Integrated Water Management Support Methodologies

Detailed work plan submitted to "Partners voor Water" (1st tender 2006)

Contact:

Peter Droogers
FutureWater
Generaal Foulkesweg 28
6703 BS Wageningen
Netherlands
tel: +31 (0)317 460050
email: p.droogers@futurewater.nl
web: www.futurewater.nl

Consortium

A unique consortium has been setup on the request of two countries, Iran en Kenya, to develop Integrated Water Management Support Methodologies to assist these countries in their water resources strategic planning. From the requesting countries the two partners per country represent: (i) water managers, and (ii) water advisors. The consortium is unique in the sense that the Dutch partners represent: (i) private sector, (ii) university, and (iii) public entity.

Dutch project partners

FutureWater (Netherlands)

FutureWater is a research and consulting organization that works throughout the world to combine scientific research with practical solutions for water management. FutureWater works at both global and national levels with partners on projects addressing water for food, water excess, water shortage, climate change, river basin management, and irrigation. FutureWater's key expertise lies in the areas of quantitative methods, often based on simulation models, geographic information systems and satellite observations. FutureWater was established in 2002 and has currently five staff members. Details can be obtained at http://www.futurewater.nl/

Institute for Environmental Studies, Free University Amsterdam (IVM) (Netherlands)

The Institute for Environmental Studies (Instituut voor Milieuvraagstukken, IVM) is the oldest environmental research institute in The Netherlands. Since its creation in 1971, IVM has built up considerable experience in dealing with the complexities of environmental problems. Its purpose is to contribute to sustainable development and the rehabilitation and preservation of the environment through academic research and training. The institute has repeatedly been evaluated as the best Dutch research group in this field. IVM's research community of about 100 scientists and support staff addresses challenging environmental problems and offers both pragmatic and innovative solutions. Since 2001 IVM has been a part of the Faculty of Earth and

Life Sciences at the Free University Amsterdam. Details can be obtained at http://www.ivm.falw.vu.nl/home/index.cfm

Waterboard (waterschap) Hunze en Aa's (Netherlands)

Waterboard Hunze en Aa's is responsible to ensure a safe environment regarding water management for the north-eastern part of The Netherlands. Waterboard Hunze en Aa's is the operational water manager for the area and at the same time responsible for strategic water decisions. The management area is 213,000 ha and is home for 420,000 inhabitants. Currently, Waterboard Hunze en Aa's is evaluating its long-term strategic mission including preparation for climate change.

Counterparts

Agricultural Engineering Research Institute (AERI) (Iran)

The Agricultural Engineering Research Institute (AERI) is located in Karaj, 25 km from Tehran, and is the principal research center regarding water and agriculture. AERI is active in the entire country and has been instrumental in supporting water resources decisions using a combination of tools such as remote sensing and models at various scales.

Isfahan Agricultural and Natural Resources Centre (IANRC) (Iran)

The Isfahan Agricultural and Natural Resources Centre (IANRC) is the main advisory body regarding water resources and agriculture for the Isfahan region and, more specifically, the Zayandeh Rud Basin. The Zayandeh Rud Basin has chronically suffered from water shortages for the past 50 years. Since 1950 a series of measures have been taken to augment natural water sources, both through transbasin diversions and reservoir construction. However by 2000 it became clear that demand continued to grow faster than it is possible to develop water resources. Some degree of radical thinking is required that will develop and implement a more integrated approach to the water problems of the Zayandeh Rud. In attempting to move towards an integrated approach water management issues at basin level are required.

SASOL Foundation (Kenya)

The Sahelian Solutions Foundation Kenya (SASOL) was established to render social, technical and financial assistance for the development of arid and semi-arid regions. SASOL is a Kenya based NGO with special emphasis on water, land, shelter, health, education and employment. One of SASOL's most important activities is in the Kitui area to help communities to build 400 dams – the highest concentration of sand dams in the world. This dense construction regenerates ephemeral (seasonal) rivers that now flow all year long. SASOL is geared towards a successful implementation of the project through there extensive contacts at various stakeholder levels in the region.

University of Nairobi (Kenya)

University of Nairobi (UoN) is a world-class African University and a community of scholars committed to the promotion of academic achievement and excellence in research as an

embodiment of the aspirations of the Kenyan people and the global community. The Department of Geology has a special focus on hydro-geology. Selection of locations for dam development to store water is one of the main interests in the hydro-geology section.

Figure 1. The two pilot areas: Zayandeh Rud (Iran) and Kitui (Kenya).

Relevance

The challenge to manage our water resources in a sustainable and appropriate manner is growing. Water related disasters are not accepted anymore and societies expect more and more that water is always available at the right moment and at the desired quantity and quality. However, the number of major water related disasters as droughts and floods is on the rise, as well as the number of people affected, total loss in lives, and economic damage (Figure 2).

