for example all farmers use nowadays drip irrigation (Geiske et al., 2009). There is not much gain anymore in water use efficiency, so future supply will have to increase.

The current water system in the Scheldt Delta is shaped according to human preferences by the construction of the Deltaworks. Water safety is more or less guaranteed and the availability of fresh water is increased, however more political questions arise on the recovering of natural water system and its associated ecosystems (for example: Kierbesluit or salinization of the Volkerrak-Zoommeer) (De Werkgroep, 2012). Political choices in combination with the effects of climate change will determine how the fresh water situation will be on Zuid-Beveland in the future and what the impacts will be for the horticultural industry. Future water demand of the horticultural sector on Zuid-Beveland in relation to climate scenarios are available (Geiske et al., 2009)

3.2 Values, principles and policy discourses

Assessment of values, principles and policy discourses is based on the following criteria:

"Is there sufficient knowledge of shared or conflicting values, viewpoints and principles for water issues and their consequences for facing water management issues?" (Rijswick et al., 2014)

Values and principles of actors are often not mentioned directly, but mostly formulated in desired goals which asks for a certain policy discourse. As mentioned by Rijswick et al. (2014, p.6) "policy discourses can be considered different ensembles of actors with specific story lines, frames, values and principles that emphasize certain aspects of water problems and policy measures". Within a certain policy discourse the possibility exists of both coalition forming, whereby actors with identical values, viewpoint and principles meet each other, and "framing" because of opposing values and views of actors and thus putting certain aspects on the foreground and others on the background (Rijswick et al., 2014).

There are two major changes in valuation which are important for this case. First of all, there are some changes between actors in valuation concerning responsibility. For example, the authorities think nowadays in more liberal solutions which changes the role of farmers. Secondly, the value of sustainability gains more importance and changes the water provision for the agricultural sector. Those values changes are translated in new policies, as will be discussed later.

For the fresh water issue on Zuid-Beveland values, principles and policy discourse are considered from the viewpoint of authorities, which are responsible for current policies and execution of it, but also from the viewpoint of actors which have an explicit interest in the issue under consideration.

Authorities

Goals concerning fresh water provision in general are outlined in several policy documents at European, national, provincial and regional level. Guiding at European level is the Water Framework Directive (WFD) which elaborates on protection of water for food production and economic activities (Rijswick & Havekes, 2012). This is outlined in the strategy for water scarcity and drought which aims to achieve greater water efficiency and a better management of water demand (European Commission, 2007).

Fresh water objectives of the WFD have been translated into national legislation with the Water Act. This act aims “to prevent and where necessary the limitation of flooding, swamping and water nuisance, and water shortage [...], also allowing water systems to fulfil essential functions in society (Rijswick & Havekes 2012).

According to the National Water Plan (NWP) 2009-2015 (requirement of the WFD) the focus of Dutch water policy is to continue fresh water provision for all users under normal conditions (Ministerie van V&W, VROM & LNV, 2009). This plan includes the Regional Water Policy Plan of the South-western Delta that correspond to the Scheldt River Basin and states in general that government will not take responsibility to provide sufficient water for sector under all circumstances (Stuurgroep Zuidwestelijke Delta, 2014). Maintaining and expanding where possible of the current availability of freshwater under changing climate conditions is considered as an achievable ambition (Stuurgroep Zuidwestelijke Delta, 2014). For areas without any supplying possibilities from the main water system, like Zuid-Beveland, the proposed strategy will focus mainly on a more economical and efficient use of fresh water, both for the regional fresh water system and consumers (Stuurgroep Zuidwestelijke Delta, 2014). New sources of fresh water need to be found within the area under consideration (Projectgroep WB21 Zeeland, 2004). Entrepreneurs in the agriculture should take more initiative to deal with environmental changes, as outlined in the national nota ‘Kiezen voor Landbouw’ (Ministerie van landbouw, natuur en voedselkwaliteit, 2004).

Perspectives concerning water supply (for agriculture) on a provincial scale are outlined in ‘Omgevingsplan Zeeland 2012-2018. The main goal is to create a balanced delta wherein safety, economic activities and ecological values are equally represented. The province does not take the responsibility to provide sufficient fresh water (especially during droughts), but encourage private initiatives by farmers and provides the means for it where possible for local water production. Maintaining and strengthening a sustainable agricultural production is of main importance, but developments within the sector depends mainly on initiatives of agrarian entrepreneurs.

One of the goals of the concerned Waterboard Scheldestromen is facilitating a responsible use of available freshwater where possible (Waterschap Scheldestromen, 2015). Despite waterboards are not obliged to provide sufficient fresh water, they cooperate where possible to minimize the impact when initiative is taken by the agricultural sector itself (Scheldestromen.nl, n.d.).

Actors with explicit interests

The most important actors with explicit interests in this issue are: the involved horticulture entrepreneurs on Zuid-Beveland, represented by their branch organization ‘Zuidelijke Land- en

Tuinbouw Organisatie' (ZLTO), Evides Industrial Water B.V. (EIW) and nature- and environmental organizations (among others Zeeuwse Milieu Federatie).

The horticultural industry attaches great importance to sufficient fresh water, because their harvest, and thus their revenues, are mainly determined by the availability and quality of the water (Geiske et al., 2009). From farmers point of view the availability of fresh water is regarded as an acquired right, and a sense of inequality is experienced because not all agricultural businesses have to pay for water (Geiske et al., 2009; TNO, 2005). Agriculture came to flourish after the construction of the Deltaworks, mainly because of more fresh water availability, but it was perceived by the governments more as a nice side-effect. However, farmers acknowledges also the limits of their areas and are willing to participate to look for other possibilities. One of these initiatives comes from ZLTO which started the project "Sustainable Freshwater provision Horticulture" in the province of Zeeland aiming to optimize water consumption and use of alternative sources (Werkgroep, 2012). But the ZLTO continues to stand up for more investment in a continuous freshwater supply ("first fresh, than salt"), because salt water is becoming more pressing in the whole delta (Geiske et al., 2009; AGF, 2009).

