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WHO Collaborating Centre for Health Promoting
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University of Bonn - IHPH Institute for Hygiene and Public Health

# WATER & RISK

## Dear Reader,

Recently, I read an article on marketing basic water treatment and sanitation systems. The authors had spent a lot of time investigating ways to achieve behaviour change in populations and implementing new technologies successfully. Their argument that you need to give people a choice was striking.

If you come with one type of technology/design, people will look at it, but they lack the opportunity to compare it with different, but similar technology. Giving a community different types of technology will result in discussions and people will think about why they prefer one solution over another. Finally, everyone will choose the technology and design that suits their personality and situation best, resulting in full acceptance. Sometimes they even end up with totally new ideas of what is needed and how it should be designed.

We base our decisions on the information available and the experiences we have gathered in life. The more information we use, the more carefully we usually decide. Encouraging people to think and discuss and providing access to information are key challenges nowadays. Sometimes this means people need to learn how to learn and overcome traditional hierarchical education systems. In other cases, the greatest hindrance is lack of access to information, which is often limited simply by lack of infrastructure, such as internet access.

Are you aware that UN Secretary-General, Ban Ki-moon has called for action to reach the Millennium Development Goals during the fewer than 1,000 days left until 2015? He called on the international community to re-energize efforts from governments to grassroots groups to make a difference. This should encourage us to exchange information on what we do and how we do it, in order to inspire more people to look into the fascinating field of water and risk. Have your say and don't be afraid to re-think and question things. We are more than happy to receive comments on this issue and look forward to your feedback.

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# Participatory implementation of sanitation infrastructure in urban areas of north-central Namibia

## Introduction

Growing demand of water and sanitation provision is a characteristic of many fast urbanising settlements all around the world. In this paper a transdisciplinary planning and implementation method is presented, which includes scientific and practical knowledge. It focuses on overcoming typical tech-nology driven perspectives, which make it difficult for prospective users to adopt new technologies in their daily lives.

Climate change, population growth and urban development are building pressure on the limited water resources in the Cuvelai-Etosha catchment area (cf. Fig. 1). This relatively small region in the central northern part of Namibia (Kluge et al. 2008) constitutes just 15% of the area and yet is al-ready home to 42% of the population.

Around 40 % of the population in Namibia's urban spaces have no access to improved sanitation facilities (MAWF 2009). It is however fair to assume that the situation in informal settlements is far more drastic. There is an acute need for action to improve the sanitary conditions. The Namibian Sanitation Strategy drawn up in 2009 aims to create awareness of sanitary infrastructure as a public commodity incorporating the aspects 'health promotion', 'environmental protection' and 'energy efficiency' (biogas), along with 'food production' (water re-use) (ibid).

The rapid growth characterising many towns in the Global South should not be underestimated, even in a sparsely populated country such as Namibia. Outapi, a town in central northern Namibia, lies roughly 70 kilometres from the Angolan border and has 4,600 inhabitants (2010). However, according to the mayor of Outapi, the population is currently doubling in number roughly every 3 years.

The water supply and wastewater treatment systems of the future must be open to any transformations in urban development impacting on the quality and spatial distribution of demand. The socio-economic and socio-cultural dimensions of water usage likewise play a crucial role. The urbanisation of northern Namibia exemplifies not only developments in Sub-Saharan Africa but also urban development in arid regions throughout the world. The following section details the underlying circumstances.

The informal settlements in Outapi are at different stages in their development. For this reason, any sanitation concept needs to work within the triangle of affordability for users, the technical and spatial feasibility of a system in transition, and requirements of future users in terms of privacy and comfort. An analysis of the building structures delivered the following categories (Deffner and Mazambani 2010). There are older informal structures with a heterogeneous composition (concrete buildings, shacks, random layout, public stand pipes and few latrines), new informal structures consisting of only corrugated iron huts with straight building lines (public stand pipes, few public and private latrines) and pre-formalised, self-administered settlements (standardised brick houses, no water/wastewater infrastructure. The three settlement types (cf. Fig. 2) characterise the transformation stages from corrugated iron hut settlements to consolidated brick houses. The result of this categorisation shows that a static overall wastewater plan would fail to take sufficiently into account the specific preconditions.

## The CuveWaters project

The CuveWaters sub-project on sanitation and water reuse is implemented by the Institute for Social-Ecoogical Research ISOE and Technische Universität Darmstadt IWAR in collaboration with the local Town Council (OTC) and Roediger Vacuum as the German industrial partner. It involves putting in place different sanitation-enhancing processes and academic monitoring and evaluation. The idea of participation plays a particularly important role as the project team is only too aware of the socio-cultural challenges that can arise with the introduction of such technically advanced solutions. For this reason, the aspect of behaviour change is tackled by means of a comprehensive, community-based approach (Waterkeyn et al. 2010; Deffner and Böff 2012). The IWRM project is furthermore embedded in existing political and administrative processes.

## Methodological approach and empirical steps

Differing design requirements for new sanitation infrastructure were drawn up with the Town Council and inhabitants of three informal settlements (Deffner/Mazambani 2008). The year 2008 saw the start of preparatory project planning along with a socio-scientific baseline study on the sanitary conditions within informal settlements. The interdisciplinary research team created its own methodology for the latter.