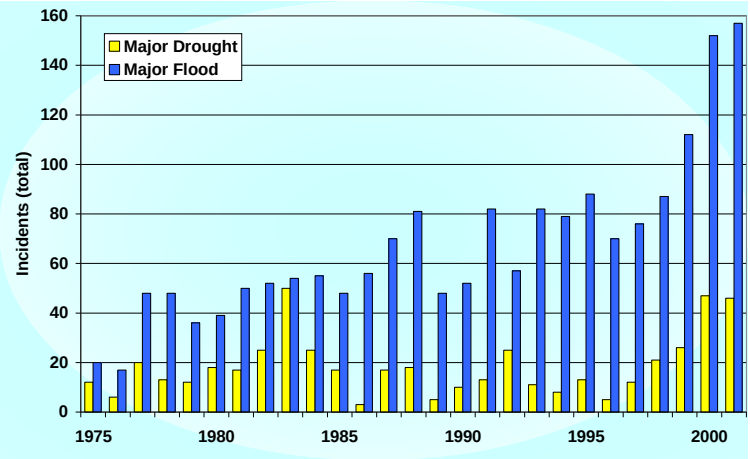

Figure 2. Number of water related major disasters over the last 25 year. Source: Emergency Events Database: EM-DAT, 2002.

Current water management practices are still focused on reacting to events occurred in the past: the **re-active** approach. Some typical examples (amongst numerous others):

- The tsunami from December 2004 has led to a tsunami warning system
- The flooding in The Netherlands in 1953 was the starting point for the Delta-works
- After the devastating flooding in Bangladesh in 1991 (138,000 dead) an early-warning system was established
- The critical situation of the Dutch dikes in 1995 and 1998 has led to a shift in water management policies (Nationaal Bestuursakkoord Water)

These types of water management policies can be characterized as **re-active.**

At many international high level ministerial and scientific meetings (i.e. World Water Forum 1997, 2000, 2003; World Water Council; World Summits) a call for more **strategic** oriented water management, the **pro-active** approach, has been advocated. Despite these calls such a **pro-active** approach is hardly adopted by water managers and policy makers.

Water managers and decisions makers are aware about the necessity of this paradigm shift, the change in thinking from a re-active towards a pro-active approach, but are **confronted with the lack of appropriate methodologies**. Instruments that are currently available are just tools on its own, while integrated instruments are required that cover the entire range leading from **data to information to knowledge to policies**: Integrated Water Management Support Methodologies (IWMSM).

To be prepared for the paradigm shift **Integrated Water Management Support Methodologies (IWMSM)** are needed that go beyond the traditional operational support tools. Note that these IWMSM are more than only tools, but include conceptual issues, theories, combining technical and socio-economic aspects. Moreover, demonstration and awareness raising regarding the opportunities these IWMSM offer are essential to ensure wider application.

IWMSM consist out of three components each with its own characteristics and purposes (Figure 3):

- **Physical component**. This part of the IWMSM relies on accurate description of the physical processes related to water.
- **Allocation component**. This component is mainly used to evaluate the impact of human interference in water distribution and allocation issues for water shortage as well as water excess.
- **Multi-criteria component**. This part of the IWMSMS is used widely for all kind of applications, but only to a very limited extent for water management issues so far. The multi-criteria approach is however of paramount importance in strategic decisions involving multiple-stakeholders.

Typical examples of the application of the multi-criteria component are:

- How to judge investments in a new reservoir vs. reforestation
- Benefits and cost of water allocation for agriculture vs. nature
- Analysis of one big reservoir vs. many small ones
- Impact and adaptation to climate change for different sectors

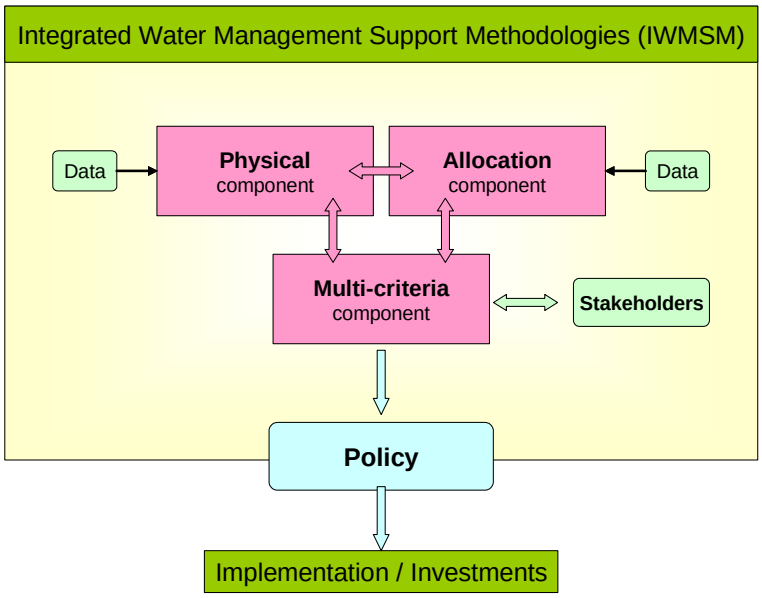

Figure 3. Conceptual framework of the Integrated Water Management Support Methodologies.