The current water supplier for Zuid-Beveland, Evides B.V. attaches importance to extension of their water service to other farmers, but only if it can be done in a cost-effective way (Geiske et al., 2009). Extension of current service is however only possible if EIW receives funding from the province. EIW perceive an extension of the pipeline as a profit, in a sense that more farmers will use their water, but on the other hand it is for them not a necessary investment because clients are bonded to EIW as the only supplier in the region and the viability of the organization is not directly dependent on an extension.

Interests or values concerning nature and environment are mainly represented by the 'Zeeuwse Milieu Federatie', which are mainly focused on improvement and extension of the current natural environment where possible (Geiske et al., 2009). A clear statement about water provision for agriculture is not found, but it is reasonable that extra water provision on Zuid-Beveland fits not within their central values and principles if proposed local solutions will be harmful for nature. If not they will not be fiercely against additional water provision, but their central value that 'agriculture damages nature' will remain active.

In conclusion

There is quite some consensus about values, viewpoints and principles among different actors. Of course most of the consensus is reached among the authorities, which is translated into clear objectives and policies. Initiatives should be taken by the horticultural entrepreneurs, to come up with local solutions for fresh water provision, and the province will provide means (in the form of knowledge) to support this. Despite the sense of inequality, farmers acknowledges their responsibility, and are willing to invest in more local solutions. Most of the opposition and tension is currently between agriculture and nature, because more water means more dominance of agriculture which can adversely affect nature.

3.3 Stakeholder involvement

In the Netherlands a public decision is often not made by the government on their own. Often a strong stakeholder involvement is applied. This has the advantage of a broad supported outcome. When the solution for a certain problem is supported by all stakeholders, the chance of implementation increases. This result in a bigger chance of solving the issue. A second advantage is the improving of decision making by using the experience and solutions of the stakeholders. Additionally, the bridge between politicians and the citizens is reduced through stakeholder involvement (Edelenbos & Klein, 2006). For this building block the following question is answered:

Are all relevant stakeholders involved? Are their interests, concerns and values sufficiently balanced considered in the problem analysis, solution search process and decision-making? (Rijswick et al., 2014)

Before we zoom into the process of stakeholder participation in the Zuid-Beveland case, the background of some stakeholders need to be explained.

Province of Zeeland

Zuid-Beveland is part of the province Zeeland. The province consist out of many polder areas. This polder areas were reclaimed for agricultural purposes. Therefore the provincial government is historical closely involved in the interest of the agricultural sector. For this reason the province did a lot of investments in the agricultural sector, like the agricultural pipeline. Nowadays the agricultural sector of Zeeland is still important for the province.

Evides

Evides is the water company in the province of Zeeland and the south part of the Province of Zuid-Holland. Evides is a public enterprise. The shares are owned for 50 percent by municipalities of Zuid-Holland and the other half is owned by the Province of Zeeland and the municipalities of Zeeland. Evides Waterbedrijf NV (ENV) consist out of two daughter companies. Evides drinkwater BV (EDW) which is responsible for the drinking water supply to the 2.5 million inhabitants of Zeeland and Zuid-Holland. The main objective of EDW is a reliable water delivery for the customer for the lowest price (www.evides.nl, 2015).

The other daughter company is Evides industry water (EIW), which operate on a commercial market. This business was founded to deliver water to the agricultural sector and the industry in Zeeland and Zuid-Holland. EIW is the owner of the agricultural pipeline towards Zuid-Beveland. However, EIW is allowed to grow and has commercial activities in Belgium, Germany and Asia. EIW will therefore not quickly invest in non-profitable project, like a new pipeline. However, large parts of the shares are owned by governmental agencies and social importance is part of their

business strategy (www.evides.nl, 2015). When the governmental agencies therefore like a particular project, they could force EIW to invest.

The Process

Through time it became clearer that there was a shortage of current water supply to Zuid-Beveland and other parts of Zeeland. To solve this problem, the government initiated the committee 'Zuidwestelijke Delta' (ZWD) in 2008 that is responsible for solving the general fresh water issue in the province of Zeeland and is known as 'de Brede Discussie' (Geiske et al, 2009). Part of this committee focuses on the area of Zuid-Beveland and the Brabantse Wal. In 2006, the 'Water uit de Wal' project was already set up and focussed on the fresh water problems and chances around the Brabantse Wal. The projects of 'Water uit de Wal' and 'Zuid-Beveland' are together known as 'de Brede Discussie West-Brabant' and are considered as one problem area since both system are connected to each other (see water system knowledge). This discussion is part of the overarching 'Brede Discussie' for Zeeland (appendix, figure 1).

To reduce the chance of friction between the two projects, almost the same stakeholders are chosen (appendix, figure 2). The involved stakeholders know thereby what's is going on in both projects. In the selection of the stakeholders there is chosen for a broad selection to consider the problem from different perspectives (appendix, figure 3) take advantages of each other's knowledge and to make sure that all participating stakeholders can give their opinion. Next to Evides and the province of Zeeland are Rijkswaterstaat, the province of Brabant, the municipalities of Zuid-Beveland, the municipality of Woensdrecht, Water board Scheldestromen, ZLTO, environmental organisations and the recreation sector have been involved in those projects (Geiske et al., 2009).

The cooperation between the different stakeholders is smoothly. This is not surprising, because two important stakeholders, the authorities and ZLTO, have the same goal: a strong agricultural sector. The authorities benefit from a good agricultural sector in the region because it increases tax income and increases the economic activity in the region. The authorities therefore invest in research projects to solve the problem locally (Geiske et al., 2009). Currently this research projects are going on and show good results (www.waterbuffer.net, 2013). When these projects, like the Fresh Maker, are successful accomplished the farmers could apply this solutions to solve the problem. Other farmers choose for conventional techniques like fresh water basins on surface level. Until now the ZLTO/farmers are satisfied with the progression of the local solutions. (Groente & Fruit, 2013).