At the planning stage, the demand responsive approach involved various steps of empirical situation analysis (2008–2009). The method mix comprised of empirical social research and different forms of interaction within district workshops is based on the experiences of the research partners. The first workshops in all three districts

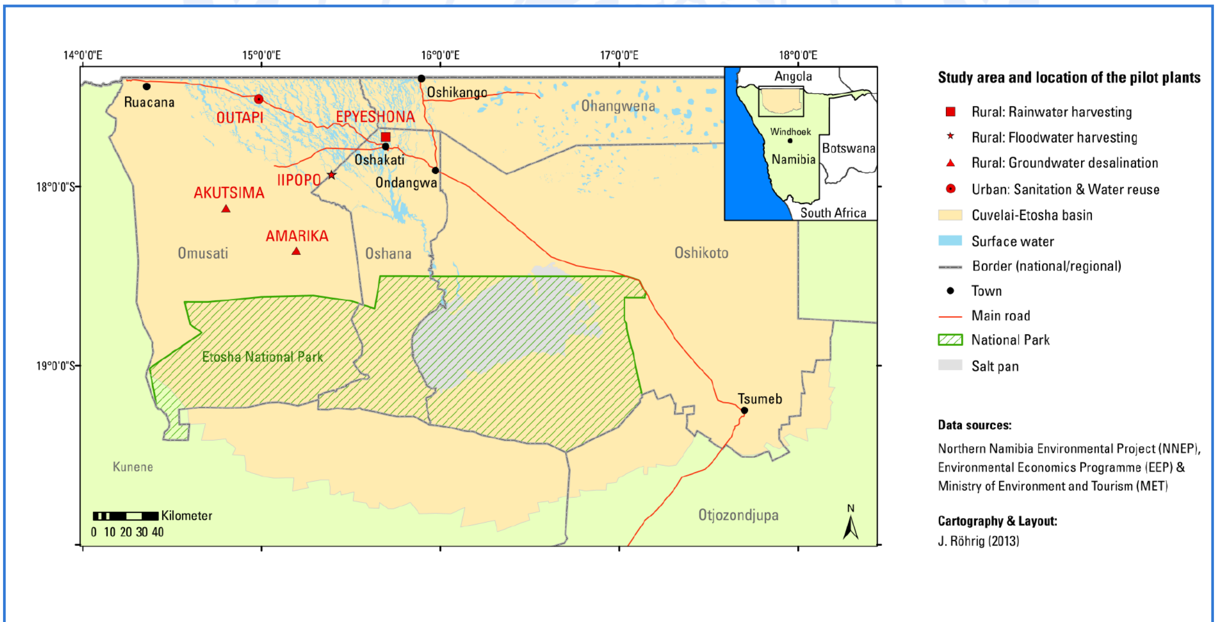



*Figure 1: Project area*
*Source: Julia Röhrig 2013*

tions to allow infrastructure to adapt to urban transformations and to improve basic sanitation conditions in general. The options to be considered are sanitary installations in private houses (individual solution), sanitary facilities for small neighbourhoods in informal settlements (cluster solution), and the concept of a communal sanitation house in a densely populated informal settlement (community solution). A re-use concept of sewage comprises the treatment and preservation of plant nutrients for agricultural use along with production of the energy required to operate the facilities. The construction and operation of the pilot installations are accompanied by participatory pro- made it possible to analyse and understand the socio-technical system of water supply and sanitary conditions. They also allowed insights into people's perception of their living conditions, daily behavioural patterns and the socio-economic situation.

The surveys emphasized the significance of co-operation and communication between users and the local service providers – there is considerable potential here, above all when it comes to improving maintenance and emergency management.

The method served to involve the residents in such a way that they can develop targets to improve their living

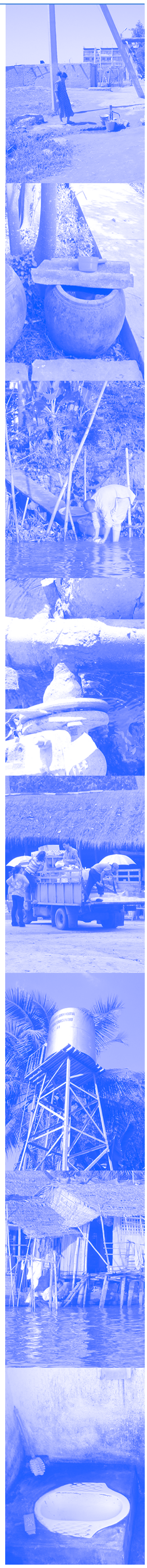



*Figure 2: Impressions from the settlements*
*Source: Jutta Deffner*

conditions. It was also a means of presenting to them the new technical options and allowing them to give direct feedback on the options. In this step, the use of visualisations (posters, architectural models, see figure 3) played an important role. Furthermore, special preparation of technical data by the engineering partner was crucial to the residents' workshops in terms of rendering the facts comprehensible for laypersons (2010–2011). Since 2008, four series of local participation workshops have been carried out with residents. Between 20 and 60 people took part depending on the size of the district. On-going discussions and workshops are taking place to involve the Town Council and other local stakeholders.