In summary IWMSM are a combination of methodologies that will support water managers in making decisions regarding strategic water management including investment decisions. In fact, they are the key to make the following steps: problem → data → information → knowledge → policies → implementation/ investments.

Two Partner for Water countries, Iran and Kenya, have approached the Dutch consortium to assist them in this paradigm-shift towards a **pro-active** water management.

The first country is **Iran** where water scarcity is one of the major challenges to economic development. For one river basin, the Zayandeh Rud, this water scarcity has increased over the last decades and the country is desperately looking for IWMSM that can help to develop their water action plans. More specifically to assist the water managers in three different fields: (i) to be prepared for dry spells, (ii) to have a transparent decision taking process, and (iii) to obtain an instrument which supports investment decisions.

The second country to focus on is **Kenya**, where both very dry and very wet areas can be found. Especially the area around Kitui will be used for the project to identify how IWMSM can be implemented to answer three fundamental questions: (i) what might be the best location for dam construction from a water resources perspective, and (ii) what will be the large-scale impact if dam construction will continue at the current rapid pace, and (iii) how will climate variability and climate change impact the dams.

Developing IWMSM for these two countries offers the unique opportunity to have tools available to take investment decisions, and simultaneously for the Dutch consortium partners to expand their business potentials.

The Dutch water sector has the unique opportunity to provide world-wide support to implement this **pro-active** approach to water management, by its specific characteristics:

- A shift towards pro-active water management has started a few years ago in The Netherlands
- A well-known reputation regarding water management world-wide
- A unique water management policy structure
- Strong linkages between research and advisory services

The **business potentials** for the Dutch water sector as a whole and the project partners specifically are enormous. A comprehensive study on the challenges the Dutch water sector faces in the world was published recently (Een wereld om water: naar een nieuwe aanpak voor de Nederlandse watersector, Netherlands Water Partnership, 2005). Findings of the study proof the expected economic benefits of this project (key issues with page numbers of the report in brackets):

- There is an urgent need for pro-active strategic water management (page 6)
- The strongest growth potential of integrated basin management is in modeling (page 19)
- Allocation of water is one of the main questions the Dutch water sector can provide services (page 24)
- A growth of the global water sector by 11% annually (page 10)
- The international water sector has a volume of € 425 billion annually (page 14)
- 50% export growth in five years providing products and services will be strengthened (page 15)

A detailed analysis of the marketing aspects of this project for the Dutch sector as a whole and consortium partners specifically can be found on page 20 of this work plan. In summary:

- A steady growth of turnover as a result of the project
- Return on investments of less than three years for the commercial partner and less than four years for the academic partner
- An extensive list of potential requesters of the services developed under this project

The project focuses specifically on three of the Partner for Water themes:

- **Water for Food and Nature**: The main objective of the project is to develop methodologies and identify their specific need to balance water allocation between food and nature. So far, benefits and costs analysis of these trade-offs are made on vague decision making processes. IWMSM will support decision making and ensure that this decision making will be more transparent.
- **Water and Climate:** Climate change will have a major impact on water resources. Strategic planning by means of evaluating adaptation strategies is required to make balanced decisions. It should be emphasized that these decisions comprises often investments in the order of tens to hundreds of millions euros.
- **Supporting Integrated Water Resources Management Plans:** Governments at various levels develop Integrated Water Resources Management Plans that involve large financial investments in the water sector and have at the same time enormous sociological impact on human beings. IWMSM are highly needed to develop and evaluate these plans.

Linkages to the **other Partner for Water themes** exist too. Groundwater is taken into consideration as the lower boundary condition for the IWMSM. The project focuses specifically on Millennium Development Goal one (eradicate extreme hunger and poverty) by supporting better planning of water for food. Millennium Development Goal seven (ensure environmental sustainability) is included as far as this concerns water. Planning for sufficient water at the right moment and of good quality using IWMSM is a prerequisite for healthy sanitation.