3.4 Trade-offs between social objectives: service level agreements

In this building block we will zoom into the service level agreements (SLA's), which are appointments between customer and seller. SLA's are in this case determined by the responsible authorities and  on trade-off based agencies in partnership with stakeholders. This block will start with the SLA's of the past and then will zoom into current allocation of appointments.

Are agreed service-level decisions based on trade-offs of costs, benefits and distributional effects of various alternatives? (Rijswick et al., 2014)

In the past, to speak in terms of SLA, the whole landscape and authorities were serving the agriculture. The agricultural sector had a strong lobby group with a big influence on political discussions. The landscape and the water system were largely adapted to the agriculture, this was for instance arranged in the land consolidation projects (Bergh, 2004). This land consolidation decreases the variability of the landscape and nature. There were also no strict environmental regulations at that time, because the agricultural interests were most important. Furthermore the agricultural sector received a lot of subsidies from the national government and EU. The authorities supported the agricultural sector, because they want a strong agricultural sector in Netherlands/EU. This was for several reasons.

Firstly, countries want to keep their food production in their own country. In case of war or trade boycott sufficient food will then be available. Secondly, to keep the standard of living in the rural area on a certain level. When many farmers go bankrupt, which might happen without subsidies, the economic activity of the rural areas will decrease and thereby will decrease the level of services. However, many economist doubt about the value of those agricultural subsidies. Around 45 percent of the total budget of the EU is spent on this subsidies, around 60 billion euro each year, while the agricultural sector generate around 5 percent of European GDP. According to the opinion of several economist this money can be spent in a better way or can be used for tax reduction (www.debatingeurope.com, 2015). This SLA is therefore mainly based on political arguments instead of a clear trade-off between costs and benefits.

Today the subsidies still exist and have political support in Europe, especially from more socialistic countries like France. (www.nos.nl, 2012). However the policy shifts towards a more liberal approach, as told in the building block values, principles and policy discourses. Especially in new projects, like the Zuid-Beveland case, the SLA's between the authorities and agriculture have been changed. The authorities want to give support, but the farmers need to find solutions themselves. This to reduce the costs of the authorities and thereby of the taxpayers.

In this new approach farmers become the investors and therefore makes a trade-off between costs and benefits more important for them. For the new solutions is there is a clear trade-off

between social objectives. Details of implementation are described in the building block engineering and monitoring.

3.5 Responsibility, authority and means

The assessment criteria for this building block is: *Are authorities, responsibilities and means well-organized to deal with water issues at the appropriate administrative scale(s) in a participative and integrative way (Rijswick et al., 2014)?*

In order to let implemented policy to be effective first the responsible agencies with respect to the water related issues have to be determined. Since responsibility and property are strongly correlated, in general owners are hold responsible for proper management of their water (bodies). Ownership of property can be divided into four types of ownership: private property, common property, state or public property and no property (Rijswick et al. 2014). The type of ownership of the water changes throughout the water delivery system. Fresh water supply in the Netherlands is seen as a public responsibility (Rijswick & Havekes, 2012), but still distinctions between several responsible agencies can be made, both public and private.

At the beginning of the sequence when the fresh water is still in the Biesbosch area, the water is privately owned by Waterwinningsbedrijf Brabantse Biesbosch (WBB), the water is retained in basins from which the water can be extracted. Evides is 60 percent shareholder of WBB and consumes 97 percent of the water under a multiple year contract (Jaarverslag Evides, 2014). The water authority is responsible for proper management of the whole Biesbosch area (De Moel et al. 2006), in this case the water authority is the WaterBoard of Rivierenland. Both the WaterBoard and WBB have the same responsibility in keeping the water sources as clean and natural as possible. Other responsible agencies with respect to this case study are the national government and the province of Zeeland, which are in this case responsible for providing means for economic development and a 'level playing field' for all actors. Additionally, the national government has the responsibility to provide consumers access to good quality water. The responsibility of Evides is to provide sufficient fresh water. Guarantee of water supply deliverance is arranged in private contracts, and when delivery capacity is insufficient Evides has to arrange extra water supply. This happened during the drought of 2006 when extra water had to be delivered from Antwerp (Jaarverslag Evides 2006).

Property owners all have their own interests and authorities should be able to assign responsibilities to these actors. Independent authorities are needed to lead to collective decisions that serve the interests of all stakeholders. Means are ways in which authorities can impose the collective decisions. Authorities relevant for this case study are the province of Zeeland and South Holland, the national government, and the WaterBoards of Rivierenland and Scheldestromen. Since the existing financial arrangements are not profitable enough to support extension of the pipeline (see financial arrangements), support from the province is required. By denying financial

support the province has a mean in the decision making for extension of the pipeline. Additionally, the province of Zeeland is large shareholder of the drinking water company (Evides.nl) providing a way for the province to force their own policies concerning freshwater supply. Drinking water companies perform a vital societal task and therefore legislation about water quality, guaranteed delivery to consumers and maintaining infrastructure is imposed by the national government. Although agricultural water is no drinking water, Evides still has to oblige some of these rules since water in the retention basins is also used for drinking water production. Tasks of drinking water companies are described in section 7 of the Drinking Water Act. The water authority is not very influential because water in the retention basins is privately owned. Most important is that the WaterBoard of Rivierenland has to give permits to fill the water basins, but once the water is in the basins Evides is free to extract and using it. The province of Zeeland has assigned the responsibility of freshwater supply to the agricultural sector itself (Reijs et al. 2005), but since there are private contracts between the farmers and Evides about fresh water supply, this responsibility is shifted to Evides.

To give a short answer to the assessment criteria, authorities, responsibilities and means are well organized, but a critical remark can be made. Because the province is large shareholder of Evides they can influence the decision making of this private company. For example when Evides would decide to increase water prices for farmers to provide a financial basis for extension of the current pipeline, the province can hold this back. Additionally, the province can deny funds for extension. This makes the province very influential in the decision making, probably too influential because it can impose public interests on a public company. Positive aspects of the assessment criteria are that Evides has the responsibility for sufficient fresh water supply so it has high interests in finding solutions to provide for fresh water in Zeeland, but the public domain is still involved. Participative capacity of the public domain is organized in a decentralized way where the provinces and local water boards have a large influence in decision making, more than the national government has.

