D 1.4.4 REPORT ON APPLICATIONS OF WATERWISE AND LESSONS LEARNED IN THE NEWATER CASE STUDY AREAS OF RHINE, ELBE AND NILE

Report of the NeWater project -
New Approaches to Adaptive Water Management under Uncertainty

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Preface

This report has been written within the framework of the EU funded NeWater project (511179 IP priority 6.3: Global Change and Ecosystems) which focused on adaptive water management under uncertainty. 'Applications of Waterwise and lessons learnt in the NeWater case study areas of Rhine, Elbe and Nile' (D 1.4.4) can be read in combination with the report 'Adaptive spatial Planning, spatial adaptation in the Nile Basin' (D 3.7.6). Co-financing for the research was provided by Rijkswaterstaat, of the Dutch Ministry of Transport, Public Works and Water management

The work has been supportive to Newater Work Packages assigned to RIZA, former part of the Rijkswaterstaat. It concerns especially the support of new methods for linking adaptive water management and spatial planning (W1.4) and the assessment of climate change impact on water quality and ecosystems (WP2.3). It has been tested at various levels of implementation in Rhine, Elbe, and most notable effort in the Nile (WP3.7).

The work of both documents is based on NeWater activities on action research in participatory processes and the development of scenarios and models to support these processes in NeWater case studies. The activities took place from May 2005 till February 2009.

This report provides insights into conditions for a successful application of the Waterwise as a support tool in stakeholder processes concerning land use options in relation to water quality, water quantity and ecosystems in various river basins and sub-basins. How Waterwise is applied may depend if it is used for discussion support, for design support or for decision support.

The methodology for the support in the stakeholder process has been worked out in a step-by-step approach considering explicitly the local situation which makes it applicable in other river basins.

The NeWater period was relatively short to test the complete participatory process. Follow-up activities are expected to be implemented in co-production with the Water Resources Planning and Management (WRPM) and the Confidence Building and Stakeholders Involvement (CBSI) both organisations of the Nile Basin Initiative, in the near future.

Wageningen, August 2009

Policy Summary

This report addresses the role of Waterwise as tool for eco- hydrological assessments in stakeholder negotiations on spatial planning issues. The often complex situations under uncertainty ask for a clear role for the stakeholders and Waterwise offers them a structure for iterative finding of solutions in a negotiation process. At the same time the multiple perspectives of the stakeholders on water management can by synchronised through a transparent and analytical tool like Waterwise. The cross-sectoral role of Waterwise in situational decision making can be considered as an important function in the transition towards adaptive river basin management.

Waterwise has been applied in 5 cases with the objective to enter into an interactive setting with the stakeholders. The applications have been made for the Beerze & Reusel, the Langbroekerwetering, and in the NeWater case study areas Kromme Rhine, Elbe and Nile. In the last three Newater cases the political context was different as well as the issues of concern and the level of application. In the Nile case Waterwise reached the best result towards its objective of entering a stakeholder process. It resulted in an intention between WRPM-NBI and the Waterwise team to proceed in co-production for fine-tuning of the tool and synchronising with local stakeholder processes. The application of Waterwise in the context of the NeWater project started in May 2005 and finished in February 2009.

Lessons drawn from the cases tell us that the problem situation Waterwise is applied to need an early analysis before determining the way Waterwise is applied. Under conditions of change the interaction between modellers and stakeholders on spatial planning issues should be on the basis of a co-production towards a collective planning tool rather than as an external support tool to stakeholder negotiations. Changes in land use options as is the focus of Waterwise, seem to be a rather delicate subject for an open transparent process. It may require a mediation approach in an environment of trust with a shared vision with options for compensation. The early entering in a stakeholder process is most relevant for identification of situation decision making approaches as well as the selection of the proper tools and stakeholders in the process. In case Waterwise can not be operative as an interactive tool in the negotiations, it may be used for advice to individual stakeholders in screening their options or serve the wider group of stakeholders and public for awareness raising when operating under less structured conditions.

By this activity NeWater knowledge and tools were applied and tested in transboundary river basins, with special emphasis on EU Water Framework Directive and Water Initiative implementation areas. The role of key factors including governance, participation and spatial planning for the transition to adaptive management of river basins were analysed and through 5 applications Waterwise has been tailored to the hydrological, institutional, socio-economic, environmental and technological settings of river basins to better assess and manage the transition to adaptive management.

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1 Introduction

The core aim of the NeWater project was to understand and facilitate change to adaptive strategies for integrated water resources management (NeWater, 2005). Waterwise has been developed as a tool for integrated assessment in a way that the required new conditions on water quality and quantity, could directly being linked with the land and water use in the up-stream area.

In this way Waterwise could provide a number of scenarios for the decision makers. Once loaded with all options Waterwise can provide new results in relatively short time for new suggestions from the users. With this quality it was considered that Waterwise would be a proper tool in the negotiations on land and water issues between stakeholders. The way how Waterwise could be used in stakeholder processes was not tried out and NeWater offered a proper environment for testing it.

Chapter 2 deals with the criteria for using decision support systems (DSS) like Waterwise in participatory processes and the built-up and functionalities of Waterwise relevant to being effective in such a process.

Chapter 3 describes the experiences with the application of Waterwise and the interaction in 5 cases of which 3 NeWater case study areas: de Beerze & Reusel, de Langbroekerwetering in The Netherlands, and the NeWater cases, Kromme Rhine in The Netherlands, the Helme as part of the Elbe in Germany and in the Nile. After a systematic description of both the interactive process and the development of the tool some characteristics of the interaction are described.

In chapter 4 a summary is given based on the lessons learnt from the 5 cases and final conclusions are given in chapter 5 concerning the interplay between Waterwise and the anticipated stakeholder processes.

This deliverable presents in chapter 3 also some potential adaptation measures in the five river basins as intended in the original version of D 144. In chapter 4 the integration between IWRM and spatial planning in the transition processes to adaptive management as intended in D 145 has been presented.

2 Decision Support Systems for participatory land and water management: Waterwise as an example

Climate change, population growth, alternative uses of natural resources and resulting competing claims create complex problems in water management under conditions of uncertainty. Conflicting interests of stakeholders operating at local level need to be dealt with whilst at the same time supra-local problems of spatial planning need to be solved. A good control at the national level is needed in order to cope with long-term developments in spatial planning of threats of climate change and the large scale developments in spatial planning. At local level water management can be perceived differently by different groups. In a certain actual situation, their interest, their perspective, their approach and observations may be significantly different Stakeholder involvement is needed to foster support of the decisions, to reach a higher level of integration and to increase the quality of decision making. In a properly planned process the stakeholders can contribute with their local knowledge, ambition, creativity and problem solving ability (Goosen, 2006)

2.1 Quality of Interaction between models and stakeholders

In the field of land and water management, the last few decades a trend can be observed in the intention of governments and water boards to cooperate more with relevant stakeholders in exploring future spatial planning and design options. This type of planning is characterized by a participatory process, actively involving parties, aiming at integrated area development and of improvement of spatial quality. Participatory spatial planning is increasingly regarded important by spatial planners, water management and policy makers (Van Walsum, 2009). Participatory planning is believed to improve the quality of the design and plans through the integration of knowledge and experience of those involved in spatial planning processes and it has positive effects on the acceptance of spatial plans by citizens.

Participatory land use and water management, however, leads to a high demand on communication about, and exchange of (spatial) information (Slager et al., 2009). Therefore, during the last decade a large number of Decision Support Systems (DSS), sometimes being referred to as Planning Support Systems (PSS), are being developed to support participatory spatial planning processes by combining process models of spatial planning often with geo-information based instruments for analyzing, visualizing and communicating data.

Examples of PSS, which focus specifically on communication and exchange of geo-information are the Maptalk and MapTable systems (Vullings et al., 2004), the SALIX projects (Lammeren et al., 2003) and research on 3D of large-scale land use models, like VisualScan (Beurden et al., 2006), are considered examples of PSS that have special focus on the support of visualization of designed plans in planning processes. Communityviz , K2Vi (Brail and Klostermann, 2001) and the PSS toolbox developed by Geertman (2002) are other major PSS developments which focus on the efficient design, evaluation and (3D) visualization of spatial plans.

Waterwise can also be considered a Decision Support System and is basically an optimization model which links measures in land and water use with spatial planning in the river basins (Van Walsum, 2009). Waterwise is an interface which is built on a simulation of a basin hydrology and linked to ecological and economical aspects of the region. In this way an optimization can be made of land and water use measures to reach the objectives of the stakeholders, be it villages vulnerable to flooding, downstream wetlands or the requirements of the Water Framework Directive (WFD). What Waterwise and other DSS have in common is that there is still not much experience gained with the participatory use in real planning processes with these tools.

Functions of a DSS

Decision Support Systems can have different functions within a decision making process. Ubbels and Verhallen, 2000 identify three classes of tools:

- Gaming techniques and simulation role playing
- Tools with emphasis on simulation and prediction
- Tools related to stimulate discussions or consensus building

Another classification of DSS according to possible functions is (figure 1):

- Tools aimed at evaluating (management) alternatives using preferences and value statements of stakeholders (*analytical focus*)
- Tools intended to support the process of revealing stakeholders' preferences and specifying objectives, designing possible alternatives in order to stimulate stakeholder interaction and learning (*interactive focus*)

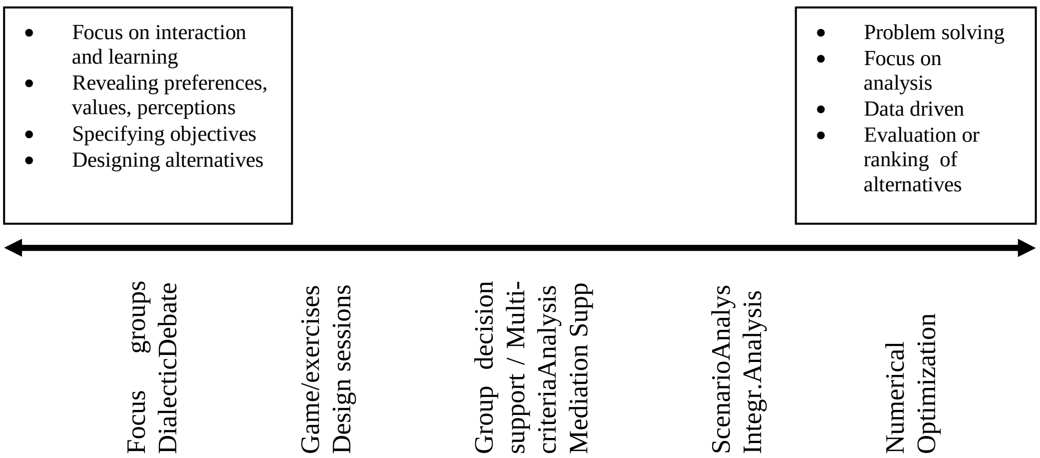


Figure 1: A continuum of decision support tools ranging from a focus on interaction to a focus on analysis (based on Goosen 2006)

Noteworthy, to position a specific DSS on the continuum one should be aware that some DSS are designed in a way that they are more appropriate to support interaction and others to support the analysis. However, one should (also) look at the way the tool has been actually used. It is still common practice to use DSS for analytical purpose. However, the application of a DSS to support a participatory planning process is gaining in popularity. The use of Waterwise in participatory land and water management process is just one example of this trend.

Co-creation

Spatial water policy has to deal with a paradigm shift from 'measures' and a 'vertical' water defence approach into a more 'horizontal' storage and integration of water and other land use functions (Goosen, 2006). This change include also that the domain of a 'water department' will have to be shared with other parties who will share the governance. This is not a simple assignment but a complete process of acceptation of responsibilities which includes substantial social learning. Tools with specific role in the participatory process are:

- Hard approaches that analyze data and provide results, projections, scenarios;
- Soft approaches that stimulate and facilitate discussion among policy makers, stakeholders and scientists.

In decision processes it is important to get the stakeholders with their different backgrounds, interests and perspectives behind a common goal.

An article analysing Participatory Integrated Assessments (PIA) with as an example the 'Delft Dialogue' (Serge Staplers, not yet published) focuses on the synergy between the stakeholders and the modellers in a co-production process where alternately the content of the model and the needs of the stakeholders are formulated. In a process where the various stakeholders have to develop their own new perspective of the changing reality it is important that this learning is structured using the same consistent model. Participants can challenge the simplified parameterization and usefulness of the model in their perspective. The article advises a more flexible approach for using models in the PIA; those models can easily be updated by adding or improving them or through using multiple, complementary models to increase the scope of feasible requests.

Roles of a DSS

The role a DSS should play in participatory land and water management largely depends on the type of problem or issue at stake. Hisschemöller (1993) identifies different roles for a DSS pending its use to address a non structured problem, structured problem or a semi structured problem (Table 1).