In summary, the **added value** of this project is that tools for strategic water management will be expanded to Integrated Water Management Support Methodologies that will be applied and tested for two cases on its marketing values. Substantial economic benefits as a result of the project are expected for the Dutch water sector as a whole, for the consortium and for the consortium partners individually.

Objectives

Considering the points outlined in the previous sections the overall goal of the project is defined as:

To develop, test and support Integrated Water Management Support Methodologies as requested by water managers and policy makers to take well-balanced decisions on strategic water management and investments.

Derived objectives of this overall goal are:

- To ensure that the Dutch water sector is prepared for the paradigm shift in water management from a re-active towards a pro-active approach.
- To strengthen the Dutch water sector in the international context by close collaboration between the Dutch partners representing three sectors: (i) private (FutureWater), (ii) public (Hunze en Aa's) and (iii) research (Institute for Environmental Studies).
- To mitigate water related problems in the two case studies by applying the Integrated Water Management Support Methodologies.
- To explore benefits and costs of the application of IWMSM for the two contrasting case studies.
- To expand the network of the consortium partners at two levels: between countries and between the demand and support partners.
- To explore the possible marketing of the IWMSM developed in Iran.
- To explore the possible marketing of the IWMSM developed in Kenya.
- To explore the possible marketing of the developed IWMSM worldwide

Workpackages

To meet the objectives of the project a set of workpackages has been developed, each with its own activities.

Workpackages:

1. Initiation
2. Setting-up and applying Integrated Water Management Support Methodologies (IWMSM)
    a. Physical component
    b. Allocation component
    c. Multi criteria component
    d. Full IWMSM
3. Meetings
    a. Kick-off and demonstration (Netherlands)
    b. Wet – less developed (Kenya)
    c. Dry – less developed (Iran)
4. Outreach and Marketing
5. Project management and coordination

Number of days total and for each consortium partners:

	Period (month)	Total (days)	FW	IVM	HeA
Work Package 1: Initiation					
1.1 Develop guidelines for country coordinators	1-3	5		5	
1.2 Develop guidelines for IWMSM	1-3	15	10	5	
Work Package 2: Setting-up and applying IWMSM					
2.1 Physical component IWMSM	4-10	15	15		
2.2 Allocation component IWMSM	4-10	10	10		
2.3 Multi-criteria component IWMSM	6-10	10		10	
2.4 Full IWMSM	6-10	15	15		
Work Package 3: Meetings					
3.1 Netherlands	2	15	5	5	5
3.2 Wet - less developed (Kenya)	9	10	5	5	
3.3 Dry - less developed (Iran)	11	10	5	5	
Work Package 4: Outreach and Marketing					
4.1 Global community	2-12	20	10	5	5
4.2 Science community	2-12	10	5	5	
4.3 Wet regions	2-12	10	5	5	
4.4 Dry regions	2-12	10	5	5	
Work Package 5: Project management and coordination					

5.1	Overall management and coordination	1-12	10	10		
TOTAL		1-12	165	100	55	10

Workpackage number	:	1
Workpackage title	:	Initiation
Start	:	Month 1
End	:	Month 3

Objectives:
The initiation phase is required for a further refining of tasks, activities and agenda's. Besides this general objective this workpackage is specifically meant to develop guidelines on the development and application of IWMSM.

Activity 1.1: Develop guidelines for country coordinators
Responsible: Institute for Environmental Studies
The two country coordinators (IANRC, SASOL) in collaboration with the Institute for Environmental Studies will develop guidelines to proceed with the implementation of the project in the two pilot areas. This activity includes an inventory of management responsibilities for water, data collection and preparation for the consensus meetings.

Activity 1.2: Develop guidelines for IWMSM
Responsible: FutureWater
The key issue in this project is to integrate the three levels of IWMSM. Guidelines on this integration do not exist so far and should be developed based on existing tools and modification of these tools. Specifically linkages between the physical and the allocation IWMSM should be developed, as well as the position of the multi-criteria one on top of these two.

Output:
- Guideline for country coordinators
- Guideline for IWMSM

Workpackage number	:	2
Workpackage title	:	Setting-up and applying IWMSM
Start	:	Month 4
End	:	Month 10

Objectives:
The Integrated Water Management Support Methodology (IWMSM) will be developed and applied for the two pilot areas. A Strength-Weakness-Opportunity-Threat analysis (SWOT) will be undertaken for the three IWMSM for the two pilot areas with a focus on benefits-costs analysis.

Activity 2.1: Physical component IWMSM
Responsible: FutureWater
The physical component of the IWMSM relies on physical data such as land cover, elevation and meteorological conditions. Since the partners have been involved in studies in the two pilot areas base data are available. However, consistency and proper formatting are required to have the same starting point for the pilot areas. A uniform data format will be used and populated. Hereafter, the physical component will be built and calibration and verification will be undertaken. Finally, the IWMSM will be tested and evaluated for a climate change scenario for the year 2050.