At the construction stage of sewages system, treatment plant and sanitation facilities (underway since the end of 2012), the demand responsive approach has involved preparing for operation (organisation, capacity development, monitoring). The project partners are carrying the participatory procedure further with a view to providing appropriate training for the users: an approach of community-based learning to health-related behaviour was adapted and applied before the facilities were opened. The adaptation of the Community Health Club approach was developed together with an NGO and local partners to meet the project and the community needs.

## Iterative planning and implementation

Taking the situation analysis as a starting point, a modular sanitation concept for a decentralised wastewater system was drawn up: the establishment of individual domestic connections and the building of community washhouses. The technical concept was adapted step-by-step to meet actual neighbourhood requirements. Only then did detailed planning commence. In the three pilot settlements, the design of the concept from a user's perspective was discussed during the neighbourhood workshops.

Besides the framing of tangible proposals for a practicable construction, three other aspects of the design process deserve special emphasis here: Paying for water and wastewater services represents a big challenge for many residents. It is thus vital to take account of their willingness (based on understanding) and ability to pay. It is, for instance, important to create awareness that water services, although linked to costs, nonetheless bring advantages capable of redeeming these costs in the long term through improved living conditions. Pricing thus takes on an important role since it is able to steer demand for sanitary infrastructures. The concept foresees a drop in the normal price for water services as well as the cross-financing of toilet utilisation via the utilisation of showers and washing facilities. The second big challenge becomes apparent in the context of user safety and preservation of the private sphere. Women using community facilities but needing to leave the house to do so may feel at risk and thus be prone to exclusion. This is especially relevant in the night hours, which is why personal safety considerations must drive the process of adaptation. The technical and operative implications of the new installations were discussed with stakeholders at various levels and resulted in sanitation modules adapted to the building structure of the informal settlements. This joint design process is at the root of further proceedings, thus reflecting the signif-icance of user friendliness and user safety. As already menti-

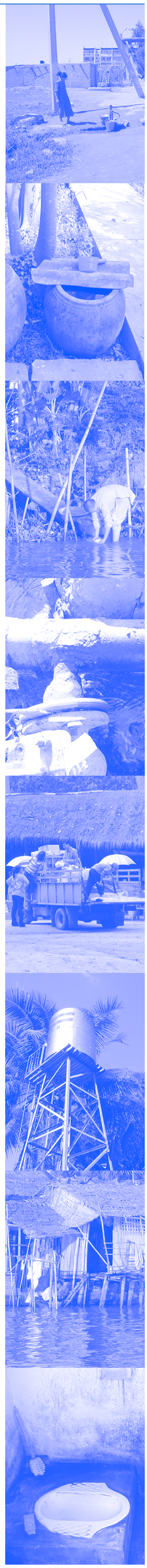


*Figure 3: Architectural model*
*Source: Jutta Deffner*

oned, design proposals were discussed and redefined with the residents and the Town Council:

There are plans for a community washhouse for around 250 users to be erected between an old and a rather newly founded settlement of corrugated iron huts completely lacking any kind of water infrastructure. Based on the residents' ability to pay and also the structure of the settlements, this consti-tutes the most promising upgrade solution.

The medium aged neighbourhood with its provisional streets and building lines will see the construction of small washhouses, so-called clusters. Each will be jointly used and managed by a set of four households. They offer greater comfort and a better protected private sphere than the community washhouse. In addition they promote privatised ownership and encourage the families using them to take on responsibility for the infrastructure.

The 'pre-formalised' area with its existing layout plan is able to accommodate individual connections to a water and wastewater network. While maximising the private sphere this also calls for sufficient resources to install and maintain private sanitary equipment. There is strong willingness among the residents to bear these costs.

## Technology is not all: Enhancing capacities

Taking western planning approaches as a starting point, the challenge here is to establish sustainable use of water and access to sanitation systems. This includes the provision of equipment (technology), construction materials, and financial resources, and canvassing to increase awareness of the need for suitable sanitary installations.

However, the task of improving hygiene and sanitation also brings up an entirely different challenge: far more important than logistical and infrastructural support is taking into account the social-psychological patterns of behaviour. Given this background, Waterkeyn et al. (2009) argue that the success depends in principle on being able to mobilise and involve the communities and settlements affected. In their view, very few approaches in recent decades have managed to mobilise residents into changing their hygiene habits of their own accord. Instead, it is fair to say that top-down initiatives to introduce water and sanitation installations serve to divide community residents as they compete for limited financial resources.