3.6 Regulations and agreements

The assessment criteria for this building block is: *Are regulations and agreements legitimate and adaptive, and if not, what are the main problems with regard to the [...] legitimacy aspects (Rijswick et al. 2014)?*

Rijswick et al. (2014) lists several aspects from literature to determine to what extent regulation is legitimate: Regulations should be (1) *based on shared or agreed values and principles including those who refer to vulnerable values and groups in society to enhance effectiveness and to avoid conflicts*; (2) *in conformity with the rule of law*; (3) *offering legal certainty with regard to rights, duties and accountability to provide a base for action*; (4) *formulated in an enforceable and effective way, (to be able to achieve the intended goals)*; (5) *decided at the most appropriate level and based on transparent rules, sufficient and relevant information and taking all interests that are at stake into account (also vulnerable and minority interests)*; (6) *offering the right mix of*

public and private instruments for the objective at stake; and (7) taking distributional effects into account to avoid damage to the water system, other interests and policy fields, and in this way to avoid conflicts.

Adaptiveness refers to the flexibility in regulations and agreements. On the one hand there is flexibility and on the other hand legal certainty and enforceable protection (Rijswick et al. 2014). When making regulations there should be made a balance between these two aspects. Flexibility in law making can be achieved in several ways: (1) *open norms*; (2) *the use of principles*; and (3) *duties of care* (Rijswick et al. 2014).

Since there is no specific policy plan for this case study, there are also no specific regulations concerning the fresh water supply in Zeeland. The national government, provinces, water boards, municipalities and water companies agree on a 'Bestuursakkoord Water'. This states the tasks and responsibilities of each agency. The National Water Plan 2009-2015 states that the supply of fresh water should be maintained as much as possible, but guarantees for constant supply cannot be given. In general there is sufficient fresh water available, but problems can arise during dry periods. For the Zeeland fresh water supply this means that, although there is enough fresh water in the retention areas in the Biesbosch, the capacity of the current pipeline is not sufficient to provide in peak demands. To ensure a sustainable freshwater supply the use of local water sources should be promoted and fresh water should be retained in the local area as much as possible (e.g. in the soil or retention lakes). Fresh water users will be held more responsible for their own water supply (in this case the farmers) and are also expected to be willing to pay more for the water (Geiske et al. 2009). Private agreements between Evides and the farmers are not public, but it can reasonably be assumed that those contracts state that Evides is obliged to deliver a certain amount of fresh water.

The legitimacy aspects concerning fresh water supply are (1) not completely based on shared agreed values, since farmers rather see their fresh water supply completely provided by the province, but this has not led to large protests so it can be assumed farmers generally agree on this value; (2) as far as can be concluded conform the law, although private contracts are not publicly available; (3) not offering complete legal certainty, since constant freshwater supply cannot be guaranteed and farmers are hold responsible for their own water supply. But since the private contracts between farmers and Evides guarantee water supply for the farmers, this uncertainty is totally on the shoulders of Evides; (4) formulated to reach the goal of a sustainable freshwater supply; (5) decided at the national level, motivation for the current approach is outlined in the National Water Plan which is publicly available and it is taking all stakeholders interests into account; (6) offering a mix of public and private instruments, as farmers and private drinking water companies are also hold responsible to arrange their own water supply, although of course they still have to comply with the governmental instruments. A critical remark can be made on the fact that the province of Zeeland is a large shareholder of the private drinking water company, since the province has more interests than financial profits this can reduce the private interference in decision making; (7) can bring damage to agriculture, as regulations limit

agricultural fresh water supply. Adaptability in the National Water Plan is very wide, as is only states the main goals and methods. Specific realization is left to the responsible authorities.

3.7 Financial arrangements

Assessing financing of water management is based on the following criteria:

Is the financial arrangement sustainable and equitable?

Member States are required (Article 9, WFD) to implement adequate water-pricing policies to improve efficient water consumption and costs of water services must be recovered taking into account 'the polluter pays principle' (Rijswick & Havekes, 2012). Dutch Water Management is characterized by charging most of costs for water services to polluters and consumers (Rijswick & Havekes, 2012).

Considering the case of Zuid-Beveland various principles have been applied to finance fresh water for the horticultural industry. Funding for the construction of the agricultural pipeline was according to a solidarity principle: the Province of Zeeland was the major funder next to EIW (Deltares, 2011). The operation of the pipeline is financed according to the profit principle whereby clients are charged for water consumption and usage of the pipeline service. But this principle is not fully applied for all customers, since farmers have been exempted from the fixed charge and thus only pays the water tariff ($= \text{€ } 0.70 / \text{m}^3$) (Groente & Fruit, 2013). This has resulted in a financing structure that is definitely not sustainable whereby the supplier is making a net loss on the operation (Stuurgroep Water uit de Wal, 2012).

The current pricing policy for the freshwater provision on Zuid-Beveland is not meeting the objectives set by the WFD. Despite the fact that the horticultural sector is charged for their water consumption, there is also a kind of protective measure active. By giving them discount for the fixed charge, the opportunity exist that saved money is used for more water consumption to reach optimal production capacity and thus reducing efficiency in water consumption.

For future water provision projects the province of Zeeland will use a different financing model. Funds will only become available in case of local water provision projects, such that fresh water provision for the horticultural industry can be handled privately (Provinciale Staten van Zeeland, 2012). Financing will be given in the form of research projects, whereby new knowledge (and new discovered) techniques) can be applied elsewhere. This way of future financing fresh water management on Zuid-Beveland is much more sustainable and equitable.