Type of problem	**What the DSS needs to do**
Non structured problems Lack of /uncertainty about knowledge and disagreement on the problem, values and/or objectives	DSS should be used as in an interactive way: Revealing preferences, values, perceptions, specifying objectives and designing alternatives
Semi structured problem 1 Lack of /uncertainty about knowledge and no /little disagreement on the problem, values and/or objectives	DSS will have a role in advocating the knowledge they generate. Their contribution will lie in being able to translate information on the functioning of the system into a language the stakeholders and decision makers can understand
Semi structured problem 2 Certainty about knowledge but disagreement on the problem, values and/or objectives	DSS will have a role as mediator and for instance aim at illustrating impacts of different management alternatives or facilitating interactive design of possible alternatives
Well structured problems (technical problems) Certainty about knowledge and no disagreement on the problem, values and/or objectives	DDS as problem solver

Table 1: Type of problem related to the role of a DSS in a participatory planning process

2.2 The use of Waterwise in participatory water management processes

Decision makers face the complex task of balancing different interests, risks, pro's and cons, costs and benefits, which all together are beyond what a human brain can grasp. Support tools allow decision makers to make explicit possible consequences of decisions, with alternatives and investigate impacts or gain insight into the possible response of parties in the process: potential opponents and proponents (Van de Ven, 1998).

Water management can be perceived differently by different groups. In a certain actual situation, their interest, their perspective, their approach and observations may be significantly different. If developed in isolation this may lead for each group of stakeholders to different processes and to different positions in the action arena of any negotiations. Schematically, this is represented in figure 2.

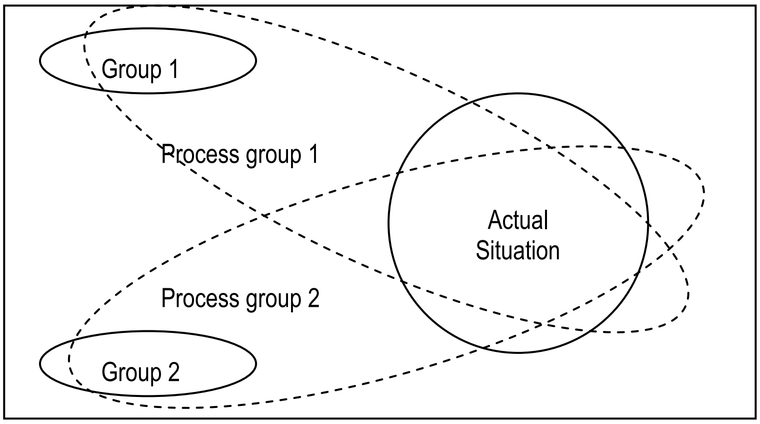


Figure 2: In a situation, different stakeholders can have different perceptions of water management problems and solutions

Types of stakeholders involved in Waterwise

When using Waterwise we enter a similar process working on options for future scenarios on issues related to the biophysical system. There are different stakeholders involved, like decision makers, water users, researchers etc. The stakeholders have different interests and play different roles in the process. Waterwise normally had the most direct link with policy makers often as client. Being responsible for land and water management planning they used the input for a separate follow-up process. The objective of Waterwise is to operate in an interactive way in the stakeholder process. In that case we consider two groups: scientists and other stakeholders. Waterwise as a tool in a participatory process has to reply on more criteria than as a decision support system (DSS) for the policy maker.

The observations and views of both processes can be brought together, in interaction, using Waterwise as a tool to communicate and discuss options with the stakeholders for land and water management (Figure 3).

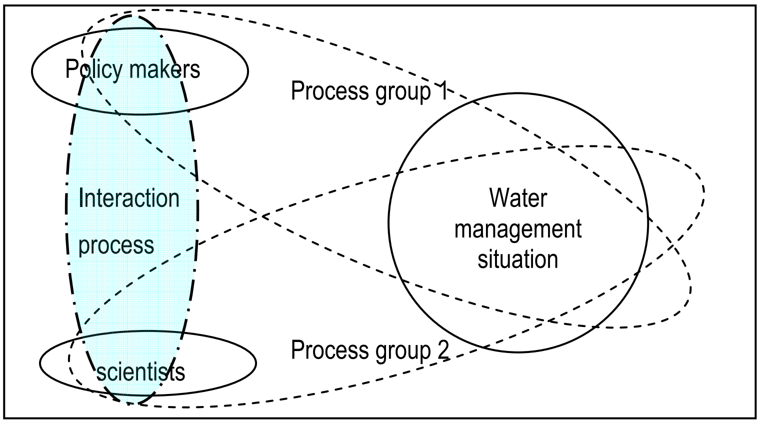


Figure 3: Bringing policy makers and scientists together in an interaction process

Questions for Waterwise to deal with

For taking into account the integrating role of 'water-space interface', used for supporting AWM, the tools should be multi-disciplinary and operational at basin scale. Thematic aspects of IWRM that should be considered simultaneously are:

- water quantity interactions, via both surface water and groundwater;
- water quality interactions, via both surface water and groundwater;
- various functions (nature, agriculture, and so on..) which are dependent on surface water and groundwater.

But the danger of such a combination of requirements is that they can lead to the development of modelling systems that are cumbersome to use. Looking for acceptable water management solutions by 'trial and error' can be highly frustrating; such experiences can cause policy makers to turn away from IWRM and lead to deadlocks in the solving of persistent water management problems. There clearly is a need for models that are more versatile than 'conventional' simulation models. The modelling system 'Waterwise' (Van Walsum, 2008) attempts to provide such an alternative. Instead of (yet another) simulation system it provides a framework for answering the policy questions directly. Simulation models can be used for answering questions of the type: 'What is the effect of removing field drainage on a neighbouring nature area?'. The direct policy question would be: 'Where should I remove agricultural field drainage to protect a wetland, and at the same time keep the income reduction of agriculture as low as possible?'. Waterwise can answer such questions and at the same take various types of stakeholder preferences into account.

The modelling system of NeWater can be implemented in a simple or a sophisticated manner:

- by filling the model equations using simple cause-effect relationships;
- or by using simulation models for performing computational experiments and then feeding the results into Waterwise.

In this way Waterwise can operates with different scenarios dependent of the conditions provided by the stakeholders and translated in variables in the model. Waterwise than uses optimization techniques to quantify and specify in space and time the outcome for various scenarios. This offers the stakeholders on relatively short notice a set of rather well defined options, which may lead desirable strategies.

Waterwise role in interactive processes

Waterwise facilitates investigations in spatial planning in complex systems under uncertainty. Measures of future land and water use can be evaluated in a transparent way. Stakeholders can directly follow the required measures in hydropower, nature development, and water management for water quality, drought problems and flood control. Waterwise provides an integrated modelling platform for exploring a range of strategies and innovative ideas with respect to the socio-economic development, required ecological status and water management conditions.

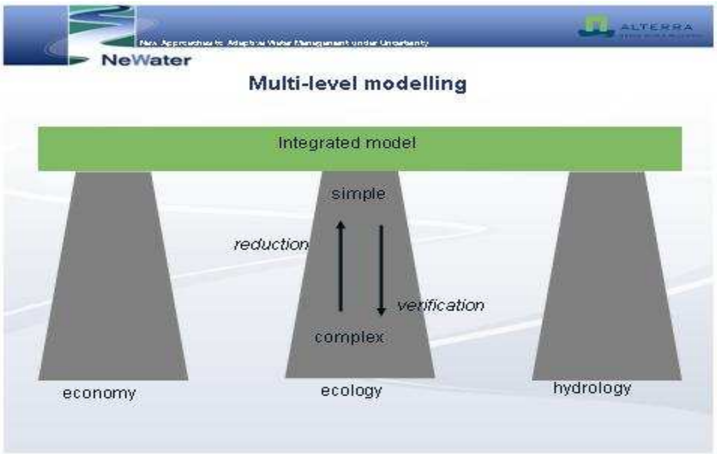


Figure 4: integrated multi-level modelling set-up of Waterwise (Van Walsum, 2009)

The results can be understood in conventional economic terms and also in terms of their effects on ecosystem services and human welfare (figure 4). Results can also be made visible for subsystems and different riparian regions to support discussions and negotiations about acceptable solutions for spatial planning and water management. The role of each group of stakeholders can be made visible and become a basis for awareness raising, integrated assessment and as decision support system or planning support system. This makes it suitable for iterative processes and co-production as indicated in figure 5.

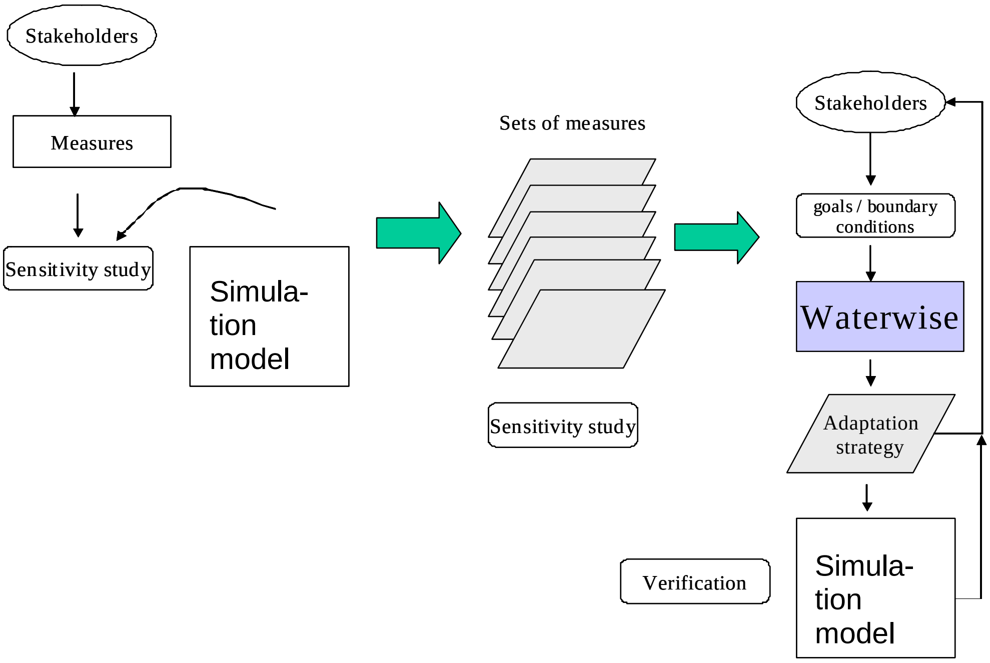


Figure 5: **Overview of setting up (left) and operating the Waterwise (sequential iterative process)**

The steps of the Waterwise assessment is based on the routine procedure for spatial planning and described in the IPEA protocol: an interactive planning mechanism for effectiveness and acceptation (Peter de Rooij, 2007, IPEA: Interactive Planning on Effectiveness and Acceptation). This routine is shown in annex III and starts with the problem definition, the setting of the objective and comparing this with the actual and the situation after an autonomous development) from where focal points for development are to be formulated.

In this way Waterwise can support stakeholders in decision processes presenting consequences of required measures in volume, spatial and temporal scales. This is done more effectively if Waterwise is fed with parameters, criteria and priorities relevant to the ideas behind the search direction the stakeholders have in mind. For introducing new parameters extra time is needed for the linkage to the hydrological system and other variables. This suggests in fact that a co-production with (key) stakeholders is indispensable. As they are both time consuming it is best to synchronise the adaptation of Waterwise with the stakeholders' process. This means that Waterwise is introduced early in the process.

Working according these lines Waterwise can operate effectively in most complex situations with competing economic and ecological claims in hydrological systems. Pending the specific needs Waterwise can (in principle by adjusting the user shell) assists the stakeholder process in many several was:

- providing scenarios in case of uncertainty of data (like climate change);
- create innovative solutions in case processes are stuck in case of diverting goals amongst the stakeholders;
- optimizing of solutions in less complex situations;
- increasing insight in problems, roles and targets if presented as a game;
- Advising individual parties to screen their options. To make clear what Waterwise could mean for the process a prototype is prepared for introduction. If accepted the co-production can be set-up with the (key) stakeholders.

Waterwise is a tool for the assessment of IWRM issues in spatial planning processes with options to interact with the stakeholders. The often complex situation under uncertainty asks for a clear role for the stakeholders and a structure for iterative finding of solutions in a negotiation process. NeWater case studies provided the opportunity to try out and test the possible roles of Waterwise and the required operational conditions.

Situated decision making

Decision making processes is specific for the situation it is applied in. The situation can be characterised by its control over the input and by the uniformity on the expected or desired output. Concerning the 'input' side it deals about the degree knowledge and data availability and the understanding of the cause-effect relations. For the 'output' side it concerns to which extend parties agree on the problem objectives and goals of the outcome. For both dimensions a variety of values is possible between the extremes from certainty to uncertainty on the available knowledge and from full agreement to disagreement concerning the goals. In this way each situation is characterised by its place in one of the quadrants of figure 6 creating 4 typical situations each with there specific approach towards decision making. The presented concept is a combination of work from Snowden (2007), Hisschemöller and Hoppe (1995) and de Boer (2008)

In the 'simple' case that all parties agree on the goals, there is clear understanding of the issues and information is ample available, a computational strategy can be followed in a bureaucratic structure. Waterwise application can follow an optimization approach for the best practice.