> "Health and hygiene promotion is therefore an ideal entry point with which to mobilise a village to not only to participate in this challenge, but to lead their own process of development and contribute through self-supply, particularly of safe sanitation, safe water and improve hygiene, food security as well as ultimately poverty reduction through income generating initiatives." (Waterkeyn et al. 2010: 2)

From the beginning in 2008 the project CuveWaters included the communities in all planning steps. Now special attention is paid to altering hygiene behaviour. To achieve this, a community-based approach is continued in the setting up of so called Community Health Clubs

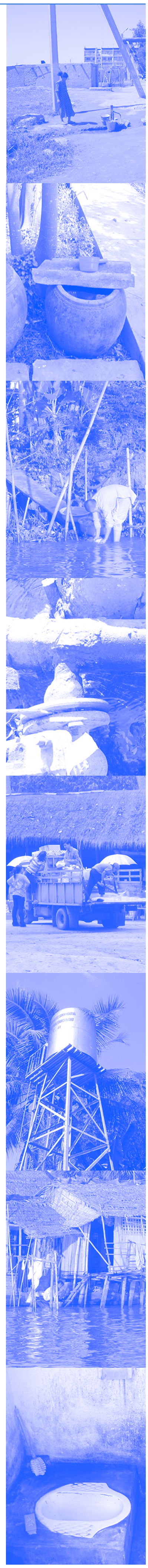


*Figure 4: Community Washhouse*
*Source: Jutta Deffner*

(Waterkeyn 2010; Deffner and Böff 2012). The main aims were:

- long lasting change of hygiene behaviour, esp. to reduce health risks
- establish a routine and demand of using toilets, showers and washing basins
- communicate benefits of sanitation facilities to embed them in everyday life
- communicate adequate use of new facilities

This approach was developed in the early 2000s by an African NGO called AfricaAHEAD and is based on scientific understanding of behavioural change and social learning. It aims to change norms and values in health and hygiene behaviour of member households. The residents need to be able to see, feel and understand the difference that improved sanitary conditions can make. This calls for a fast social and cultural learning process. By way of comparison: in Europe, the devel-opment from open urination and defecation to water closets and sewage systems took several hundred years as opposed to just a few years here.

The first step to this was a six-month community-based and discursive learning scheme in the Com-munity Health Clubs to impart proper use in terms of knowledge and everyday practices. Starting with issues such as avoidable diseases, cooking, household and personal hygiene, it went on to teach the correct use and maintenance of the new sanitary installations and provide support for the transfer of ownership. The facilitators of the Health Clubs were trained beforehand by AfricaAHEAD and were recruited from the communities and a nearby vocational training centre with a class of community development.

The element of the 'health session' included in the Community Health Club approach is ideal for introducing new topics to the inhabitants of the settlements in Outapi. For example, it was used to impart the use and care of the new sanitation infrastructure and washhouses, or the self-organisation strategies for the community. The 'homework' element was suitable, especially for conveying proper use of the sanitation facilities installed for the households or to try out new practices in the household.

Therefore the Community Health Clubs are a very important part of the implementation. Only both components can make the project successful: the software side (behaviour & use) and the hardware side (technology).

## Further aspects of capacity development

Operation and financial responsibility of the infrastructure (wastewater treatment, community washhouse and cluster washhouses) will be taken over from the project by the Town Council during 2013. It will be possible to finance the costs for repairs and maintenance from the charges. However, it is absolutely vital to build capacity in this phase in order to safeguard not only the operation but also proper use of all the technical installations. Here again the demand responsive approach impacts on the realisation of the concept:

- A participatory approach to create a management and pricing concept: parallel to the building measures the Town Council together with the project team drafted a pricing system and worked out the details of management.
- Capacity development for operation: this includes the training of water/wastewater technicians to maintain the plant in a nationwide course and the provision of experts to oversee the start-up phase.
- In the first two years, operation and use of the installations will be subject to technical and socio-cultural monitoring. The findings from this will help in optimising the socio-technical system.

*Figure: 5: Health Club session*
*Source: Patrick Rickert*

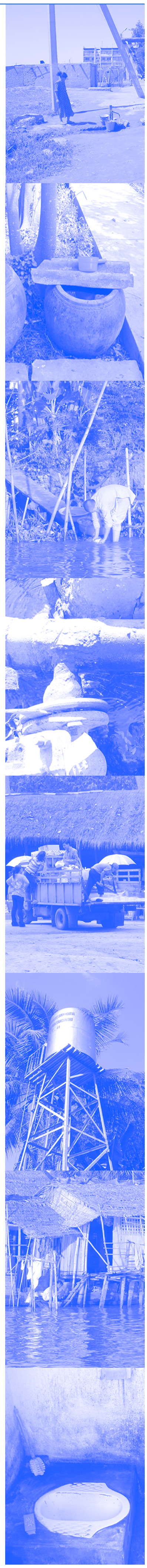
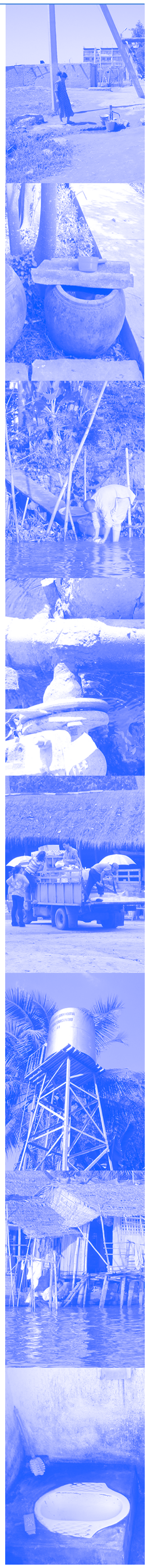


*Figure 6: Opening day at the community washhouse*
*Source: Jutta Deffner*



## Conclusion and prospects

Many sanitation projects fail because they only involve residents ex post in measures to boost acceptance and provide user training. It therefore follows that a combined explorative and participatory approach prior to technical implementation can create improvements. The demand responsive approach presented here follows this path. Residents and local stakeholders are actively included right from the planning stage as the only way to ensure informed decisions on their part.