3.8 Engineering and monitoring

This part will describe the existing infrastructure in Zuid-Beveland for agricultural functions (engineering system). By using SLA's it could be determined whether this infrastructure in Zuid-Beveland should be improved and what improvements are needed. Moreover, monitoring of water system is needed to check whether the system is in concession with the SLA's. The following assessment criteria is used to determine the engineering and monitoring of the water system (Rijswick et al., 2014):

“Are service level agreements sufficient available (implicit or explicit) in order to redesign the existing infrastructure? Are design and consequences of different alternatives sufficient available? Is there sufficient monitoring of the system and are the data analysed?” (Rijswick et al., 2014)

The water system in Zuid-Beveland needs sufficient freshwater for agricultural purposes and protection against salinization. As told in the previous building block, water system knowledge, an agricultural pipeline is therefore constructed. The SLA, reliable supply, is during peak demands not possible. Therefore the involved stakeholders are searching together for possible local solutions. It is not likely that there will be one local solution for the whole problem. Several solutions are needed to cope with peak flow. Many solutions have come into place to increasing the local storage of freshwater.

The horticultural area of Zuid-Beveland harbours a lot of creek ridges, because of their sandy composition, and serve as a natural storage for freshwater. Rainwater will form a freshwater lens under these creek ridges. This water is in some parts of Zeeland already used. This principle, however, could be enhanced by humans by infiltrating actively. As a result, the freshwater lens increases (www.waterbuffer.net, 2013).

A second local solution is the “freshmaker”. This is a pilot project, whereby also water is infiltrated actively in the subsurface in winter and spring time. This is done with a horizontal drain at a depth of around 5 meters. At a depth of around 15 meters, brackish water is abstracted with another horizontal drain. This water is discharged on an already brackish ditch. With this system the size of the freshwater lens increases extremely, therefore it is possible to extract water for irrigation from the own substrate (www.waterbuffer.net, 2013). This method has low costs and is the best option for water supply in times of high peak demand, instead of redesign the existing pipeline (Oude Essink et al., 2014). The costs for 1 m³ of water from the agricultural pipeline are 70 eurocents (Groente & Fruit, 2013). The costs for 1 m³ of water from the freshmaker is around 35 cent (Groente & Fruit, 2013). The farmers in the region have therefore showed interest in this solution. However the freshmaker is a research project which still needs to prove it service on a larger scale.

Another alternative freshwater source is the construction of natural freshwater 'buffer' basins or lakes. Water can be pumped out of these buffer basins when there is a peak demand. This water can be delivered through the normal pipeline, since the bottleneck of the agricultural pipeline is situated in Brabant. The volume of such a basin should be much larger than the peak demand, because the basin must be combined with a natural function. Also existing basins could be used as freshwater source, however there are uncertainties about the future of those existing basins. For example the Markiezaatmeer will become salt when the Volkerrak-Zoom will be turned into a salt lake. The disadvantage of buffer lakes are the high fixed costs and will only be considered as an option when the cost price per cubic meter reduces (Stuurgroep Water uit de Wal, 2012).

Increasing the confessional above-ground storage basins is no solution, because this reduces the valuable agricultural land. Also research has shown that using the effluent of a sewage treatment is no effective solution (Stuurgroep Water uit de Wal, 2012).

The water demand of the agricultural sector in Zuid-Beveland is established in a study of ZLTO. This research was based on interviews with the farmers in this area. Also the CBS has the water supply of Zuid-Beveland mapped in 2005. In this research they noted how the farmers in Zuid-Beveland came to their fresh water (Geiske et al., 2009). Through this monitoring, there is a relatively large amount of knowledge about the system. The research projects, like the infiltration in creek ridges and fresh maker, are very closely monitored. In this way, knowledge is collected to improve their performance and to order if they are a good solution.

3.9 Enforcement

To achieve good water management and governance, attention should be given to the whole policy process. Public participation; formulation of rules and other decision making processes; as well as attention to the actual achievement of goals is important to successfully implement water management policy. Additionally, enforcement will be needed to guarantee all participating parties will execute the made arrangements. A lack of good enforcement will negatively affect the water management and governance, whereby conflicts and decreasing legitimacy could originate (Rijswick et al., 2014). The following assessment criteria are used to determine the enforcement of the water system in Zuid-Beveland:

Are regulations and agreements enforceable by public and/or private parties, and are there appropriate remedies available (Rijswick et al., 2014)?

Deliverance of fresh water by EIW to the farmers is stated in private contracts. By these contracts EIW is obliged to deliver certain amounts of fresh water, and farmers can subsequently enforce the deliverance. The public domain has very limited means to change these contracts, e.g. enforce more equal water distribution or limit water use. EIW gets their water under multiyear contract

from the Biesbosch. Although the Biesbosch basins are privately owned, the Waterboard of Rivierenland will probably have some means of enforcement concerning the filling of the fresh water basins. The National Water Plan does not contain enforceable regulation, but that is also not the intention of this plan. It is rather hard for provinces and waterboards to effectively enforce the development and use of local fresh water sources. Fresh water is a private good owned by EIW and when farmers are willing to take large investments in (unsustainable) fresh water deliverance, authorities cannot always stop this. However, authorities can stimulate the outlined policy in the National Water Plan by means of subsidies. This can be subsidies for construction of infrastructure, but also knowledge development (as with the Fresh Maker). The province has declared that fresh water supply is the farmers own responsibility, this means farmers cannot enforce water deliverance. Section 4.6 of the Water Act states that water authorities have to develop water management plans and subsequently execute and enforce these plans. The waterboards are responsible for the management of the freshwater in the Biesbosch, and are supervising EIW for water quality and management. As EIW will also aim for good water quality, in practice enforcement on these issues will probably not be very necessary. The waterboards in a certain province are supervised by that province (Waterschap Zeeuwse eilanden, 2009). The “Bestuursakkoord Water” ensures supervision of each other by the involved parties. Since the “Bestuursakkoord Water” is an agreement between several acknowledged parties, strong enforcement will probably not be necessary.