Activity 2.2: Allocation component IWMSM
Responsible: FutureWater
The allocation component of IWMSM is based on simplified physical settings and focus on how water is managed. Data collection for the two pilot areas is the responsibility of the country coordinators, while FutureWater will ensure that a common methodology will be used. The allocation component will be built and discussed with responsible agencies for water allocation using the options to perform swift scenario analysis.

Activity 2.3: Multi-criteria component IWMSM
Responsible: Institute for Environmental Studies
Input for the multi-criteria component of the IWMSM comes on the one hand from the physical and allocation components and on the other hand from stakeholders and experts from the pilot countries; Iran and Kenya. The Institute for Environmental Studies will create a first setup of the multi-criteria component for the two pilot areas and during discussions with stakeholder fine-tuning by consensus will be achieved.

Activity 2.4: Full IWMSM
Responsible: FutureWater
The full IWMSM will be required to evaluate the strategic pro-active water resources issues the project focuses on. It is likely that this is a function of the physical as well as socio-economic setting of the country. An evaluation of this country specific need is the first component of this activity. The second component is to analyze best options of linkages between the three components of the IWMSM.

Output:
- Integrated Water Management Support Methodology (IWMSM) for Kitui, Kenya
- IWMSM for Zayandeh Rud, Iran
- Technical report on developing IWMSM

Workpackage number	:	3
Workpackage title	:	Consensus meetings
Start	:	Month 2
End	:	Month 11

Objectives:
Consensus meetings aim at evaluating the IWMSM for the two pilot areas. For each country a range of stakeholders (water users, water managers, decision makers) will be included with the objective to undertake a SWOT analysis including benefits-costs analysis. A consensus meeting in a pilot country will be visited by a limited number of partners from the other pilot country (1 or 2) to ensure cross-cutting interactions. These consensus meetings have clear marketing and business opportunity components.

Activity 3.1: Temperate - developed (Netherlands)
Responsible: Hunze en Aa's
In month 2 the first consensus meeting will be organized. The first objective is to give the project a quick start by sharing data, information and knowledge. The second objective is to get project partners acquainted with IWMSM. The third objective is to demonstrate foreign partners the Dutch approach towards pro-active water management and IWMSM. This last objective is clearly geared towards promoting the export of Dutch water expertise.

Activity 3.2: Wet - less developed (Kenya)
Responsible: SASOL
The consensus meeting towards the end of the project will have a SWOT component and a business opportunity part. First days of the meeting will be with a small select group directly involved or interested in the project. Last days aim at targeting a bigger audience to ensure proper outreach and explore business opportunities. A modest training component will be included as well.

Activity 3.3: Dry - less developed (Iran)
Responsible: AERI
Same as activity 3.2 but in Iran.

Output:
- Stronger partnership between the consortium partners
- Better knowledge of pros and cons of country specific IWMSM
- Improved knowledge of the options the Dutch water sector can offer internationally
- SWOT analysis of the IWMSM with a strong focus on benefits-costs analysis
- Reports describing the two country studies

Workpackage number	:	4
Workpackage title	:	Outreach and Marketing
Start	:	Month 2
End	:	Month 12

Objectives:
The overarching objective of the project is to get the developed and evaluated IWMSM applied globally. This workpackage will ensure a proper outreach of project activities and results at different levels and locations. The derived objective is therefore a strengthening of the Dutch water sector as a whole and the consortium partners specific.

Activity 4.1: Global community
Responsible: FutureWater
The global community will be reached by a mixture of activities. An important activity is, especially for FutureWater and the Institute for Environmental Studies, to include results of this project in other international studies and consultancies. Publications in journals targeting water managers worldwide, such as Water International, will be submitted. A website with methods, results and conclusions of the project will be setup with links from websites of the consortium partners.
A business plan will be developed emphasizing the marketing potentials for the Dutch water sector as a whole and the consortium partners specifically.

Activity 4.2: Science community
Responsible: Institute for Environmental Studies
Publication in a peer reviewed journals will be the means to reach the science community. It should be emphasized that reaching the science community and writing scientific publications is one of the marketing instrument for the Dutch partners.

Activity 4.3: Wet regions
Responsible: SASOL
The wetter regions have specific challenges in using IWMSM. Focus will be more on water excess rather than on water shortage. It might be that the physical component of the IWMSM will therefore be more relevant than the allocation one. SASOL and UoN will use their own network to get project results and conclusions under the attention of other potential users. Networks, technical reports and presentations are the means to reach these groups.