The success of the project in the long term, is not yet granted. After the first months of the operation of the most crucial facility – namely the community washhouse – the feedback from residents and the responsibility and willingness of the Town Council to deal with problems arising has so far been positive. Working against a constantly changing backdrop requires the understanding of those involved, which is only possible if an appropriate basis has already been created prior to difficult implementation situations.

## Acknowledgements

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# Safe future use of the river Ruhr
# The Project „Sichere Ruhr“

## Introduction

The river Ruhr gives its name, ‘Ruhrgebiet’ to a German region in North Rhine Westphalia, one of the biggest metropolitan areas in Europe. Used for centuries for transportation, sewage and mining water disposal and as a drinking water source, the river has had an eventful history. Today the Ruhr secures the drinking water supply for nearly 5 million inhabitants of the metropolitan region. The river water is used for artificial groundwater recharge in combination with filtration-flucculation-adsorption-oxidation treatment steps, applying the so-called “Mülheimer Verfahren”. Furthermore, hydroelectric power is generated by the Ruhr and it is used as a recreational area by local residents and tourists.

Within the German BMBF (Bundesministeriums für Bildung und Forschung - Ministry of Education and Research) RiSKWa research program (Risikomanagement von neuen Schadstoffen und Krankheitserregern im Wasserkreislauf - Risk management of new pollutants and pathogens in the water cycle) the “Sichere Ruhr” collaborative research project aims to explore conditions for the safe future use of the river Ruhr as recreational water and as an improved drinking water source. Optimization of the waste water and stormwater treatment, reduction of the microbial burden caused by combined sewer overflows and bathing water safety are subjects contained in the research plan.

A multidisciplinary, holistic approach was chosen to give the research a broader perspective. By the end of 2014 a research consortium of ten partners covering the required expertise in the fields of (micro-)biology, sociology, communication science, geography, engineering science, chemistry, psychology and medicine will try to answer two main questions:

1) Can particular sections of the river be used microbiologically and hygienically safely as recreational (bathing) water?

2) Which options are available to further optimize drinking water treatment?

The project is structured into eight work packages covering hazard and risk assessment, risk perception and communication, participation, discharge reduction, an early warning system and an implementation concept for risk management. For hazard assessment, several bacteria, viruses and parasites (see Table 1), as well as relevant accompanying physical and chemical parameters are measured and analyzed in a subsequent risk assessment process. Risk assessment also covers risk communication, risk perception and public participation with regard to recreational and drinking water.

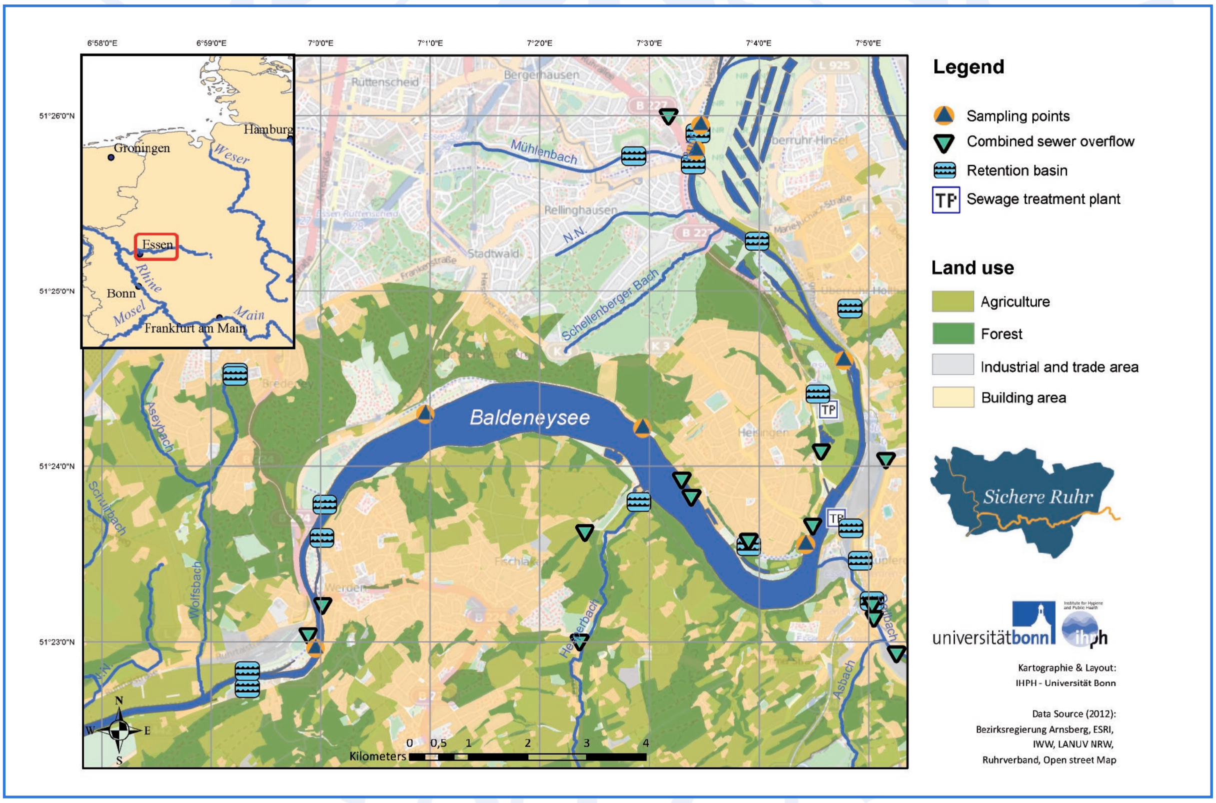
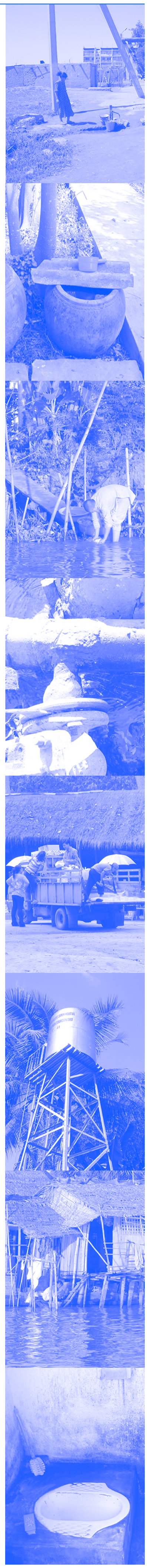