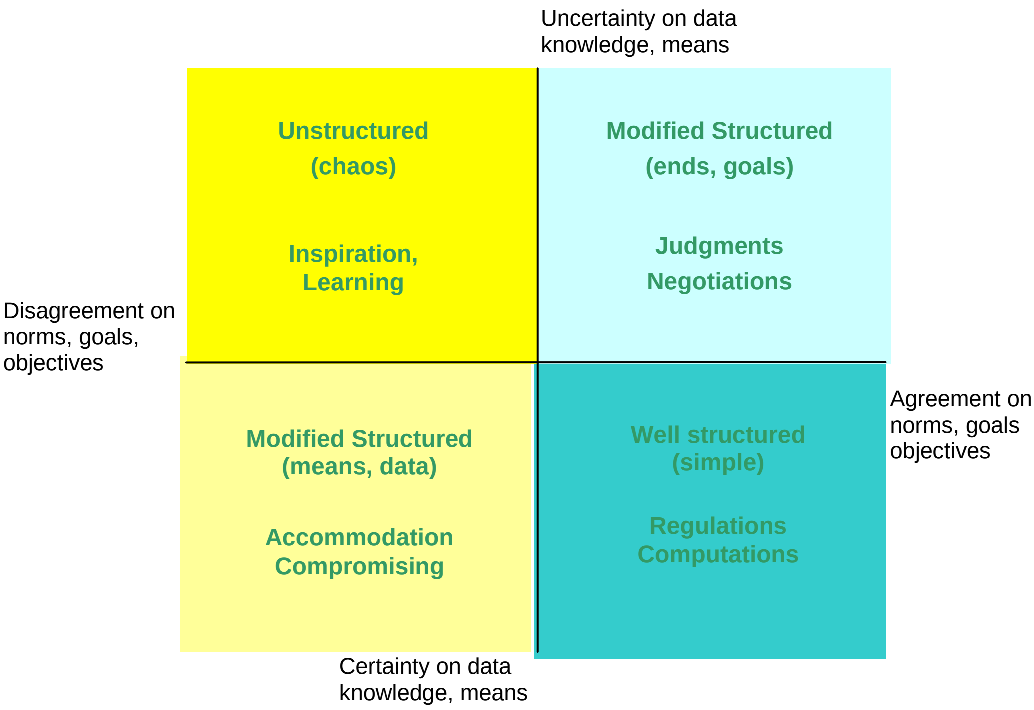


Figure 6: situated decision-making approaches

For the situation that parties agree on the goals, but there is uncertainty on the data or the cause-effects are not all clear (climate change), an approach of proper judgmental strategy is needed with and negotiations between the parties. A Waterwise application will be oriented on scenario development leading to a good and robust practice.

When data are sufficiently available and the problem well understood but the parties do not agree on the goals, the process is becoming complex and accommodation policy must be followed with a compromising strategy leading emergent practice. Waterwise can contribute though try-outs and for all b co-production with the stakeholders providing a basis for reframing of their targets and adjust their expectations.

With uncertainty on data and parties' disagreement on the goals there is a chaotic situation where a learning process and inspiration is needed. Waterwise can contribute by visualizing innovating scenarios and increase understanding and common vision through a gaming approach for novel practices.

2.3 Framework of analysis of Waterwise application in the case studies.

Indicators are needed to analyse the possible role and the qualities of Waterwise in relation to stakeholder processes before, during and after the interactions.

At the introductory stakeholders meetings Waterwise has been introduced as a scenario tool. The actual role Waterwise could play in the case study areas depends on the situation and the related decision-making approaches. Therefore the possible role in the situational decision-making is taken as a first indicator (see figure 6).

Based on recent opinions on the interaction between participants and modellers in an interactive stakeholder process some framework for analysis can be made on the qualities of tool and interaction. Goosen (2006) mentions points of attention once using DSS in participatory spatial planning process:

1. Matching with the needs: the original requirements and user needs and timing them right;
2. User friendliness /presentation of results: users can not interact with software that is too complicated or lacks transparency;
3. Assumption of rationality: DSS aims to contribute to rational decisions, whereas political and emotional motives may play a role;
4. Political and institutional barriers: decision makers may feel bounded by the DSS;
5. Flexibility: DSS should be able to adapt to changes in terms of data and assumptions as well as in values and objectives of end users;
6. Reliability and confidence: User may have little confidence in the DSS and its outcome.

For each of the following cases the performance of Waterwise will be compared with the above mentioned criteria in the section analysis and conclusions. In a final chapter 4 the lessons learnt and conclusions will be drawn from this study.

3 Application of Waterwise and analysis of the cases

In this chapter the Waterwise application in five case study areas are presented. The applications in the river basins of Beerze & Reusel and in the Langbroekerwetering both in the Netherlands mainly show the development of the Waterwise tool internally. During the NeWater project Waterwise was applied for the case studies Rhine (Kromme Rhine), the Elbe (Wipper & Helme) and for the Nile (the basin as a whole). Main focus is on the interactive process between the stakeholders and the modellers which will be presented systematically, in an attempt to draft lessons learnt. Each case will start with a short introduction and than deals with the following issues:

1. 'People and Issues of concern' to describe some tasks on spatial planning in the regions, the issues of concern and which stakeholders are involved;
2. 'Planning and Tool development' to mention the process as planned, with which parties actual contact was established and the land and water scenarios developed by using Waterwise;
3. 'Process and Workshop findings' to describe which meetings were organized and the results of the stakeholder sessions and which contribution was realized towards any final result.
4. 'Analysis and Conclusions' based on the criteria mentioned in §2.3. In the last chapter and overall summary of the conclusions will be given.

3.1 Beerze & Reusel

The request for spatial planning solutions for Beerze and Reusel was the start of the development of Waterwise (Van Walsum 2002) supported by the Research Council of Wageningen UR for developing a methodology for 'planning with water'.

The region of Beerze & Reusel was to be used as a first test case, because this region was already studied (and modelled) extensively for a national research programme on global climate change, to explore the consequences of climate change for hydrology and ecology. In the new project the focus was broadened to include agronomic aspects, with expertise being drawn from LEI, the Dutch national agronomic economic institute. The project was performed by a team divided into two groups: one served as 'stakeholders group' and the other as 'model force'. The project team worked on this assignment in an inventive way as to simulate stakeholder interaction for the enhancement of Waterwise towards an interactive decision support (DSS) tool.

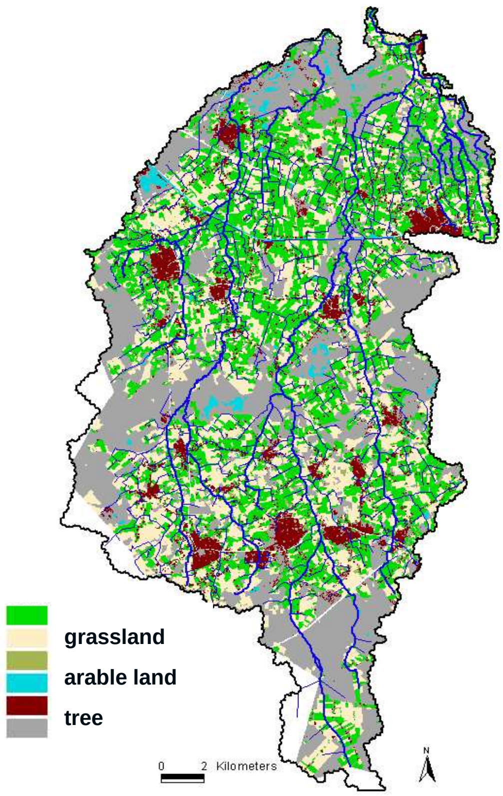


Figure 7: Overview of the land use in the sub-basin of the Beerze & Reusel

3.1.1 People and Issues of concern

The watershed of Beerze and Reusel is a typical rural area with agriculture, nature, small streams and dispersed villages. Spatial planning is under the responsibility of the Provincial administration and regulated through European and Dutch laws and regulations on the Water Framework Directive (WFD), the legislation on desired groundwater levels (GGOR), the legislation on new priorities in water management to avoid droughts as well as flooding in the Water Besluit 21st century (WB21) and, the legislation on the ecological main corridors in The Netherlands (EHS). Implementation of spatial planning is delegated to townships and water boards.

The issues for the research in the Beerze and Reusel catchment were the water quality as influenced by the intensive animal husbandry, seasonal flooding, finding the best location for ecological corridors (EHS), drought sensitivity of agricultural lands in summer, need for new orchards and new housing areas and the increased adaptive capacity of the system for climate change.

For this work on spatial planning the Provincial administration was the main stakeholder and potential user of the results of the planning process. The delegated stakeholders were towns and villages, farmers and agriculture union (LTO), custodians of the ecological zones and the Waterboard.

3.1.2 Planning and Tool development

In the Waterwise development process for Beerze and Reusel the Province was the main contact for information and for feedback. For detailed information the project team approached the province, the Waterboard and selected stakeholders.

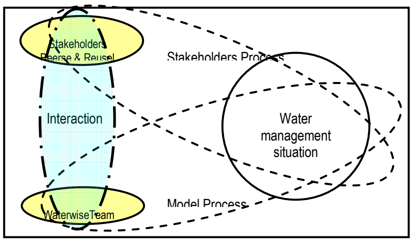
Depending on goals set and constraints imposed the Waterwise system generated optimal land use patterns, taking into account a peak flow reduction (quantitative flow at outlet level), a reduction of nature desiccation, a reduction of N-loading needed for complying with the WFD-goal (water quality), minimizing the loss of agricultural income (Van Walsum, 2005). Optimization of spatial solutions is expressed in a 'yearly catchment balance' consisting of investments costs and income, based on an evaluation of the following measures: field drainage for new pastures, land use changes, river flow retention measures. The study provided the actual situation and the autonomous development as well as 7 different strategies with focus on nature, floods, water quality, combination nature/flood, nature water quality and an integral strategy.

3.1.3 Process and workshop findings

The scenarios with 15 combinations of measures have been run. The conclusion was that of the 4 combinations only the nature/ water quality option had a synergy profit. For all others it appeared that combining objectives was more costly than simply adding measures. The spatial claims of the stakeholders were clearly conflicting. In an ideal process the information about the trade-offs between the objectives could be used by stakeholders for arriving at some sort of consensus. As there was no real stakeholders process ongoing in the river basin accessible for Waterwise, the interactivity of the tool was tested in a simulation by Alterra staff with roles for 'implementers' and 'stakeholders'.

No formal feed back was received nor asked for, from the Province about the set-up and results of the study. The results however have been made available for dissemination of the approach as an Alterra report (report 433).

3.1.4 Analysis and Conclusions



It can be concluded that this project offered the opportunity to work out the Waterwise model for a real live problem area. A number of scenarios have been formulated which –if required- could have be fine-tuned according wishes from any of the stakeholders. The interaction with the stakeholders was simulated. In reality interaction with stakeholders will provide additional issues to solve. But Waterwise than may have been able to reply on stakeholders needs, by incorporation of new values and functionalities.

Concerning the framework analysis criteria for a stakeholder interactive DSS tool (see 2.3) the following remarks can be made:

1. Matching with the needs: Waterwise offered scenarios for a broad set of issues as reported by the Province and Waterboard and covering the legislation in this point.
2. User friendliness: this was tried out in the simulation game realized by Alterra staff and considered as promising.

3, 4, 5, 6 Assumption of rationality, Political or institutional barriers, Flexibility and Confidence were difficult to check on as the policy level was not involved in the process and no feedback was received.

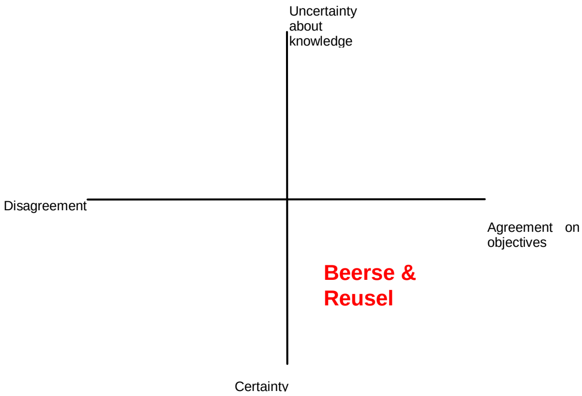


Figure 8: Waterwise position in situated-decision making

The decision making position of Waterwise in Beerze & Reusel was more a test study than a reality. Still scenarios have been developed based on realistic changes in objectives. This was worked out through a role-play between 'modellers' and 'stakeholders'

There was no disagreement on objectives and values. The test setting was meant to develop optimal solutions for assumed scenarios. Problem and objectives were clear (combination of KRW, WB21 and nature objectives) and there was no discussion about the knowledge provided. Waterwise could highlight options and clarify the range of combinations of spatial options.

Waterwise showed a good performance as DSS tool with options for stakeholders' intervention but did not receive feedback from the Province. Further development of Waterwise was considered with integration in a stakeholder's process and need for scenario development.

3.2 Langbroekerwetering

As follow-up to the Beerze & Reusel study an application in Langbroekerwatering was a good opportunity to enhance Waterwise further (Van Walsum, 2006). The study was requested by the Hoogheem-raadschap De Stichtse Rijnlanden and partly financed from the Research Council of Wageningen UR funds in Wageningen in order to apply Waterwise as tool for integrated assessment connected with an ongoing planning process.