Activity 4.4: Dry regions
Responsible: AERI
The challenges dry regions faces will put a stronger emphasis on the allocation component of the IWMSM with a strong linkage to the multi-criteria one. AERI and IANRC will use their own network to get project results and conclusions under the attention of other potential users. Networks, technical reports and presentations are the means to reach these groups.

Output:
- Expansion of networks
- Publications (one peer-reviewed, two in journals targeting water managers, three technical reports)
- Presentations in the two countries
- Business opportunities report and strategy
- Website

For the Dutch consortium partners, and especially for the Institute for Environmental Studies and FutureWater, articles in scientific journals and in journals targeting water managers are important marketing tools.

Workpackage number	:	5
Workpackage title	:	Project management and coordination
Start	:	Month 1
End	:	Month 12

Objectives:
To manage and coordinate the project in general and to ensure that project objectives will be reached.

Activity 5.1: Overall management and coordination
Responsible: FutureWater
The project will be managed in a strict manner to ensure that activities will be completed timely to guarantee that the overall objective will be reached. Since all activities are specified in detail for each country and for each IWMSM progress can be monitored relatively simple. Insufficient linkages and communication between partners, a common problem related to multi-country projects of this nature, will be overcome by two means. First of all the intensive consensus meetings (three times in one year) will ensure proper linkages between partners and countries. Secondly, the management style will be stringent by a strict adherence to agreements, deadlines and deliveries.

Output:
A well managed project focusing on timely delivery of project results.

Team and responsibilities

The project will be undertaken by three Dutch and four foreign partners each having its own tasks and responsibilities. The seven partners represent three different groups required for a successful project:

- Responsibility: Requester versus supporter
- Economic: Developed versus less developed
- Physical setting: Dry versus versus wet

These three indicators will form the responsibility matrix for the project.

		Responsibility		Economic		Physical setting	
		Requester	Supporter	Developed	Less developed	Dry	Wet
FutureWater	Netherlands		√	√		√	√
IVM	Netherlands		√	√		√	√
Hunze en Aa's	Netherlands		√	√		√	√
IANRC	Iran	√			√	√	
AERI	Iran		√		√	√	
SASOL	Kenya	√			√		√
UoN	Kenya		√		√		√

Team

Each partner of the consortium has designated a Principal Investigator to undertake the project. Given the nature of the project (identification and marketing opportunities) high-level senior staff will do most of the actual project activities. For some minor activities additional staff will be included in the team. A short description of the Principal Investigators is provided here, while detailed CVs are included as appendices.

The Principal Investigator and project leader for **FutureWater** is **Dr. Peter Droogers**. Peter is an expert on integrated water resources management at different spatial scales with emphasize on water for food and water for nature issues, climate change, decision support systems, simulation modeling in combination with data mining and remote sensing. Peter has over 15 years of experience working in The Netherlands and overseas (as a resident in Sri Lanka and Turkey). Non-resident assignments included Cambodia, The Gambia, France, India, Iran, Kenya, Niger, Pakistan, South Africa, Spain, Uganda, Vietnam, and USA. Research was conducted at various institutions including Wageningen University, International Water

Management Institute, and FutureWater. Peter is part-time lecturer at several universities and has written over 100 publications of which 50 appeared in peer-reviewed journals. He is reviewer for a number of journals and is one of the associate reviewers of the Journal of Hydrology.

Principal Investigator for Institute for Environmental Studies, Free University Amsterdam (**IVM**) is **Dr. Jeroen Aerts**. Jeroen has been employed at the Institute for Environmental Studies in Amsterdam since 2002. He is a leading scientist in the area of climate change, adaptation strategies and water resources management. Research and consultancy activities include a vast number of international climate and water resources management projects, in countries as The Netherlands, Central Asia, Bangladesh, Kenya, Southern Africa, India, Vietnam and USA. His projects focus mainly on water management related issues as disaster management, insurance arrangements, poverty reduction and sustainability and risk management strategies. The kernel of most projects is a stakeholder approach where both scientists and policy makers jointly develop and evaluate management strategies.

Principal Partner for Waterboard **Hunze en Aa's** is **MSc. Jan den Besten**. Jan is hydrologist at the Waterboard and responsible for development and supervision of projects related to operational and strategic water management in the area of Groningen and Drenthe. Prior to his current job he was attached to Waterboard Fleverwaard for five years. From 1991 to 1993 he was involved in FAO's activities in Haiti, Tanzania, and Mozambique. Jan was also attached to Wageningen University and responsible for research and training courses at the Department of Irrigation.