*Figure 1: Study area „Essen – Baldeneysee“ with sampling points*
*Source: IHPH*

The study area is a section of the river Ruhr with a range of 52 km beginning at the lower end of the “Kemnader See” down to the water treatment plant at Mülheim Styrum East and encompassing the cities of Bochum, Essen and Mülheim, with a focal point at the ‘Baldeney See’ near Essen, a popular lake used for bathing and other recreational activities (see figure 1).



| Bacteria | Bacteria (cont.) | Viruses | Parasites |
|---|---|---|---|
| E. coli | Campylobacter spp. | Adenovirus spp. | Giardia lamblia |
| Intestinal enterococci | Salmonella spp. | Polyomavirus spp. | Cryptosporidium parvum |
| Coliform bacteria | Leptospira spp. | Enterovirus spp. | Trichobilharzia spp. |
| Clostridium perfringens | Aeromonas spp. | Rotavirus spp. | |
| Pseudomonas aeruginosa | | Norovirus spp. | |
| | | Coliphages | |

*Table 1: List of pathogens investigated in this study.*

## Hazard assessment

Initially intensive, structured collaborative literature research was carried out covering literature relating to the relevant pathogens over the last ten years. To identify the risk regulation process for recreational water in Germany, 12 qualitative interviews were conducted with experts and participants in this process, representing federal and national ministries, NGO's and economical associations.

To evaluate the current pathogen load, a total of 184 water samples taken at 23 sampling dates at eight sampling sites along the river Ruhr (see figure1) and these were analyzed for a defined set of pathogens. Additionally, each treatment step undertaken in a water treatment plant (Mülheim Styrum East) was analyzed for the same set of pathogens. The information compiled was used during the following risk assessment steps.

## Risk assessment

The European bathing water directive requires the measurement of the E. coli and intestinal enterococci indicator pathogens. Emphasis is put on so-called 'bathing water profiles' (European Union, 2006). Their purpose is to provide a description and risk-based assessment of the bathing water sites, incorporating rain and sewage discharges, catchment area, surrounding land use and anticipated, short term pollution which could have an impact on the use of the sites as recreational water.

Within the Sichere Ruhr project not only indicator organisms, but also the mentioned pathogens are considered. Additionally, point sources of wastewater discharge in the catchment area are documented, mapped and assessed. There is also analysis of diffuse pollution from agricultural areas, which is analyzed by the investigation of land use data with the help of a geographic information system (GIS).

The hazard impact on bathers will be analyzed by an exposure assessment and risk characterization. The risk concept is based on the risk definition in the WHO Guidelines for recreational water (2003), where a differentiation between hazard as *"a set of circumstances that could lead to harm"* and risk as the *"probability that such an event will occur as a result of the exposure"* is made.

Referring to the literature search, the pathogenic potential is assessed with regard to ingestion and dose-response relationships. The exposure resulting from a bathing event is also assessed through the literature reviewed. Subsequently, a quantitative microbial risk assessment (QMRA) based on the water sampling results will be conducted. To describe and communicate the impact of an infection, Disability-Adjusted Life Years (DALYs), known from the WHO/Worldbank Global Burden of Disease (GBD) Project (Murray et al. 1996), are calculated on the basis of the QMRA results, to classify and compare possible harm from an exposure to pathogens through bathing.