3.2.1 People and Issues of concern

The watershed of Langbroekerwetering is a rural area with agriculture, nature along small streams and dispersed villages. Spatial planning is under the responsibility of the Provincial administration and regulated through European and Dutch regulations (WFD, GGOR, WB21, EHS). Implementation of spatial planning is delegated to the townships and water board.

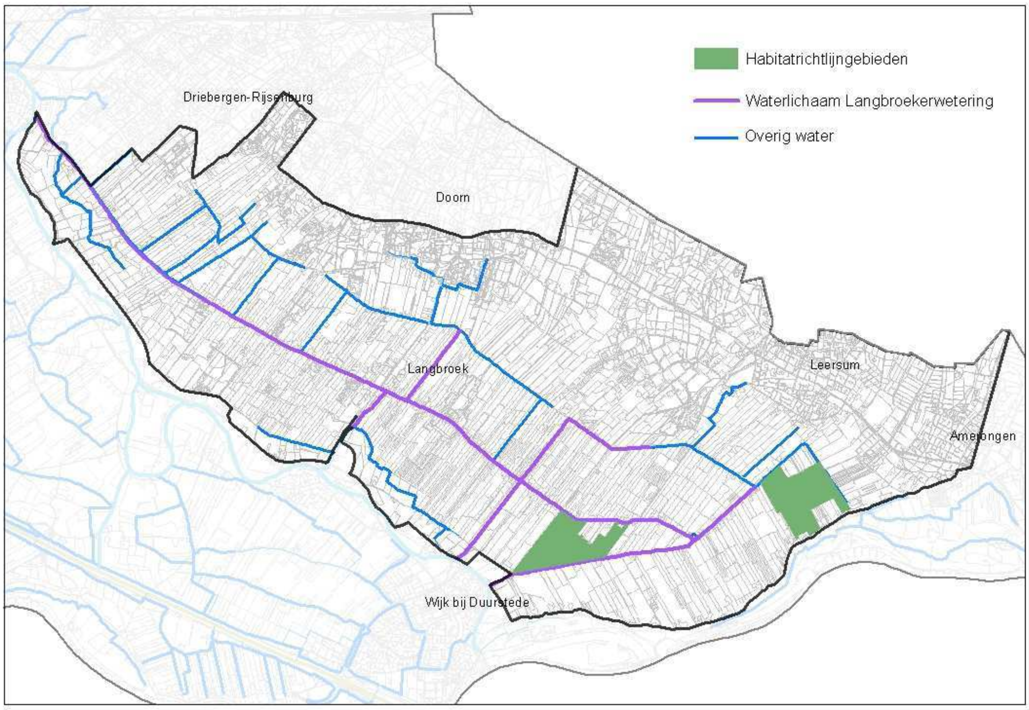


Figure 9: Overview of the Langbroekerwetering with water streams and nature areas

The suggestion from the Waterboard was to develop the most suitable groundwater and surface water regime, serving nature, agriculture production, flood control considering impacts of climate change, water storage, groundwater levels, restoration of existing nature and selection of areas for new nature. These targets could be reached by specific measures in the water and land use system. But where these measures were impossible or too expensive, the change of land use was an option to be considered in the spatial planning. This is especially relevant as some movement in landuse was foreseen because of economic developments.

Spatial planning is a task of the Province (Utrecht) which assigns an area development commission under DLG including representatives of agriculture, nature and the water board. A project team was established with Agriculture, Nature and Hoogheemraadschap De Stichtse Rijnlanden (HDSR) which provided information and feedback to the Waterwise project. Local stakeholders were to be involved in the approval of the plans.

3.2.2 Planning and Tool development

The Waterwise team was asked to develop scenarios for spatial planning in the watershed of Langbroekerwetering in consultation with the project team members and during this process to provide the Hoogheemraadschap De Stichtse Rijnlanden: conditions for development, a description of the 'playing field' with some options for the future and a preferred scenario. This was to be discussed within the development commission of the Langbroekerwetering and consequently with the stakeholders.

The contact of Watewise was directly with the Waterboard, which provided the basic information, the requirements and guidance as well as with the other members of the project team like Agriculture/LTO and nature organizations. There was no direct contact with the regional commission DLG.

Waterwise provided the state of possible hydrological situations, considering the climate change impacts with their effects flooding & desiccation. Sites for new nature were indicated including sets of measures for the water management of both nature and agriculture. These set of measures were optimized to obtain the desirable results for groundwater, nature, income in agriculture, flooding. The "water-connectivity' strategy (open gates with a maximum interrelation between the different types of land use showed that the goals of some variables were constraints to the others: so a 100% win-win situation could not be obtained. Therefore 4 preferential scenarios were formulated and presented to the project team. Based on specific requests of the project team most feasible options were developed and a preferred scenario formulated.

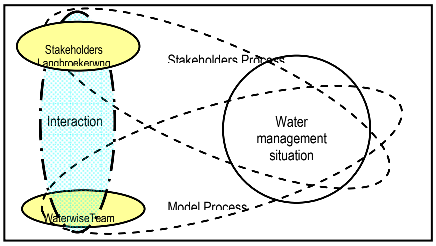
3.2.3 Process and workshop findings

According to the planning the Waterwise team discussed 4 scenarios as 'corners of the playing field' with the project team members and arrived at the following preliminary conclusions :
1/ water management improvements for both nature and agriculture are desirable;
2/ locations of dry and wet areas need buffers between both;
3/ locations dry/wet margins should be indicated in detail for the actual agriculture;
4/ specification nature targets were to be incorporated.

This set of conditions were worked out and presented by the Waterboard (as project team member) in the regional development commission which provided feedback to the Waterwise team through the Water board again, indicating their preferences on nature, agriculture and water management. Based on that input the Waterwise team developed a preferred scenario with effects on nature, possible drought/wet damage for agriculture and flooding risk for townships.

This 'preferential scenario' finally has been presented by the Waterboard in the regional development commission (area committee of DLG). There was no direct contact with the regional commission DLG who is instrumental in organising the stakeholder process. The Waterwise team did not received direct feed back on any follow-up stakeholders process. It was reported however that Waterwise was not used in a stakeholders process because solving the issues would result in a land use change as the spatial variation of actual landuse was too dispersed. The Waterwise version that operates with units where buffering between wet and dry lands is less problematic was considered not a useful tool at that moment. Application of Waterwise could become interesting again when a landconsolidation programme is considered based on transparent and rational land use changes.

3.2.4 Analysis and Conclusions



The Langbroekerwetering provided Waterwise the opportunity to develop a new application to support a decision making process of complex spatial planning dilemmas. The step-by-step structuring of Waterwise routines showed the possibility to more interactive decisions making. This was realized with the key stakeholders: a selection was made between the suggested scenarios which were reprogrammed according the reformulated 'conditions from the field'. Apart of information gathering, the interaction between model and key stakeholders was incidental. There was no interaction with local stakeholders as the regional development commission preferred to keep the issue of land use change at this stage out of the discussion; transparency and rational decision making would create more unrest that pragmatic solutions.

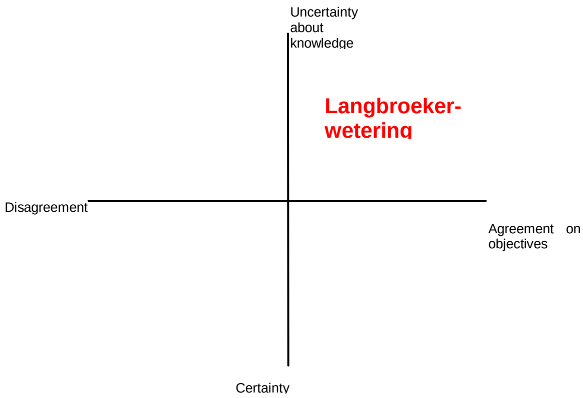


Figure 10: Waterwise position in situated-decision making

The decision making position of Waterwise in Langbroekerwetering was an assignment in preparation to a stakeholder process. Considering climate change was explicit one of the requirements. This places Waterwise in a decision support role with relevant scenarios.
Waterwise was not involved in the follow-up process and how Waterwise would function in such a process is not known

Concerning the framework analysis criteria for a stakeholder interactive DSS tool (see 2.3) the following remarks can be made:

1. Matching the needs: Waterwise offered scenarios for a broad set of issues as formulated by Regional Development Commission before any stakeholder process had been started.
2. User friendliness: The key stakeholder was using the output of Waterwise rather than the tool. The results of this complex exercise where reasonably consistent and presented in an understandable way for the key stakeholder.
3. Assumption of rationality: given the fact the both the Waterboard and the DLG make use of their own stakeholder processes can be an indication of confidence and less transparency of their processes.
4. Political and institutional barriers: land use change apparently was not a realistic option so the Waterwise stopped. Remains the question if Waterwise was applied if the upscaling of landuse would have been a realistic option.
5. Flexibility: Waterwise showed flexibility in adjusting the scenarios according the suggestions of the Regional Developments Commission and feedback through the Waterboard.

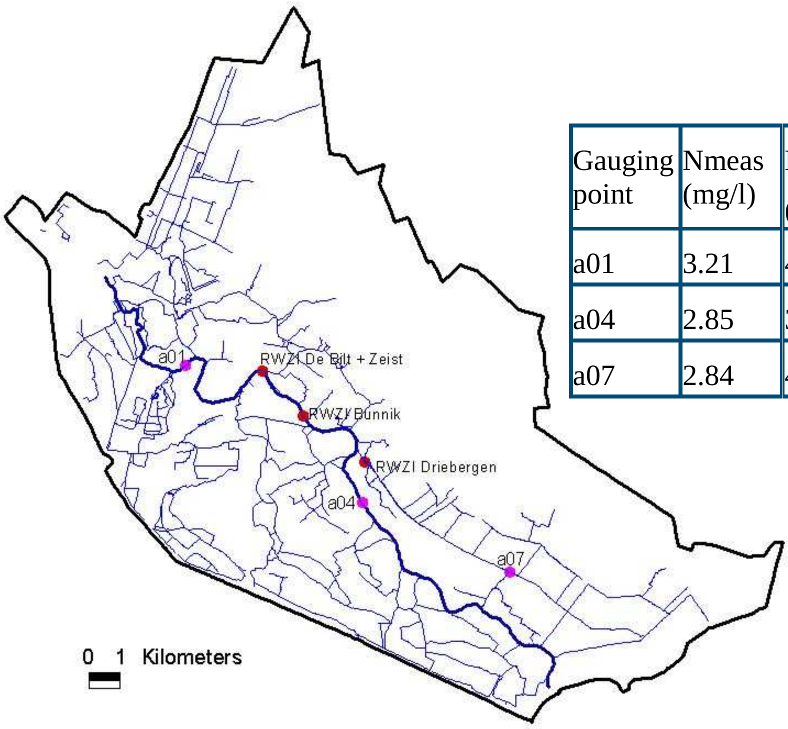
6. Reliability and confidence: there was late feed back that the Waterwise version may have needed a larger scale of operation than the spatial variation of this area allowed. There was no signal that the outcome of Waterwise was considered as not reliable.

Waterwise showed a good performance as DSS tool and the options for key-stakeholders' intervention were used through delegated messages and unfortunately not in an interactive process.

The problem area is interesting and the satisfaction with the technical outcome of the Waterwise results asked for further development of Waterwise possibly at a larger scale with more integration in a stakeholder's process.

3.3 Rhine

This application of Waterwise in the 'Kromme Rijn' is the first (out of three) implemented in the NeWater case study areas. The NeWater project approached the Waterboard Hoogheemraadschap de Stichtse Rijnlanden (HDSR) *to facilitate and study stakeholder involvement processes in the Kromme Rijn area* (Buiteveld, 2006, p13). At that moment, there were two major processes on-going, firstly the formulation of the water management plan (WB21), and secondly the implementation of a pilot for the Water Framework Directive. The cooperation meant for the Waterboard scientific backing of local stakeholder processes and for NeWater a place for action research, enhancement and field testing of their tools.



Gauging point	Nmeas (mg/l)	Nsim (mg/l)	Pmeas (mg/l)	Psim (mg/)
a01	3.21	4.56	0.23	0.23
a04	2.85	3.57	0.16	0.14
a07	2.84	4.39	0.31	0.37

Figure 11: Verification of N, P results in the Kromme Rhine

In this chapter the objectives, the parties involved, the process, the outcome and the lessons learnt from the process related to Waterwise are presented.

3.3.1 People and Issues of concern

The watershed of the Kromme Rijn is a typical low lying river landscape with agriculture (mainly grassland and some orchards), nature along small streams, some dispersed villages and because close to Utrecht also more extended living areas. Spatial planning is under the responsibility of the Provincial administration and regulated through European and Dutch regulations (WFD, GGOR, WB21, EHS). Implementation of spatial planning is with the townships and the water board.

In the area were 3 issues to be discussed by the stakeholders: water quality (WFD) because fertilizer use in agriculture and pollution form the sewerage system, conflict between dairy farmers (water level) and orchards (water quantity in frost period) and options for biodiversity.