3.10 Conflict prevention and resolution

Shared sources of water can be causing either conflicts or positive effects, among others cooperation and stability in a system. Therefore it is important to identify what the benefits of such a system are. The concept ‘water valuation for water dispute resolution’ focused more on the advantages of ‘benefit-sharing’ instead of ‘water-sharing’ (Rijswick et al, 2014). Important from this approach is that it involves ‘thinking about water in terms of its value’. The following assessment criteria are used to determine the conflict prevention and resolution in Zuid-Beveland:

Are there sufficient conflict prevention and resolution mechanisms in place? (Rijswick et al., 2014)

Prevention of conflicts starts initially by involving all stakeholders when addressing the issue such that different interests have been taken into account. This prevents conflicts at an initial stage of negotiation and thus extra costs or delays (Wolf, 2007). As discussed in ‘stakeholder involvement’ all actors with a certain interest in the fresh water situation on Zuid-Beveland have been involved from the initial stage and there were no indications or announcements concerning exclusion of actors. A possible source of conflicts would arise in the second phase, when solutions are proposed and values and principles from actors have not been taken into account or there is serious tension between opposing values and principles. Also in this part there is no clear indication for

tension between actors, since values and principles are widely supported by all and it seems all of them are pleased with the proposed solutions so far. In the next phase attention is paid to the responsibilities, especially for the implementation phase but also from whom and where funds should come from to finance solutions.

Considering the current arrangement of the water system the province had the responsibility in financing water supply for horticulture on Zuid-Beveland, in the form of a pipeline, and EIW for delivering the water and charging the consumers. Both responsibilities of EIW are potential sources of conflict. Farmers benefit from the current system, since they are lower charged for water compare to industries, but it is not clearly stated why farmers have to pay a lower charge. Apparently it is a kind of protective measure initiated by the national government that follows EU-legislation which subsidize agriculture: more than third of EU budget goes to agriculture (Europe-nu, 2015). Industries have so far not demanded for lower water prices or made a clear statement against this inequality, but it remains a source for possible conflict between industries and EIW. This also applies for the water supply by EIW to agriculture: farmers demand for more water but won't get it. Probably the signed contracts protect EIW and thus prevent conflicts, since farmers only did a request for an extension instead of more water supply though the current pipeline.

To prevent aforementioned potential sources of conflict in the current arrangement of the water system, the province has decided for a different water policy. Farmers receive more responsibility for their water provision and have to come up with local initiatives, which will be financed in the form of knowledge by the province. This new arrangement contributes to conflict prevention, since the consumer of water is responsible for its own supply. It also takes away some of the differences in water charging: farmers also have to contribute financially for new water supplies. Since responsibilities and agreements are pretty clear and severe conflicts have not appeared so far, it is not clear whether rules or procedures have been formulated by actors that prescribe how to handle in case of conflicts. 

3.11 Analysis overview

Variable	Indicator	Performance	Score	End score
Water system knowledge	Level of knowledge	Knowledge is quite sufficient and based on scientific research to determine the current fresh water situation and resources. Also future scenario's which consider water demand in relation to climate change and water availability are available.	3	3
Values, Principles, discourses	Shared/conflicted values, viewpoints, principles	Quite some consensus about values, viewpoints and principles among responsible authorities: translated into clear objectives and policies. Farmers' values/viewpoints differ slightly, but acknowledge their responsibility to take initiative. Major differences in values/viewpoints are between agriculture and nature: more fresh water means more dominance of agriculture	3	3
Stakeholder involvement	Width of participation	In the committee of the 'Brede discussie' and 'Water uit de Wal' is chosen for a broad stakeholder involvement. This to share knowledge and experience.	3	2.5
	Depth of participation	For the stakeholder involvement a broad participation is chosen. However, there is still depth between the important stakeholders.	2	
Trade-offs between social objectives	Consideration of alternatives	In the procedure are many different solutions adduced, which afterwards were explored.	3	2.5
	Cost benefit ratio	In the solution is a proper cost benefit ratio applied	2	
Responsibility, Authority & Means	Clear responsibility designations	Yes. Provinces are responsible for water policy. Farmers are responsible to find own fresh water supply solutions. Evides is responsible for delivery. Some	2	

		conflict of interests as province is also shareholder of Evides.		2.67
	Participative capacity	Yes. Decentralized authorities. e.g. water boards and provinces have most influence. Local communities (e.g. farmers) are supported in own initiatives.	3	
	Integrative capacity	Yes. All stakeholders are involved and work together.	3	
Regulations & Agreements	Legitimacy	Good. Conform existing laws, transparent reports, clear motives for current regulations, avoidance of conflicts as all parties are involved. Some conflict of interests as province is also shareholder of Evides and farmers may not like they have to take more initiative to get fresh water.	2	2.5
	Adaptiveness	High. National Water Plan only prescribes local freshwater sources should be promoted. Specific fulfilment of this is left over to local authorities.	3	
Financial arrangement	Current pricing policy: sustainable and equitable	No, farmers are less charged for water consumption than industries, supplier (EIW) is making net loss as a result.	1	2
	Future pricing policy: sustainable and equitable	Yes, only financing local projects for fresh water supply. This will be in the form of research projects, to create new techniques and provide to solution of the fresh water issue	3	
Engineering and monitoring	Engineering and alternatives	Service level agreements are sufficient available in order to redesign the existing infrastructure. Consequences of different alternatives are sufficient available.	2	2
	Monitoring	The current system is sufficiently monitored, only the fresh maker and creek ridges solutions are sufficiently monitored, other alternatives are not implemented in real-life and cannot be monitored yet.	2	

Enforcement	Enforceability of public sector	Low, since fresh water supply is private. Authorities can stimulate their policy by subsidies, but not with strong rules. E.g. they cannot forbid extension of the pipeline.	2	2.5
	Enforceability of private sector	Strong, fresh water supply is arranged in contracts, so parties are bound to deliver even in case of drought.	3	
Conflict prevention and resolution	Prevention	Conflicts are prevented by a wide stakeholder participation and broad attention for values and principles by discussion sessions. Possible conflicts about the pipeline are prevented by the signed contracts. The new water policy contributes to conflict prevention, since farmers are responsible for their own supplies.	3	2.5
	Resolution	It's not clear whether rules or procedures have been formulated by actors that prescribe how to handle in case of conflicts for the current situation. Responsibilities and agreements are now pretty clear, so it's expected to be 'conflict proof'	2	

4. Conclusion and recommendations

In the introduction the following research question was posed: *Are there any improvements possible in the water governing capacity to improve the problem-solving process for fresh water supply issues in the horticultural sector on Zuid-Beveland?*

The analysis of the ten different building blocks show that the water governing capacity is at a quite high level to deal with the current fresh water issue on Zuid-Beveland. For this case a similar analysis method, as pointed out in “the pilot study Zuidwest-Brabant, Reigerbergsche Polder en Zuid-Beveland by Geiske et al. (2009) (appendix, figure 4), like the ‘water governance assessment method’ is used to address the whole problem. This resulted in well overview of shortcomings of the water system, but also what solutions are necessary and where possible chances exist to solve the freshwater issue on Zuid-Beveland.