For the Agricultural Engineering Research Institute (**AERI**) the Principal Investigator is **Dr. Mehdi Akbari** who is research assistant professor at AERI. Akbari is irrigation and drainage engineer, with over 15 years' research and field experience on soil and water issues. His interests are in the applications of remote sensing data and image processing methods for monitoring environmental variations. In particular the use of multi-sensor, multi-scale and temporal data for characterizing hydrological parameters variability (such as Land Surface Temperature and Evapotranspiration) in irrigation systems.

Principal Partner from the Isfahan Agricultural and Natural Resources Centre (**IANRC**) is **MSc. Manouchehr Torabi**. Torbai is an agricultural hydrologist with a long-term track record on water management issues focused on agriculture. He has led a couple of research projects, including a 5-years international collaborative project with the International Water Management Institute. He is proficient in data collection and modeling to solving water related problems on the ground.

Principal Partner from **SASOL** is **Dr. Makau Mutiso**, who is a political scientist by training. Mutiso is currently executive chairman of SASOL and responsible for the implementation and development of projects. Mutiso is author of over 100 publications in professional journals, applied journals and books. Mutiso has an extensive track-record of managing projects from various sizes, national as well as international.

Prof. Eric Onyango Odada is Prinicipal Investigator for the **University of Nairobi** (UoN). Odada is professor of Geology at UoN and also Programme Director of the Pan African START Secretariat (PASS); a network of global environmental change research in sub-Saharan Africa. Odada has over 15 years teaching experience, has led many projects of various sizes and has published more than 50 articles. Odada's main interests are in: assessment of water resources,

study of past global change in hydrological cycle, integrated water resources management, and water supply and sanitation.

Spin-offs

Society

The impact and spin-offs for the society can be grouped into three distinct benefits. First of all will the two case studies **benefit directly** by testing and implementing Integrated Water Management Support Methodologies (IWMSM) so that better decisions are taken that will benefit people in the regions directly. Second, after a successful introduction of the IWMSM in the pilot areas **expansion to other areas** will take place, serving people outside the two case studies. These impacts can be enormous as improved water management will have a positive effect on sanitation and health aspects and on food production and thus famine or nutritional shortage. Finally, the **looming water crisis** is a serious threat that might induce local and regional water conflicts. Only by better planning methodologies based on pro-active and people oriented approaches these potential conflicts can be overcome.

More specifically the benefit for the **Zayandeh Rud area in Iran** will be: (i) better prepared for future dry spells, (ii) a more transparent decision taking process regarding water resources planning, and (iii) a methodology directly available to support investment decisions in the water sector.

For the **Kitui region in Kenya** specifically are the benefits in summary: (i) a tool to identify locations to invest in new sand dams, (ii) larger scale impact of many new small dams, and (iii) instrument to identify impact of climate change on sand dams.

Innovation

It is clear that the water sector faces enormous challenges. So far, tools in isolation have been used in a rather re-active approach and it is clear that the water sector is on the brink to change towards a pro-active approach. The innovative aspects of the project should not be underestimated. The current practice in strategic water management decisions are often driven by political motives with, sometimes, simplified non-integrated technical tools. A big leap forward, **a paradigm shift**, is to have integrated methodologies available to support such a decision process that is acceptable to all relevant stakeholders: water users, water managers and policy makers. The methodologies are new as they go beyond the tools as such and integrate data, conceptual issues, theories, and combine technical and socio-economic aspects as well.

Consortium

The most important spin-offs for the **consortium partners** will be the improved and broader networks as a result of the project. The consortium partners have up to now a working relationship on a one-to-one basis:

- FutureWater and Iran
- Institute for Environmental Studies and Kenya
- Institute for Environmental Studies and FutureWater
- FutureWater and Hunze en Aa’s

The project will be very beneficial to FutureWater to expand its network to Kenya and for the Institute for Environmental Studies to expand to Iran. For Waterboard Hunze en Aa's the project will establish real contacts abroad necessary to fulfill the commitments as stated in the strategic plan of Waterboard Hunze en Aa's.
Besides this expansion of the one-to-one relationships, the consortium partners will develop a **business strategy** to expand their joint activities in other parts of the two pilot countries. Moreover expansion to other countries will be explored as well. These activities will take place under work package 4 (page 14).

More specific the following initiatives give the consortium ample opportunities:

- The "Unie van Waterschappen" recently published their strategic plan including a concrete plan of action to use expertise of Dutch waterboards abroad. Activities will be 50% within Europe and 50% outside Europe.
- A major collaborative effort between eight countries, including Netherlands, Iran and Kenya, is under review by the Dutch Directorate of Development Aid (DGIS). Results of this Partners for Water project will contribute to this initiative.
- FutureWater has very good contacts with the International Water Management Institute (IWMI) which has opened an office in Iran recently. This will provide unique additional opportunities to a continuation and expansion of activities in Iran.
- The Institute for Environmental Studies is under negotiation with the Global Environment Fund – United Nations Development Program (GEF-UNDP) to establish a long-term relationship with partners in Kenya.