For the Water board HDSR, it was important to come up with a ‘maximum ecological potential’ for the water body Kromme Rijn, compliant with the European Water Framework Directive and a water management plan for the (mainly agricultural) area ‘Kromme Rijn’, including a decision on the water levels (‘peilbesluit’) and an optimal ground and surface water regime (Buiteveld, 2007).

The objectives of the Province were more or less the same as for the Waterboard. They were particularly interested in the relationship of water management with groundwater and spatial planning (Buiteveld, 2007).

Stakeholders others than the Province and the Waterboard are from the 3 townships, the agriculture sector like the farmers organisation LTO, the fruit and dairy farmers, nature organisations and to a smaller extend the tourist organisations, fisheries and navigation.

3.3.2 Planning and Tool development

During one of the first meetings between NeWater and the Waterboard HDSR, a stakeholder analysis was made. A division was made between a core group, and a consultation group, comprising the main interest groups and a communication group. In the core group the Waterboard HDSR, the Province of Utrecht and the three townships were represented, while in the consultation group those 5 and 15 organizations were counted, among which farmers’ organisations, government organizations, and nature organisations all at different levels (local, regional and national) (Buiteveld, 2007).

Waterwise had been developed with support of the core team and the information of selected stakeholders. It was intended to at least have the first results of Waterwise presented at the stakeholders meetings for further consideration including the application of the interactive options.

Waterwise produced a hydrological base considering the desired groundwater level, the storage and drainage capacity, anticipating on climate change for the whole sub-basin of the Kromme Rijn. A simulation was made of the pollution in the area including a spatial distribution and cost effectiveness of measures, and finally some scenarios of optimized measures (land use, fertilization, sewerage, water measures) for the desired water quality. Measures included (combinations of) reduced fertilization levels and manure application, less contamination from the sewerage system and natural cleaning like natural buffering and helophytes. Waterwise could also operate interactively and work out alternatives brought forward by the stakeholders to develop own scenarios.

3.3.3 Process and workshop findings

At the first instance (February 2006), the water management plan seemed a routine project for the Waterboard. In the case study, different methods for stakeholder involvement were used, like excursions, meetings, workshops, newsletters, a website and small scale meetings with the community (‘kitchen table meetings’). Between the different levels of participation there was a systematic interaction (François et al, 2007).

In the course of the process of the ‘Area Water Plan’ (WB21) in the area between the Kromme Rijn and the Amsterdam-Rijn kanaal, it became clear that there was a tension between the fruit growers and other farmers (especially the dairy farmers). Hydraulic calculations showed that the fruit growers needed much more water, especially for frost prevention during early spring. This would result in too high water levels for the dairy farmers. The Waterboard saw its task changing from ‘maintaining a certain water level’ to ‘provider of water’, which requires another physical infrastructure and another organisation (Buiteveld, 2007). In the process the Waterboard also changed its role from merely convener to stakeholder.

The Waterboard decided to adjust the water management situation and as a solution for the water requirement of fruit farmers, widening of the ditches was proposed. In this relatively small scale issue the tool of Waterwise was considered as less relevant and the attention remained focussed on the water quality issue of the Kromme Rijn, which turned out to be quite complex because of the disturbing situation of the Amsterdam-Rhine canal. It addition it turned out that the system were greatly influence by the management of the water inlets and outlets and not the by the climate change effected river flow.

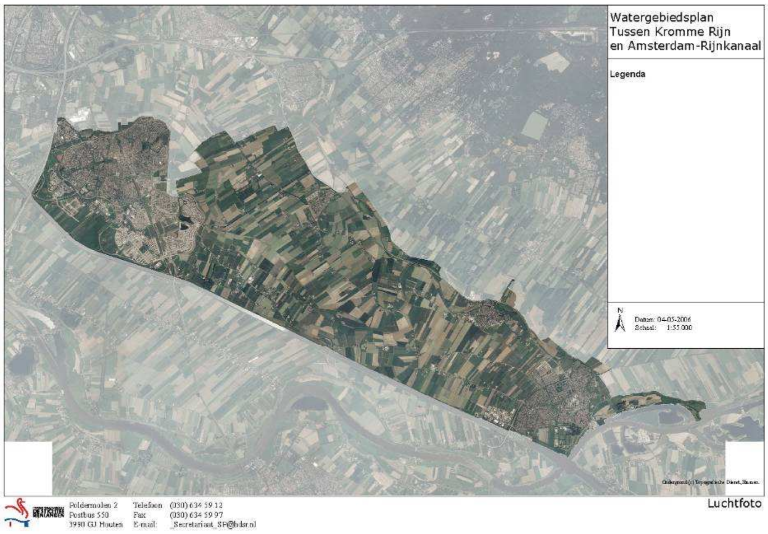
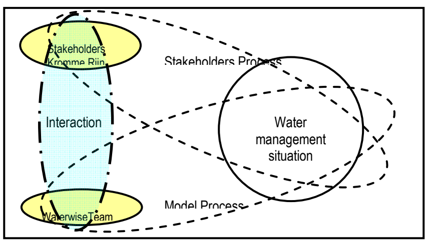


Figure 12: Overview of the land use by fruit- and dairy farmers in the left branch of Kromme Rhine

In the main time the WFD targets seemed more relaxed for an artificial fast flowing water bodies as the Kromme Rijn and when finally Waterwise options related to the water quality and flooding aspects were presented to the Waterboard, it considered the change in land use as a too drastic intervention. Simple measures were sufficient to reach the desired effects on water quality, water quantity and biodiversity.

This was confirmed in a stakeholder meeting in June 2006 where the hydro-chemical input for Waterwise were presented. The suggested water management plan of the Waterboard received a broad support amongst the stakeholders. So there was no need to develop Waterwise towards a complete tool for consultation and interactive stakeholder meetings.

3.3.4 Analysis and conclusions



Finally Waterwise was not developed for follow-up stakeholder meetings as there situation changed and more pragmatic solutions became available. It was unfortunate for the efforts made, that this opportunity passed by but the price of action research. It is possible that to solve problems at the longer run, land use changes become opportune again and interesting for the stakeholders. It can be concluded that also during the process the researchers have to keep an open view on upcoming requirements and that time to reply on that may be short or very long.

For the process the change of role of the Waterboard remains remarkable as convener/facilitator controlling the process towards interested party. Unfortunately the changing position of Waterwise in the process has not been mention in the NeWater stakeholders report as it dealt mainly with the Area Water Plan.

Concerning the framework analysis criteria for a stakeholder interactive DSS tool (see 2.3) the following remarks can be made:

1. Matching the needs: Waterwise replied on the originally formulated requirements of the stakeholders but this could not be tested as at the situation for the Waterwise changed by the relaxation of the WFD requirements. The Waterboard could present during the stakeholder process less far reaching and easier solutions.
2. User friendliness: Waterwise could not be tested as it was not be further developed for application because changing requirements at the stakeholders side.
3. Assumption of rationality: Waterwise was directed towards a broad view on ‘landuse change’ based on integrated water management targets as applied in the Netherlands (WB21, etc). Aspects of transparency and rationality may become useful again when the land and water situations becomes more urgent again..
4. Political and institutional barriers: As more straight forward water measures appeared to be an acceptable and rather easy to implement, a solution through ‘land use changes’ indeed was less acceptable.
5. Flexibility: Waterwise has proven not to have an answer for all land and water issues: in the ‘Area Water Plan’ the scale of operation was too small and the case of the water quality issue of the WFD proves that Waterwises’ domain of land use changes is an issue one prefers to avoid.
6. Reliability and confidence: the application of a new version of the hydrological SIMGRO model in this complex hydrological setting caused delays an initially inconsistent results.

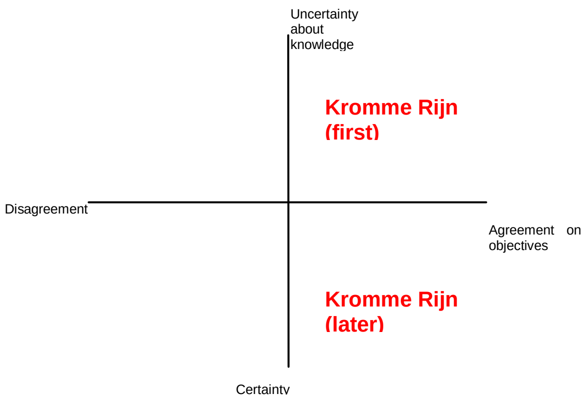


Figure13: Waterwise position in situated-decision making

The decision making position of Waterwise moved during the process. Original problem definition was to find solutions to reach KRW (water quality) requirements taking into account Climate change.
It turned out that the WFD criteria relaxed and there was little effect of climate change on the river flow.
During the process. Because of both reasons Waterwise moved to another decision-making quadrant and got another role to play which even was not urgent anymore.

In order to test the specific capacity of Waterwise the case of Kromme Rhine did not work out as expected. Waterwise as interface between land and wateruse options, is a powerful tool for solutions in complex urgent situations. In case of the Kromme Rijn a pragmatic solution to all stakeholders was found which did not require any land use change.

The change of WFD criteria is a learning point considering the importance of situational decision-making approaches and the role of a process decision unit.

3.4 Elbe

When organising training for practitioners in the NeWater project, Waterwise was selected amongst a number of other tools for adaptive water management to be trained in a Train the Trainers workshop in Potsdam. Waterwise was considered as an interesting tool as it provides scenarios in land- and wateruse changes for an improved water management according WFD. In addition it is an interface which can be coupled with eco-hydrological models applied in the area. Waterwise could help the water management in Elbe watershed in their strategy plan and building commitment to actions; a 3rd step in AWM cycle (see annex I). The training showed how to load Waterwise with data from a case study and how the tool can be used with stakeholders in the context of adaptive water management. (Terwisscha van Scheltinga, 2007). The participants of the training provided also feedback on the use of the tool. They considered Waterwise as a proper tool to provide stakeholders of the water basin with relevant scenarios on issues related to water quality, to floods and to low water levels.

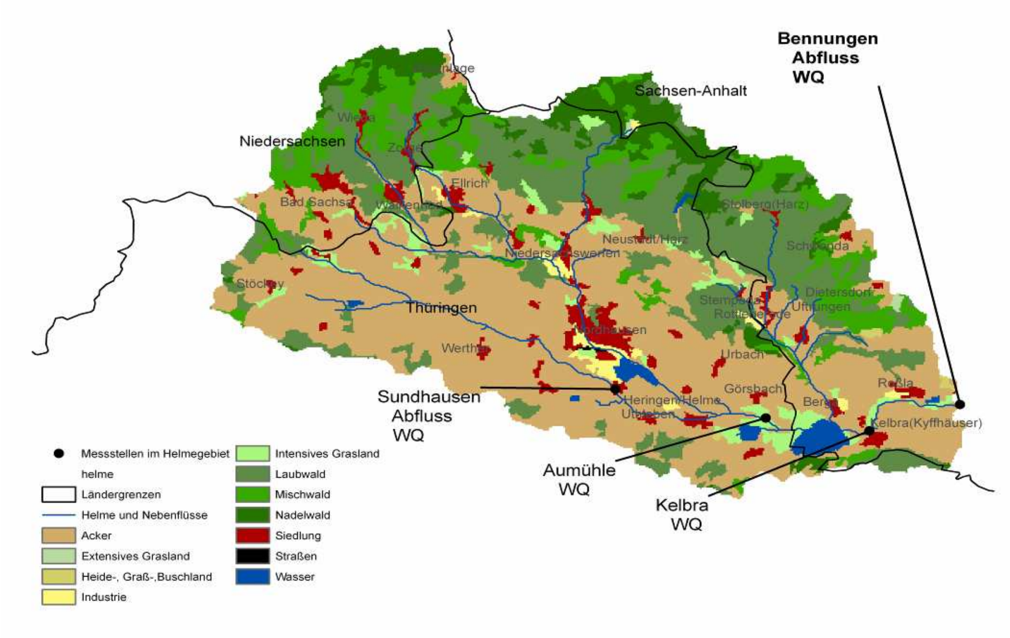


Figure 14: Landuse in the sub-basins Helme and Wipper in Thüringen

The eight participants of the two-day workshop in Potsdam (May 3-4, 2007) were a mix of modellers, future trainers and stakeholders with representation also from the Tisza basin. The set-up of the course provided therefore a combined programme: an overview of integrated models for the purpose of decision making under uncertainty; the built-up of the tool and principles and practices of AWM

Based on the results of the training Waterwise was chosen for application in the Elbe by the case study coordinators which received a request from stakeholders in Thüringen. For the Wipper and Helme the water quality was supposed to be upgraded by possibly changes in landuse including fertilizer application levels. This could help the country to fulfil the Water Framework Directive criteria.

3.4.1 People and Issues of concern

In Germany the states ("Länder") like Thüringen are directly responsible for the water management as well as the spatial planning. The Helme and the Wipper were located in 3 states Saksen-Anhalt, Nieder Sachsen and Thüringen. WFD implementation is delegated by the Thüringen Ministry for Agriculture, Nature and Environment to environmental agencies the districts and the Thüringen department of environment and Geology.