*Figure 2: pilot Ozonization plant*
*Source: S. Roder (RWTH Aachen University)*

## Technical Measures

In Germany wastewater discharge does not generally undergo a final disinfection process. To evaluate the impact of an improvement in the water quality at point source discharges, two wastewater treatment plants and a stormwater overflow basin are equipped with pilot ozonation and UV disinfection systems (see figure 2).

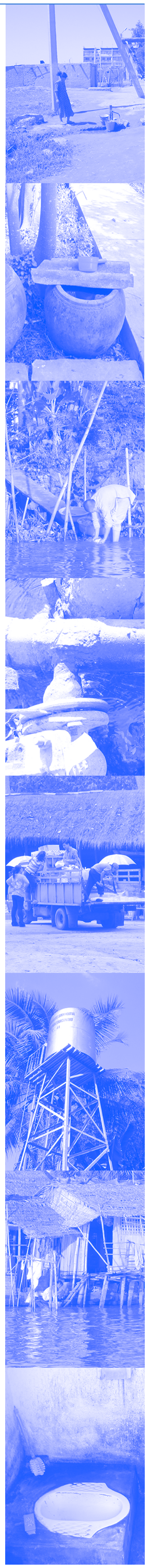


*Figure 3: Scenario Workshop*
*Source: Sichere Ruhr*

The data collected, combined with precipitation and discharge data, are analyzed using statistical methods and neuronal networks, to predict hazardous pathogen concentrations (determined in the risk assessment step) by means of fast and easy to measure indicators. In addition, the results of pilot testing equipment for an autonomous online measurement of indicator organisms are validated by microbiological analysis.

Prediction of pathogen concentrations and online sampling results will lead to the establishment of an early warning system which could initiate a temporarily bathing ban in the case of contamination.

## Risk Perception and Risk Communication

In parallel to the natural scientific research focused on water and pathogens, psychologists analyzed public risk perception concerning bathing and drinking water associated health risks using the results of a telephone survey (N = 1355). This was accomplished by a discourse analysis of results from similar projects for the Isar (Munich) and Spree (Berlin) rivers. The results of the psychological research contribute to the risk communication efforts to create an information channel communicating research results to the affected population and vice versa.

The current progress can be viewed at: http://www.sichere-ruhr.de

## Implementation

Finally, realization and financing concepts for sustainable safe bathing and a secure drinking water supply will be developed with the help of further surveys and workshops (see figure 3) in close cooperation with stakeholders and shareholders including the regional population. Potential bathing scenarios and their economic cost will be discussed in such workshops. Task catalogues for the practical implementation of these scenarios could be used as basis for future decisions by the responsible stakeholders.

The long-term objective of the project is a comprehensive concept and recommendation guideline for the possible use of the river Ruhr, and in particular the "Baldeneysee", as recreational water. Working in close cooperation with the Essen city authorities is paramount. The aim is to transfer the results of the project to the entire river and other rivers in Europe.

**The Project partners are:**

- Aquatune
- IWW Water Centre
- The Institute for Technology Assessment and Systems Analysis (ITAS)
- Ruhrverband
- Ruhr-Universität Bochum, Hygiene, Social and Environmental Medicine
- RWTH Aachen University, Chair and Institute of Environmental Engineering
- Rheinisch-Westfälische Wasserwerksgesellschaft mbH
- Universität Bonn, Institute for Hygiene and Public Health, WHO Collaborating Centre for Health Promoting Water Management and Risk Communication
- Universität Duisburg-Essen Aquatic Ecology, Biofilm-Centre, Institut für Soziologie, Institute for Communication Science
- Xylem Water Solutions Herford GmbH

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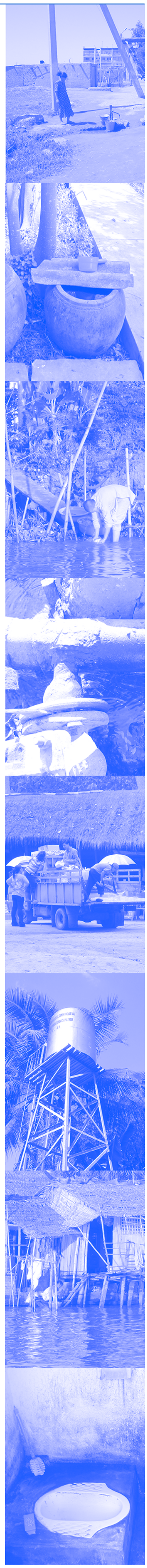
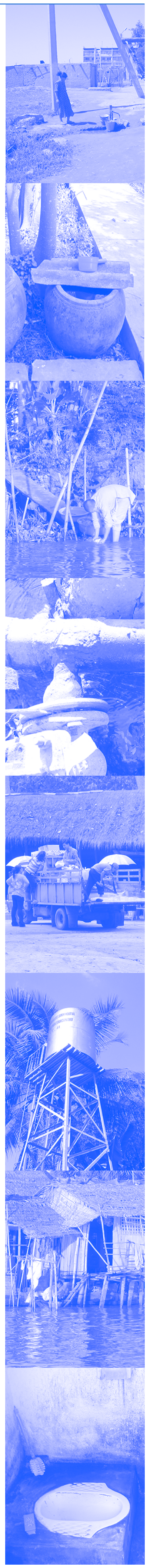
**Project homepage:**
**http:**//www.sichere-ruhr.de