Fresh water issue as a whole deserves a lot of attention at national and provincial level when looking at the several steering committees that have been initiated to address freshwater issues in several parts of the province. For the Zuid-Beveland case two steering committees are responsible: ‘Begeleidingscommissie Brede Discussie’ and ‘StuurgroepWater uit de Wal’.

An important strategy of them both is the high involvement of stakeholders from the beginning and therefore a lot of attention is paid to values and principles of stakeholders. This strategy includes also several meetings and discussion sessions which has created also more understanding among the stakeholders. More awareness is created about the responsibilities of the different actors, especially who should take the lead, but also who should follow. Stakeholders agree on the fact that local solutions are necessary and farmers must take more initiative to increase water availability. The question remains however which option is favoured if costs and benefits will be outweighed. This phase will take place if research to this subject is completed.

Thus, the high level of water governing capacity has now resulted in clear solutions for the fresh water issue which meet the objectives of all stakeholders. Important steps, which are necessary to come up with appropriate solutions, have been taken so far and now the phase of implementation has come into place. Since the ‘problem-solving’ process was quite a success, no large improvement can be adduced so far. An important thing to keep in mind is that the ‘problem-solving’ process took quite some time and therefore it’s recommended to speed up the process of negotiation, such that effective solutions become quicker into place.

Recommendations for assessment method

The assessment method has a clear structure of building blocks, but some of them are not well defined and eventually this result sometimes in overlap between several building blocks. This led to some discussion among the writers of this report. To be precise some elements are shared

between two building blocks, for example financial aspects are both elaborated in financial arrangements and responsibility, authority and means. This could be probably prevented by putting the connected building blocks together or closer to each other.