The Helme river basin is located at the margins of the Harz mountain area. The geology is dominated by karst rocks. The middle and lower parts are respectively in slightly hilly and relatively flat areas. Due to very good agricultural soils this part used to be called the "golden valley" and the main land use in these parts is still agriculture (grass and crops). The structure of the river in the lower part is strongly influenced by human use. Banks are reinforced, weirs serve to regulate water levels and discharges, important parts are canalized in order to protect agricultural land and urban areas against floods and to serve old mills. And near the border between Thüringen and Saxen-Anhalt a quite substantial basin (several hundred ha.) was constructed near the town of Kelbra. The middle and lower parts are polluted with nutrients and also with salts stemming from Kali mining activities.

The socio-economic situation in the area is not good. Unemployment is high and no strong perspectives for growth are present. A new highway has been constructed right through the centre of the river basin. And local authorities are anticipating some industrial development by preparing industrial sites along this new infrastructural artery. Some hopes are directed to tourism and recreation.

All in all the Helme river basin is a relative small area, situated in a beautiful country with relative low socio-economic dynamics. High investments in river improvement or in land use changes are not to be expected.

The WFD requires measures to improve the water quality in ground and surface water to reach the desired status. For the major part the water quality depends on pollution from fertilizer residues in the drainage water. This was mostly in agriculture. Thüringen was in the process to develop measures and to have them approved by the stakeholders.

The WFD plans requires the involvement of all land and water users. At this stage the main stakeholders were the representatives from the ministry of Agriculture, Nature and Environment, from local Environmental Services, from the Thüringen department of Environment and Geology and some relevant local stakeholders. As subject matter specialists normally local universities and research institutes are invited.

3.4.2 Planning and Tool development

After identification of Waterwise as an interesting model for Elbe and the Train the Trainers in Potsdam, a prototype of Waterwise for the Helme was to be developed by PIK and Alterra based on locally available hydrological SWIM model and economic data. The results than were to be demonstrated at a meeting with core stakeholders from the government of Thüringen mainly. There it was to be decided if Waterwise would satisfy as a decision support tool and if it would be used in meetings with local stakeholders for approval of the WFD related plans.

For applying Waterwise with the available information and models the cooperation between PIK and Alterra was purely on-line and the need of face-to-face sessions was felt. Waterwise was prepared as a decision support tool for spatial land and water use strategies to support the WFD. The Waterwise prototype for the Helme presented suggestions to reduce pollution against minimum loss of income by change of land use which may include change of level of fertilizers, change to another crop or taking land out of production and switch to nature.

During the calculations it appeared that in Helme the water quality was dominated by the pollution of industry and eventual changes of land use became less effective. Therefore it was decided before the meeting with the core stakeholders already that Waterwise should focus on the Wipper and than also including the impact of climate change.

3.4.3 Process and workshop findings

Results of the prototype of Waterwise for the Helme were presented on a workshop in Erfurt, Thüringen on March 27 and 28, 2008 organised by the ministry of Agriculture, Nature and Environment. Other parties invited were the local Environmental Service from Sondershausen, the Thüringen department of Environment and Geology, regional universities from Jena and Kassel and research institutes like PIK, RIZA, Alterra, and the Water Research Institute from Prague, all partners within NeWater. In this respect it is important to mention that German states hardly deal directly with partners from outside and that the Dutch were more or less operating under the wings of PIK.

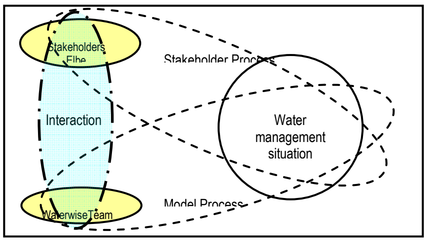
The workshop consisted of a one day meeting in the ministry and a field visit to the Helme-Wipper basin. During the 1st day workshop options were discussed about the need of scientific support for the implementation of WFD with contributions from PIK, from Alterra (Waterwise) and Jena University mainly. The demonstration of the Helme prototype showed the potential of Waterwise as support to the institutes for decision making and to the stakeholder process for formulation of the WFD measures.

The excursion to the Helme and Wipper on the second day, confirmed the managed status of these rivers. The land use was mainly extensive agriculture and nature; a landscape with a high touristic value. It appeared that the main reservoir was becoming a seasonal rest place for birds which influence the water quality in the lake and down streams heavily, in spite of any reduction of fertilizer contamination which was the goals of the Waterwise application.

Waterwise was appreciated as a very clever ‘thinking partner’ in developing realistic scenarios and could strengthen the process of negotiations with the stakeholders in the planning face. It appeared however that the measures for WFD already had been formulated by the departments and core stakeholders, and only a confirmation of the stakeholders was needed. It was concluded now that Waterwise may have been available too late in the process for developing land and water measures together with the stakeholders. Waterwise may also have been too early as the people are not yet ready to easily discuss changing land use (practices) for improved water quality and management in general. May be also In fact Thüringen preferred simple water measures through individual consultations in stead of an open spatial planning process. Still land use change was mentioned is an interesting option.

PIK was informed by letter of the ministry of Agriculture, Nature and Environment one month later that Waterwise would not be involved in the coming stakeholder approval round in the Elbe. What remained was the option of a ‘thinking partner in spatial planning’ for the future.

3.4.4 Analysis and conclusions



During the discussions Waterwise was considered as a powerful tool to apply in the process of spatial planning. It was felt that Waterwise should have been introduced to the main stakeholders at an earlier stage so the development of the scenarios could have been made together. Also the role of Waterwise in the process hen could have been decided: as decision support, as interactive tool in the negotiations or for awareness raising at the start of the process.

The decision-making position of Waterwise was perceived differently by both parties. Elbe case study was presented as a case with a clear objective: achieving a better water quality with an option to consider changing climate conditions, including uncertainty of data. It was thus presented as a moderately structured problem towards its ends (see figure 15).

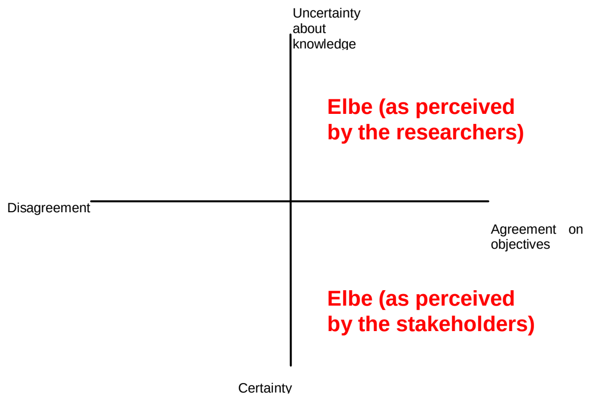


Figure15: Waterwise position in situated-decision making

The stakeholder objectives however appeared differently directed and not focused on the interaction between water and land use; simple water management measures were considered as sufficient to improve water quality and accommodate some expected climate change.

Consequently there was no uncertainty on the data and the problem became simple and well structured. Use of Waterwise became less interesting.

Concerning the framework analysis criteria for a stakeholder interactive DSS tool (see 2.3) the following remarks can be made:

1. Matching the needs: Waterwise was able to indicate land use alternatives for improved water quality in the Helme. The actual need however was different again as the plans for measures to reach the desired water quality, had been made already.
2. User friendliness: the results of the Waterwise prototype for the Helme were shared with the main stakeholders. They did not work with the tool in an interactive way as it was supposed to be: operating Waterwise with changing variables according to suggestions from the participants/ stakeholders.
3. Assumption of rationality: amongst the participants of the workshop there was no doubt about the logic of the calculations and the value of the output. Of course learning more about Waterwise the feeling grew with the responsible parties that application of Waterwise would changes the plans they already made with selective stakeholder consultation.
4. Political and institutional barriers: There was a feeling that may be change of land use to reach better water conditions down streams was felt as a possible rigid measure for the farmers in this region. But if presented in an earlier stage one was not afraid to have this discussion with the stakeholders. At least this was not the impression; one was interested to apply Waterwise in a next round of negotiations when needed.
5. Flexibility: there was no specific situation that asked for flexibility. For the main stakeholder the presentation of the prototype provided sufficient information to get an idea about the potential of Waterwise.
6. Reliability and confidence: Newater certainly was considered as a trustworthy tool because of the co-production with PIK, a much esteemed institute in the field of eco-hydrology by the Thüringen representatives. Otherwise scientific cooperation outside the state is no practice in Germany.

However there was a clear interest of the major stakeholders in Waterwise as a tool in spatial planning, the proper conditions were not created. In a following cycle of WFD or at any other more complicated land-water related problem a Waterwise application was considered by the ministry in Thüringen.

3.5 Nile

Water shortage, flooding and water quality are major issues at least in some parts of the Nile basin. The linkage with land and water use in the basin is obvious. Therefore the Waterwise application in the Nile basin has been an option from the start of Newater. This case study focuses on the tasks of the NBI including transboundary water management. Waterwise could compare the national spatial planning of the 10 countries with the optimal land and water use for the whole of the Nile.

Waterwise has been part of the Train the Trainers workshop organised by the Regional Water Study and Training Centre in Cairo from 19-21 February 2008 under the title "Learning about adaptive management in the Nile basin – Learning for interdependence" (François, 2008). The training was focussed on supporting adaptive water management in the basin (see annex I). This NeWater course for the representatives (18 persons) mainly from the Nile countries, included Waterwise as a tool for integrated assessment, the Podocarpus game being a tool for Multiple Actor Behaviour Simulation and the Search Conferencing approach to identify and start-up processes on water management development.

The Waterwise part of the training consisted of a description of the spatial planning in the basins and the drivers influencing them. A second part described the filling and fine-tuning of Waterwise towards regional conditions and stakeholders interests. Finally the role of Waterwise in a stakeholder process was discussed. A simulation with direct involvement of the participants representing their countries was not realized.

In the process of improvement of the Waterwise prototype for the Nile fruitful use has been made of the feedback of the participants of the training. The participants identified more variables that could be added as to improve the applicability of Waterwise, which was used for further improvement. Above all Waterwise was considered as a stimulating tool in discussions related to land and wateruse changes.

Figure 16: topographical map of the Nile basin

3.5.1 People and Issues of concern

Tasks in water management spatial planning

In principle spatial planning is a national issue and basically an autonomous process with limited national enforcement. The use of the Nile's water however is an international issue and has been settled in the Nile Water Agreement (1929): a treaty between Egypt and Sudan to which riparian states have to comply because it was internationally ratified during the British ruling period. In fact the very treaty is also the millstone around the neck of the region as it paralyzes the water use in the up-streams countries (Roest, 2008).

Issues of concern
Population growth and widespread poverty are key drivers in socio-economic development, which adds to the pressure on water resources caused by climate change and climate variability. Effects also include ecological consequences like reduction in stream flows, and degradation of riparian habitats. In the upstream countries of the Nile Equatorial Lake region as well as in Eastern Nile countries like Ethiopia, forests are cut down and wetlands are drained. Soils are eroded, resulting in reduced crop yields and non-sustainable livelihoods. Groundwater recharge is reduced and -levels lowered, river flows become flashier and downstream flood and drought impacts are more severe. Other stresses include high sediment loads, water quality changes, seawater intrusion and waterweed infestation. Especially in Egypt and Sudan the aspirations of the population and economies are intricately linked with water.

The approach of the Nile Basin Initiative (NBI) is to develop and broaden the attitude towards water into a trans-sectoral development in the region in which the ‘fruits of the Nile water’ are shared rather than the cubic meters of water. The complexity of the water requirements coupled with a continued increase in the demand for water in the Nile basin, call for urgent, systematic, sustained and concerted actions at the basin scale. This also calls for adaptive measures and implementation of the principles of IWRM to ensure sustainability of the water resources. In a basin wide context, interrelated issues on quantity and quality of surface water and groundwater, and the extraction, use and disposal of water resources should be comprehensively analyzed.

Stakeholders involved
The Nile basin Initiative (NBI) is the counterpart of Newater Nile Case Study in which all Nile countries are represented. On this issue of water related spatial planning the 9 riparian countries (Eritrea is not yet actively involved in NBI) are the ultimate stakeholders, but in this stage of introduction of Waterwise in the region, the Water Resource Management Planning and Management programme (WRPM) as specialized branch of the NBI is a adequate key stakeholder for co-production of the model before launching it in the political arena. For obvious reasons another relevant key-stakeholder is the sister organization of WRPM, and working on the domain of stakeholder processes is the programme on Confidence Building and Stakeholders Involvement (CBSI) supportive to the NBI programme. Together they could form the process team.

Concerning the spatial planning the stakeholders are the Nile countries which are in the process to develop their National Adaptation Programme of Action (NAPA’s). They provide land use information and community-level input to identify adaptation projects required now in order to enable these countries to cope with the immediate impacts of climate change.

3.5.2 Planning and Tool development

Planning of the process
Already at the Newater 2005 quick-off meeting of the Nile case study in Entebbe with broad participation of NBI, the foundation was laid for the application of Waterwise in the region (Olet, 2005). Here it was decided amongst others to focus the NeWater project activities in the Nile on “Integration of the important sectors within the Nile Basin (agriculture, hydropower and environment) with water management” and on “Sharing of the benefits of water management instead of just sharing water resources”. This combined focus clearly

links water management with spatial planning in the region with an emphasis on the transboundary context.