Business opportunities

The World Water Council estimated that investments in the water sector for the developing world will more than double from US$ 75 billion annual currently to US$ 180 billion by the year 2025. Same estimates at a global scale are US$ 5,000 billion currently and an annul growth rate of 11%. It is evident that decisions that have to be taken for these investments can not be done by the existing simplified tools but require better Integrated Water Management Support Methodologies. Business opportunities for the **Dutch water sector in total** as a result of this project are therefore substantial. More concrete the IWMSM developed and demonstrated under this project are highly required by the Dutch water sector to support worldwide decisions that will be taken over the years to come regarding investments in the global water sector.

For the Dutch water sector as a whole estimates has been made on the additional growth of the Dutch water sector as a result of the project. By conservative estimates, as shown in the following table, the expected benefits of the project will be above € 3 million:

Cluster	Export (€ x million)	Project focus (%)	Growth (%)	(€ x 1000)
Waterbeheer	630	5	2	630
Water en Groen	840	10	3	2520
Waterbouw	1680	0		
Drinkwater	630	0		
Afvalwater	420	0		
Total	4200			3150

This table is based on “Een wereld om water: naar een nieuwe aanpak voor de Nederlandse watersector, Netherlands Water Partnership, 2005”. The “Project focus” column indicates the share of the total cluster export that is covered by this project. The growth percentage is the anticipated increase of this share. The growth percentage multiplied by the project focus percentage and the total export results in the expected benefits.

For the Dutch water sector it is essential to establish and expand its world-wide recognized expertise on water management issues. It is however of paramount importance to react on the paradigm-shift from the re-active approach to the integrated strategic pro-active approach in water management. The project is unique in the sense that the Dutch **consortium partners** incorporate the three cornerstones of the Dutch expertise: the world-famous water management structure of waterboards (Waterboard Hunze en Aa’s), the expertise of the academic world (Institute for Environmental Studies) and the fast-growing private research-consultancy firms (FutureWater).

More concrete, an economic analysis has been done to assess the benefits that will emerge from the project for the consortium partners based on a five years forecast:

Consortium partner	Growth in turnover[1] (€ x 1000)				
	2007	2008	2009	2010	2011
FutureWater	50	100	175	200	200
IVM	25	100	125	150	150
Hunze en Aa's	10	10	10	10	10

[1] *As a direct result from this project*

Consortium partner	Growth in profit[1] (€ x 1000)				
	2007	2008	2009	2010	2011
FutureWater	23	45	79	90	90
IVM	6	25	31	38	38
Hunze en Aa's	1	1	1	1	1

[1] *As a direct result from this project*

Consortium partner	Investments[1] (€ X 1000)	Markting[2] (€ x 1000)	Total (€ x 1000)	Return on investments (yr)
FutureWater	105	25	130	2.6
IVM	55	20	75	3.2
Hunze en Aa's	10	0	10	10.0

[1] *Project costs*

[2] *Additional costs by consortium partners to commercialize the product and services (not included in the Partners for Water budget).*

These analyses are based on the following assumptions:

- Profits on turnover are partner specific. For the commercial partner (FutureWater) this percentage is relatively high as the difference between commercial daily rates and actual salary costs is substantial. For Waterboard Hunze en Aa’s this percentage is low reflecting the public-entity of the organization.
- Five years after completion of the project turnover growth will be stabilized.
- Growth in turnover is only related to projects abroad. However additional, spin-off in the Netherlands is expected as well, but not included in the figures.

- The expected growth in turnover will be realized by the following requesters:
  - FutureWater
    - World Bank projects
    - International organizations
    - National governments
    - EU Research projects
    - Services to large consultancies
    - Asian and African Development Bank
  - Institute for Environment Studies (IVM)
    - EU Research projects
    - NGO’s
    - National governments
    - Curriculum, foreign students
  - Hunze en Aa’s
    - Foreign policy Unie van Waterschappen

Budget

The budget can be seen in Appendix 2. Some additional clarification is provided here:

- About 30% of the total budget will be spent on personnel costs in The Netherlands. This time will be mainly used to develop and build the IWMSM. These activities are undertaken in Netherlands where access to data, computers, internet and literature is better than in the pilot areas.
- Input from the two pilot areas is essential to: (i) gather data required to build the two IWMSM, and (ii) ensure proper marketing and business opportunities contacts. Therefore is about 16% of the budget allocated to local partners.
- Of the total 290 project days more than 70% is spent abroad.
- To ensure proper outreach, prepare future activities of the consortium and to disseminate project results to potential users 30% of the personnel time is allocated (work package 4).