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Appendix

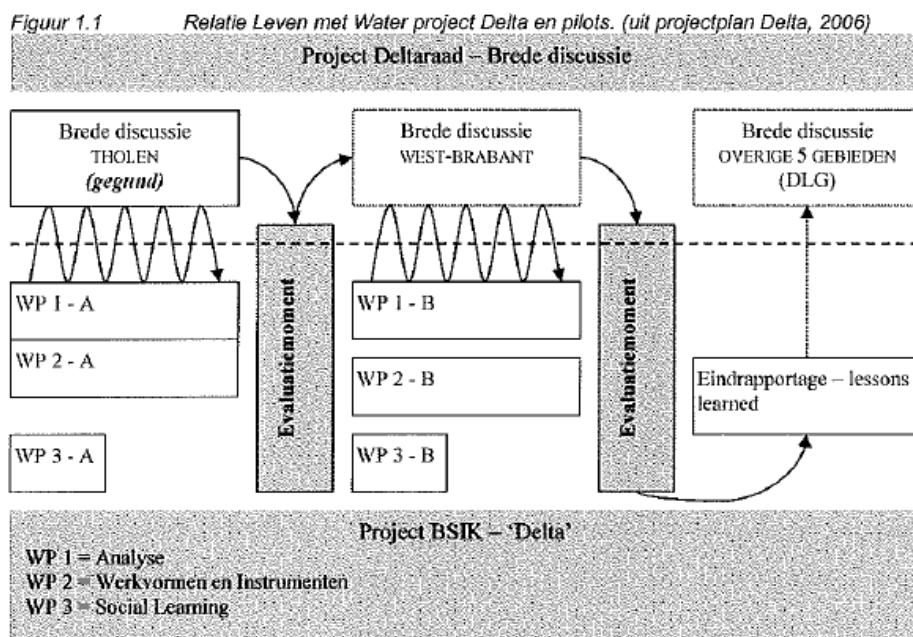


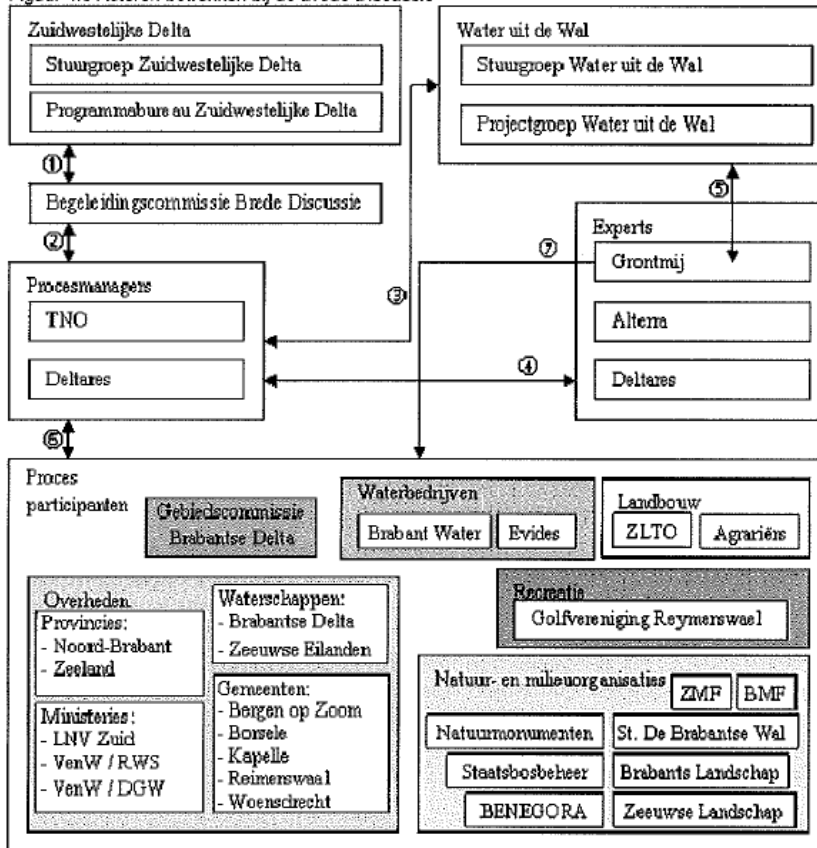
Figure 1 – Geiske et al., 2009, p.3

Tabel 4.1 Deelname partijen

	Stuurgroep ZWD	Begeleidingscommissie Brede Discussie	Stuurgroep / Projectgroep WudW
Ministerie van VenW – DGW	X		
Ministerie van VenW – RWS	X	X	X
Ministerie van LNV	X		
Provincie Noord-Brabant	X	X	X
Provincie Zeeland	X	X	X
Gemeente Bergen op Zoom			
Gemeente Borsele			
Gemeente Kapelle			
Gemeente Woensdrecht			X
Gemeente Reimerswaal			
Waterschap Brabantse Delta	X	X	X
Waterschap Zeeuwse Eilanden	X	X	X
Gebiedscommissie Brabantse Delta			X
Brabant Water			X
Evides		(X) ¹	X

Figure 2 – Geiske et al., 2009, p.25

Figuur 4.5 Actoren betrokken bij de Brede Discussie



- ① Deze pijl geeft weer dat de relatie met de Zuidwestelijke Delta, zowel stuurgroep als projectgroep, tijdens het proces gelegd is via de Begeleidingscommissie Brede Discussie en met name via de contactpersoon van de opdrachtgever, de provincie Zeeland.
- ② De Begeleidingscommissie Brede Discussie is ingesteld om het consortium TNO/Deltares (de procesmanagers van de Brede Discussie) in de Brede Discussie te ondersteunen. De focus ligt daarbij op het proces. Er zijn tijdens het proces regelmatig bijeenkomsten geweest waarbij het consortium de stand van zaken besproken heeft met de Begeleidingscommissie en er gezamenlijk vervolgstappen bepaald zijn.
- ③ In het proces is er vanuit het consortium TNO/Deltares ook nauw contact geweest met de stuurgroep en projectgroep Water uit de Wal. Met name als het gaat om inbreng van informatie ten behoeve van de oplossingsrichtingen, maar ook over de invulling van de twee bijeenkomsten.
- ④ Het consortium TNO/Deltares heeft op verschillende momenten samengewerkt en contact gehad met experts. Met Grontmij daar waar het ging om de oplossingsrichtingen van Water uit de Wal, met Alterra daar waar het ging om efficiënt watergebruik en met Deltares daar waar het ging om informatie over verzilting en zuivering van effluent. Deze experts waren, uitgezonderd Grontmij (zie ⑦) niet direct betrokken in het proces.
- ⑤ Grontmij is als expert nauw betrokken geweest bij de stuurgroep en projectgroep "Water uit de Wal". Grontmij heeft veel studies uitgevoerd die hierop betrekking hadden.
- ⑥ Er is nauw contact geweest tussen het consortium TNO/Deltares en de proces participanten. In sommige gevallen in gezamenlijke bijeenkomsten, maar indien nodig ook afzonderlijk – zoals met de agrarische sector en de natuur- en milieuorganisaties.
- ⑦ Grontmij is ook deelnemer geweest in het proces van de Brede Discussie, in het bijzonder vanwege hun kennis op het gebied van de oplossingsrichtingen. Zij zijn aanwezig geweest op de gezamenlijke bijeenkomsten van de Brede Discussie.

Figure 3 – Geiske et al., 2009, p.23

Figuur 4.8 Conceptuele model over input, proces en outcome van probleemstructurering
Decision-making process

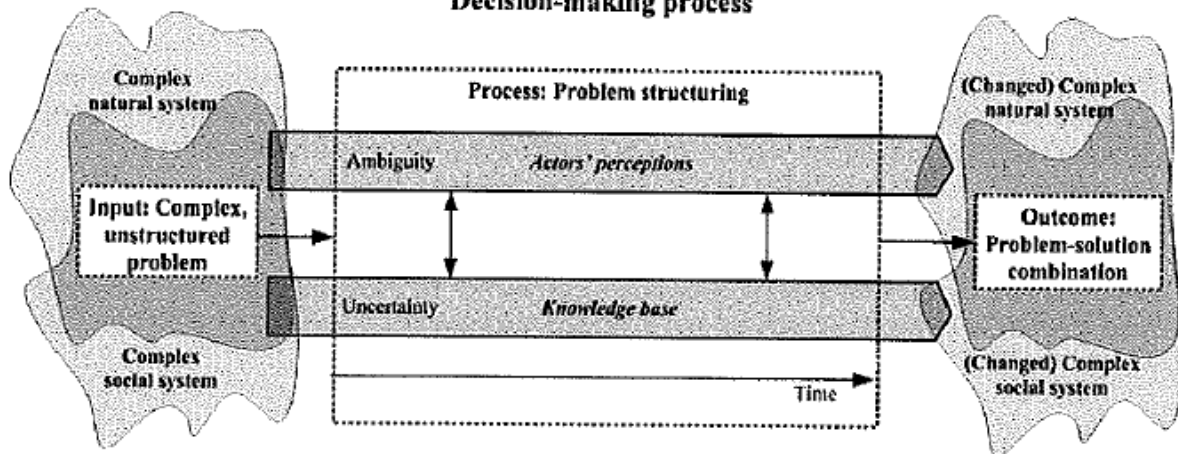


Figure 4 – Geiske et al., 2009, p.63