Waterwise has been developed along the lines of land and water use options based on the limited water available and their contribution to the economic development of the individual countries and the basin as a whole with also a climate change component added to the system.

After a training workshop it was the intention to have Waterwise presented at the Technical Advisory Committee meeting (TAC) in an interactive session with the representatives of the various Nile countries. In the aftermath further sessions at country level were foreseen, however not within the period of NeWater.

Unfortunately the intended TAC meeting was delayed beyond the NeWater project period which limited the contacts with NBI to the WRPM, the 'modellers' branch of the NBI, which operates from Addis Ababa, Ethiopia. The application of Waterwise could be synchronized with the models, tools and stakeholder approaches used in the region with an outlook to co-production.

Tool development

The Nile Basin application of Waterwise was constructed based on a simplified hydrological model integrating information from 120 sub-basins of the Nile; at a more detailed level there are 1371 so-called 'hydrotopes', which in turn are comprised of 3 million 1 km^2 pixels. All the major rivers are included as well as the main lakes and reservoirs. The land use was derived from a FAO classification and each country’s current and potential agricultural production was assessed. The main hydropower stations are included.

Based on the limited availability of water and the required ecological flow, Waterwise offered scenarios for investments in water related sectors like agriculture and hydro-energy, but also for protective investments in food sufficiency to reach the Millennium development Goals (MDG). Investments could be prioritized for specific regions/ countries like up- and down-stream. The effect of climate change was simulated based on expected temperature rise and uncertainty in rainfall.

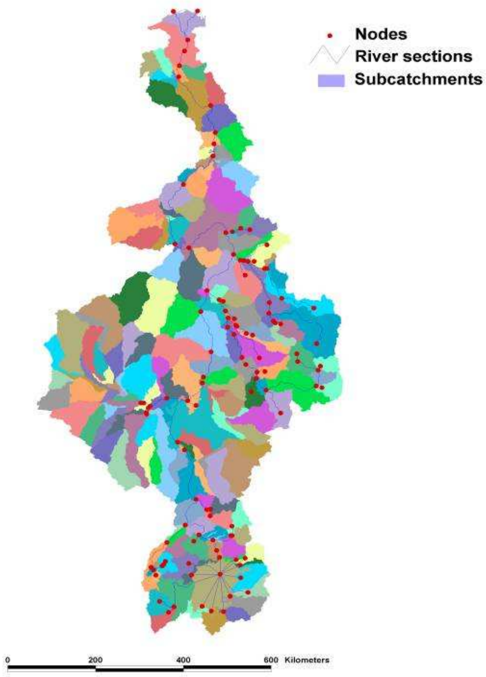


Figure 17 : Sub-basins in the Nile basin

3.5.3 Process and workshop findings

‘Process and Workshop findings’ describes which meetings actually have been organized and the results of the stakeholder sessions and which contribution was realized towards any final result.

The WRPM invited the Waterwise team for a workshop on February 28, 2009 (the last NeWater day). Unfortunately the CBSI representative could not be present but the results where shared. There was a presentation of tools and software used by WRPM as well as Newater related to hydrology, land and wateruse. The built-up of Waterwise was presented as well as the scenarios on land and wateruse changes for more effective use of the available water resources. The concept of Waterwise was inspiring for WRPM and suggestions were made how to further supply Waterwise with completer data and relevant variables. The suggestion was made to focus land use planning in relation to water management initially on sub basins and separate countries first before applying it to the complete Nile basin in a later stage. Co–development was considered as an option for future cooperation.

The workshop with the stakeholder WRPM was held in a constructive atmosphere of technicians, planners and away from direct implementation and local policy makers. The conclusions of the meeting were that:

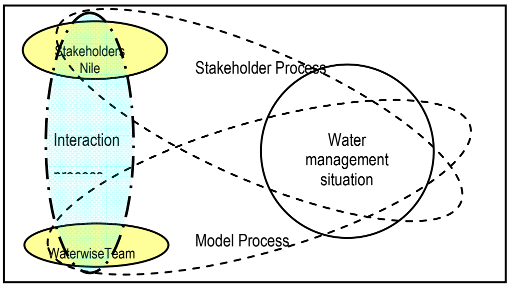
- the main added value of Waterwise is the integration of land use planning processes with water management problems;
- a co-production between Waterwise and MRPW would be helpful on technical research issues and improved data availability for increased credibility;
- the sub-basin (or watershed) would be a better initial work level for Waterwise to avoid sensitive political issues and to remain closer to the application.
- Waterwise may be less acceptable for politicians as Waterwise makes hidden agendas transparent;

and questions to be answered:

- who is the intended end-user of Waterwise: researcher, developer, policy maker, water managers,
- what is the possible role of Waterwise: for assessment of scenarios, as negotiation tool, for awareness raising,...
- could Waterwise be used together with WRPM tools for riparian dialogues.

It was suggested not to present Waterwise at the NBI-TAC meeting in April 2009, as conditions for a proper presentation were not assured and priority was given to an introduction of NeWater first through these specialized branches of NBI like the WRPM and the CBSI.

3.5.4 Analysis and conclusions



This relevant key institute WRPM was aware of the potential of Waterwise and formulated criteria for completion of this Waterwise prototype for application in the region. The NBI has still a long way to go and Waterwise could play a role in stakeholder processes along with other models used by WRPM for Nile countries. The cooperation with CBSI would be an integrated part of this co-production.

Concerning the framework analysis criteria for a stakeholder interactive DSS tool (see 2.3) the following remarks can be made:

1. Matching the needs: for this key stakeholder WRPM Waterwise was considered as a complementary tool for improving the water management in the Nile basin. However this prototype showed still a lack of data and relevant issue to cover;

2. User friendliness: As mainly the output of the prototype was presented and discussed there was no opinion on the user friendliness of the tool;

3. Assumption of rationality: there was a clear warning from WRPM that the output of Waterwise can be not accepted at decision making levels as it makes hidden agendas transparent;
4. Political and institutional barriers: The whole process of international cooperation between the Nile countries is still quite delicate. Working at the basin level with country representatives as stakeholders could therefore be sensitive. Therefore the sub-basin or watershed level and country scale were suggested;
5. Flexibility: The potential flexibility of Waterwise, within the issues that are linked to the hydrological system have been confirmed during the workshop,
6. Reliability and confidence: there was confidence in the tool as such, only the output of this prototype was less reliable as basic data were missing. Co-production with WRPM and CBSI would overcome this problem.

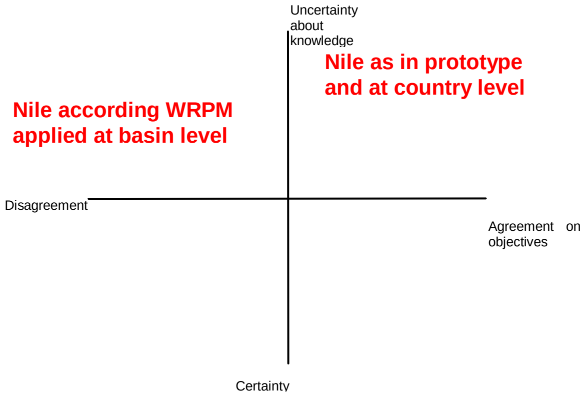


Figure18: Waterwise position in situated-decision making

The decision-making position of Waterwise is different when it is operating at other levels. The problem definition for applying the Waterwise tool at basin level was quite clear: to evaluate the interaction of the various NBI projects, all focused at a better water use (agreement on problem definition). Unclear was how they influence each other at the basin scale. So there was an uncertainty in the knowledge about the effectiveness of various measures. In addition climate change was taken into account.

The tool application is up till now confined to the WRPM, the ‘technical’ member of the NBI/Nile Basin. The stakeholders at government level have not been reached as at this level there is no real agreement on objectives. The use of Waterwise was suggested to country level where there is more consensus on the goals. Examples from the country level (e.g. the impact of small scale land use and water allocation upstream) could highlight these transboundary differences and move the problem at basin level downwards to a moderately structured (means) problem in which there is scope for mediation and negotiation.

The workshop with the ‘technical’ stakeholder proved to be very effective for both parties and some important statements on a future stakeholders' process could be made. It made some weak and strong points clear of this application and there was a clear intention to involve each other in future steps of co-production.

4 Lessons learnt

This chapter presents the experiences with Waterwise applications in 5 cases in which Waterwise was increasingly applied for planning support and as tool for interaction with the stakeholders.

Situational decision making

One of the main lessons learnt in this NeWater period is the importance of the 'situational decision making' and the different roles Waterwise may play in it. As explained in section 2.2 one distinguishes four basic situations which combine two dimensions: more or less certainty on the available data and more or less agreement on the objectives of the decisions to make. DSS tools may play different roles in each of them.

Waterwise always is introduced as prototype for situations with uncertainty in data, with a set of scenarios tailored to the regional conditions. Making the first prototype is a time consuming operation. During or soon after presentations of Waterwise at the key stakeholders, possibly members of a decision team, the situation on land and water management appeared to be different; in the Nile the situation at transboundary level was more sensitive and complex. In Elbe en Kromme Rhine solutions appeared to be more straight forward and the NeWater tool hardly was needed. There remains a dilemma if initial contacts do not give such signals or that situations can change that quickly that the use of Waterwise becomes less urgent. It may be quite possible that this urgency may come back soon.

Stakeholder interactions

Based on a framework for analysis of interactive processes between stakeholders and modellers as described in chapter 2.3, The experiences have been compared. It also gives insight in which role Waterwise can play in future and how this can be assured in the stakeholder processes.

1. Matching the original requirements and user needs and timing them right;

The prototype of Waterwise was based on pre-formulated stakeholders needs. Actual needs cover a wider area and can only become clear if at least some interaction take place like in Nile and Elbe. The Kromme Rhine learns that needs can change in time once criteria relax and more simpler solutions become acceptable. In Elbe Waterwise was invited for a 'stakeholder confirmation process' rather than with open options as decisions already were made through individual consultation with the stakeholder. In the Nile the introduction was in time as stakeholder processes at transboundary level as the process is still building-up. Here is an opportunity for co-production with the key stakeholder at country and basin level.

2. User friendliness /presentation of results : users can or can not interact with software that is too complicated or lacks transparency;

The user friendliness of the interactive functions of Waterwise was tested for the Beerze & Reusel, with research staff and not with stakeholders. In Kromme Rijn Waterwise was even not fully developed before it loosed its urgency. In Elbe and Nile the prototypes of Waterwise have been presented satisfactory showing the potential of the tool. Presenting of an interactive version would have been effective only after substantial cooperation with at least the key stakeholder (process team).

3. Assumption of rationality: DSS aims to contribute to rational decisions, whereas political and emotional motives may play a role;

For the Nile case it was advised not to present Waterwise at the next NBI meeting; even not in the form of a simple poster session. At this stage introducing an open decision process on land and water issues is still sensitive. WRPM preferred to be involved and have Waterwise integrated in their programme before presenting to NBI. In de Kromme Rhine and Elbe measures were formulated without any land use changes, which is less complicated for all. Applying Waterwise with landuse change options would have introduced new political issues and caused a delay in the process.

4. Political and institutional barriers: decision makers may feel bounded by the DSS;

Providing information to the stakeholders in the transparent way Waterwise does, is not always desirable to use in an interactive negotiation process. In Elbe it was felt that farmers were not ready yet. In the Nile it was advised not to apply Waterwise at basin level as negotiation tool between the countries as relations at this level are still too delicate and more 'space' for negotiations is needed. Therefore an introduction at country level was advised supporting the individual stakeholders. In other cases there were no political or institutional barriers observed as such.

5. Flexibility : DSS should be able to adapt to changes in terms of data and assumptions as well as in values and objectives of end users;

No conclusions can be drawn on this point as Waterwise has actually not operated in an interactive setting. However the Beerze & Reusel test learnt that Waterwise can be fast in integrating new data and priorities and can reply directly on new information. When requests include new types of variables and criteria, additional time is needed for integration in the model. Co-production with the stakeholders in an early stage will minimize additional time needed to incorporate unexpected issues. For upcoming issues not related to the bio-hydrological system, always 'supplementary' models will be needed.

6. Reliability and confidence: User may have little confidence in the DSS and its outcome;

There was some hesitation at the stakeholders when Waterwise presented input and output data in early stages of development trying out a new version model, using less reliable input data and regional priorities because less of access to the 'area'. Co-production with WRPM and CBSI will not have such limitations.

5 Conclusions

Waterwise has been applied for five cases of which the last three in the NeWater case study areas Kromme Rhine, Elbe and Nile. Testing of scenario assessment qualities as well as interactive facilities for stakeholders resulted in suggestions for improvement of Waterwise and points of attention for the application.

It also showed that changes in land use options seem to be a rather delicate subject for an open transparent process as used by Waterwise. Situations with diverting objectives may require an approach of trust building to develop a shared vision and with options for compensation. In addition the tool should be introduced in time

Co-production with the key-stakeholders like modellers and decision teams, is essential for application of decision support tools: underlying problems are better understood, the relevant variables, and data become more easily available, and the character of the decision making process and the role of Waterwise can be identified. Co-production with the (local) stakeholders promotes that the parties gain trust in the tool, become more open to share data and develop common goals.

As interface for models and economic relations Waterwise is very suitable for co-production; stakeholder processes and tool application can run parallel in time and the chance that unexpected issue come up and new variable have to fit into the model is reduced.

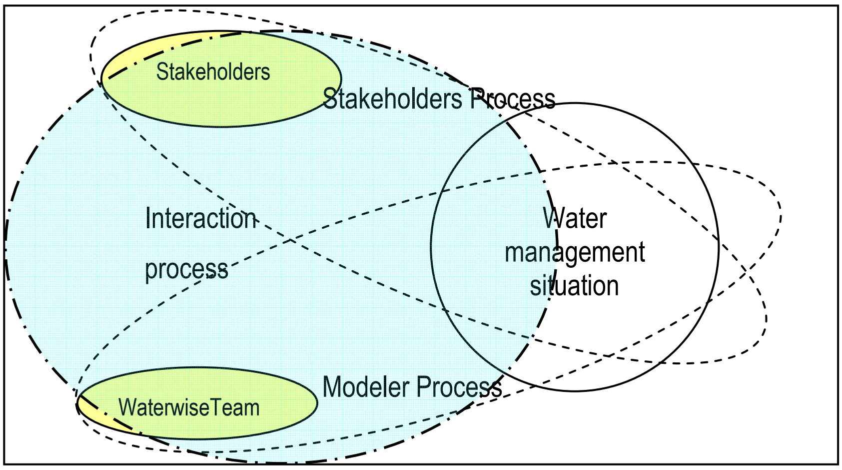


Figure 19: Early interaction of Waterwise in stakeholder process

The interaction between modellers and stakeholder therefore is during an extended period of time (see figure 18) and should not be limited to one decision moment (figure 3).

Waterwise designed as a planning support tool for processes and individual parties has been tested now as an interactive decision support tool and may develop new functionalities to operate effectively in different roles like, for guiding stakeholders towards common goals and for awareness raising in the form of a game. Complementary tools always should be considered as to cover the whole interest area of the stakeholders as Waterwise is limited to the domain of water management and spatial planning.

The experience in the NeWater case studies shows the need and possibilities to bring the capabilities of decision support system and the requirements of the end-user closer together.

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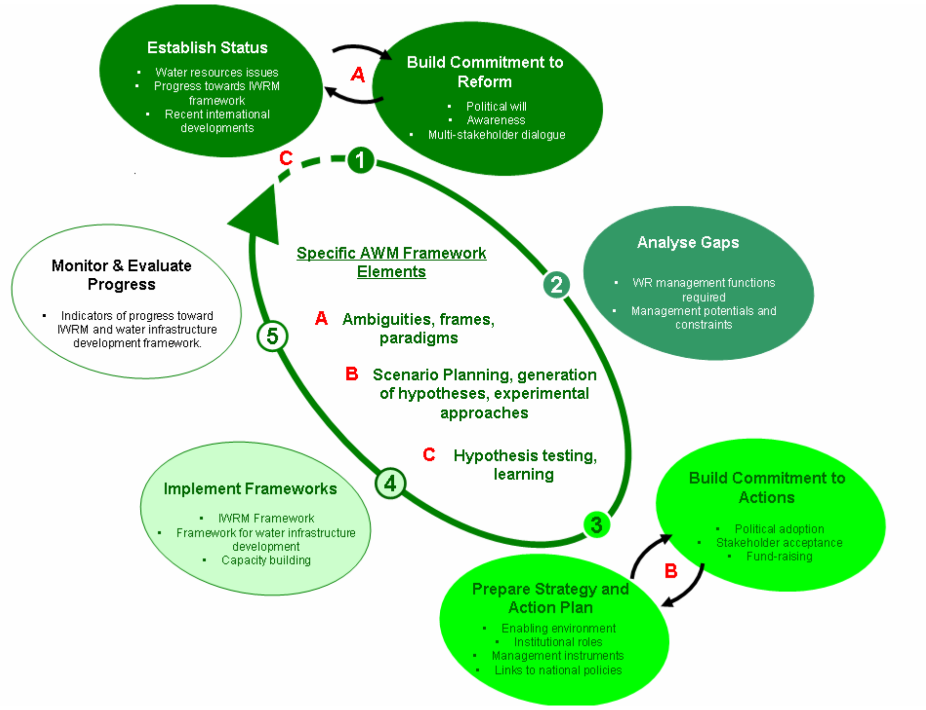
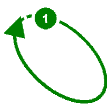
7 Annex I: water Management cycle

The AWM cycle consists of a number of steps and can be considered as a continuous process. The steps of the AWM cycle have specific goals and also include specific themes which describe the setting or the environment in which the instruments and measures can be most functional and supportive to adaptive water management. In practice, themes appear in a number of the steps as required by local conditions and issues in the region.



The steps and themes are presented below:

1. Establish Status and Build Commitment to Reform

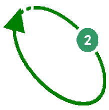


The starting point of the adaptive water management cycle looks towards identifying the critical water resource issues that need to be tackled. This means that the progress towards a management framework in which the issues can be addressed needs to be charted, while taking into account recent international developments.

To sustain this progress political will is necessary, as is building awareness through a multi-stakeholder dialogue. The dialogue needs to be based on knowledge about the subject matter and awareness rising is one of the tools to establish this knowledge and encourage the participation of the broader population.

Themes to deal with during this step are mainly related to the participation process: development of stakeholder commitment, carrying out stakeholder and institutional analyses and dealing with multiple actors, ambiguous issues and diverging perspectives.

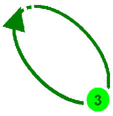
2. Analyse Gaps



The gaps in the adaptive water management cycle can be analysed based on present development, policies, legislations, institutional situations, possibilities and capacities.

Important themes here are Indicator Development, Setting up of Monitoring, Data Collection and Participatory Integrated Assessment. This last theme helps managers gain an overview of the issues and tools that are required when dealing with the parties involved.

3. Prepare Strategy and Action Plan and Build Commitment to Action.

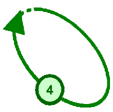


Application of the framework for water resources management requires a strategy and action plan. This means establishing an environment in which institutional roles and management instruments can be applied to set-up relevant measures.

As with the first step of the cycle, commitment by others towards the actions will be necessary. This can be done through working on integrating the plans in a political agenda, gaining stakeholder acceptance and committing finances to achieving that acceptance.

Essential themes here are Participatory Integrated Assessment, and the use of integrated assessment models to develop scenarios with support of stakeholders.

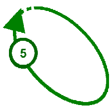
4. Implement Frameworks



Implementing frameworks and plans in the real-world poses challenges. It is likely that changes will have to be made in the present management structures, which most likely requires building capacity and institutional capability to implement the plans.

Relevant themes here are Building Implementation Capacity and the Use of Adaptive and Flexible Implementation Plans to anticipate the uncertainties.

5. Monitor and Evaluate Progress



At the end of the first cycle, monitoring and evaluation of progress will serve as input on how to adjust or fine-tune the course of action. To add value to this information it will be important to choose indicators that describe the progress towards adaptive IWRM and towards the development of water infrastructure.

In this step, as in each of the previous steps, the most relevant themes are “Monitoring the Process” and “Participatory Evaluation”.

8 Annex III Suggestions on Waterwise by participants TtT Cairo

Comments participants TtT Cairo, 19-21 February 2009

Training

1. Documentation needs to be sent
2. Presentation too fast …
3. Much was said, but fast; important that people can see the model in action: change some data, then see the results; makes clear the data needs, brings it to life if accessible (e.g. via web);
4. In presentation not enough view on equations;
5. The numbers did not mean much for anybody not in Nile;
6. The dynamics is a good asset, but time dynamics not properly explained;
7. Did not understand input and output of model; automatically transport files… people like this
8. Found the mode interesting, but application of the model is not complete. Needs much more information, and opportunity to do exercises and get experience with it; only then you will understand it
9. Explanation of mathematical method: jumped many steps, so hard to understand what the parameters are, what is changed, etc. If these gap can be bridged, then model can be of value; training should be organize just focused on using model;
10. Lacking a literature survey, no overview given of other modelling, pity…
11. User interface not made clear;

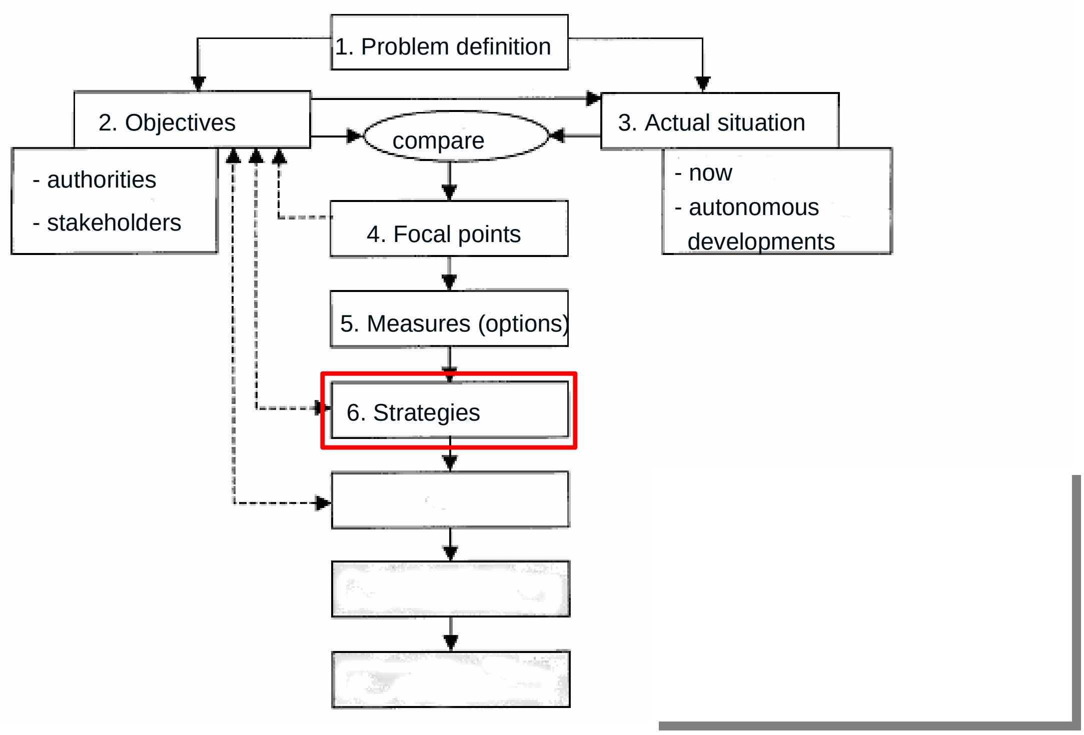
Model

12. Powerful tool, but weakness in simulation model: it should be simple indeed, but not too simple … lots of room for adjustment to the basin conditions;
13. Happy that the model will be open source, so that people have insight and can also contribute themselves to the code.
14. Question about license: model is created in XpressMP, which is commercial code; you must buy; could you use special modules for LP;
15. Happy about open source, then gives much more possibility for calibrating it ourselves;
16. Developing models is one thing, but sustainability of a model is something different; so it is important that more people are involved!
17. Interested in the model, because it integrates different aspects;
18. Found interesting that it showed the relationship between Integrated Assessment and Adaptive Water Management;
19. Is connection with GIS possible?
20. Model contain economic aspect, but for Nile not yet adequate… economists should be included in modeller group;
21. Why have catchment models proved so unsuccessful, in 90's lots of enthusiasm; but danger is that a hyper reality is created; reduce attention for field work… computer world, destructive; when modelling a simplification is necessary but exclude event-driven ecology;
22. Interesting, but fast presentation; gave large area for discussion; but requires a substantial trajectory for getting it used in practice; requires many days of work;

Waterwise in action

23. The concept needs to be taken into real life, leave the prototype phase;
24. The model simply took decisions that for instance meant less water use by Sudan; ownership of water is not taken into account;
25. User interface not made clear;
26. What about the salinity; it should play a role, but doing it with a linear formulation; it would be nice to include the salinity, would be nice to include; there are no models that can do this!
27. At one point in the presentation “the fixed regime of Nasser”; (misunderstanding);
28. Crop yield: linear approach, should add stress coefficient; growing stages of crops;
29. Nothing was said about pattern of crops (was fixed); could be optimized;
30. Should be linked to the Millennium goals; if the project goes further, then funding agencies will no doubt want this link, also relationship with IHP;
31. Waterwise can initiate discussions;
32. Can be useful, but be careful in using it for getting funds from e.g. World bank; so do not use it as a DSS tool for such decision; needs a lot of refining;
33. Could be used in assisting decision makers, prioritizing investment decisions; there are already efforts for developing DSS models; but Waterwise could augment these tools; good to have a link between Newater and ongoing efforts;

9 Annex IV: PIEA steps in spatial planning procedure



Steps of the IPEA procedure used in spatial planning processes in The Netherlands

Step 6. Strategies is followed by step 7: Plan, step 8: Implementation and step 9: Evaluation