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## Productive treatment of faecal sludge: from waste to fodder and profits

The National Centres of Competence in Research (NCCR) are a research instrument of the Swiss National Science Foundation (SNSF). They aim to promote innovative approaches to scientific research in areas of particular importance to Switzerland. Central to all NCCR North-South activities is a commitment to partnership between institutions and individuals in the northern and southern hemispheres. The NCCR North-South undertakes research in the fields of global change and sustainable development. It is dedicated to finding sustainable, practical solutions to the specific challenges of global change. Research supported by the NCCR North-South program has developed promising technologies for faecal sludge treatment to reduce public health risks. An overview of recent developments is presented in the West Africa Regional Policy Brief No. 2, which is summarized below.

In developing countries, lack of low cost, efficient treatment technologies commonly results in faecal sludge from domestic on-site sanitation systems (e.g. latrines) being dumped untreated onto the land or into drains and watercourses. This puts public health at risk and contaminates the environment. Sludge drying beds planted with reeds are a cost-effective and technically feasible approach for treating sludge. The plants can be used as fodder for livestock and the bio-solids can be applied as compost to cropland, thereby increasing agricultural productivity.

Globally, 2.5 billion people lack access to improved sanitation, including 1.2 billion who have no facilities at all. There is a need to greatly accelerate progress in improving sanitation, particularly in sub-Saharan Africa and southern Asia. Poor sanitation increases disease incidence and consequent loss of earnings and dignity, both important factors contributing to poverty. Discharge of untreated faecal sludge directly into the environment results in in major health impacts. One gram of fresh faeces from an infected person can contain around ten million viruses, up to a billion bacteria, and 100,000 worm eggs (Feachem et al. 1983). Improved sanitation alone can reduce rates of diarrhoeal diseases by 32%–37% (Mara et al. 2010).

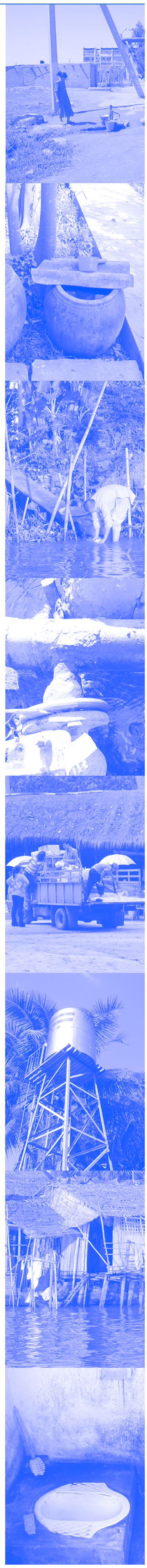
Planted sludge drying beds (PSDBs) are a viable way to treat faecal sludge in developing countries. The system effectively separates solids and liquids in faecal sludge and can handle larger amounts of solids than systems such as activated sludge or waste stabilization ponds. They retain 90–96% of solids and eliminate 78–99% of chemical and organic pollutants. The system efficiently removes faecal parasites, trapping almost 100% of helminth eggs at the surface of the filtering matrix (Koottatep et al 2005). The sludge may need to be stored for at least six months or composted to eliminate pathogens and make it safe to handle.

*Figure 1: Pilot scale faecal sludge planted drying beds*
*Source: Linda Strande, Sandec*

A wide range of emergent plant species can grow in the watery, muddy, and anaerobic conditions of PSDBs. The most important role of these plants is in stabilising

*Figure 1:Dewatered faecal sludge*
*Source: IHPH*

*Figure 2: Constructed wetland*
*Source: IHPH*



the soil surface to avoid the formation of erosion channels. The plants chosen should be readily available, grow and multiply well, have high transpiration capacity, tolerate different water levels, pH and salinity, have a deep growing rhizome and root system, resist insect attacks, and be easy to plant. Plants grown on the dewatering beds can be fed to livestock. The bio-solids can be composted with plant material and used as fertilizer in agriculture and aquaculture.

The size of the PSDB should be based on the quality and amount of sludge to be treated and take into account climatic factors that affect the dewatering rates. Low solid loading rates (SLRs) of 30–80 kg total solids/m$^2$ per year have been suggested for the treatment of activated and digested sludge in Europe, but PSDBs in warm, tropical regions can be loaded at much higher rates (100–250 kg total solids/m$^2$ per year) (Koottatep et al 2005, Kengne et al 2008).

Despite the advances of PSDBs in the reduction of threats posed by the discharge of untreated faecal sludge into the environment, more data are needed to better design low-cost, efficient treatment technologies These include: the identification of suitable plants that are resistant to insect pests and tolerant of salinity and other abiotic stresses; the treatment of effluent; the safety of the by-products of the treatment plant as well as their marketing; the performance of the system when operated at large scale; and a cost-benefit analysis of the system. The authors of the policy brief encourage governments and donor agencies to promote research aimed at optimising existing technology as well as implementing successful approaches.

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**West Africa Regional Policy Brief No. 2**
http://www.nccr-north-south.unibe.ch/publications/Infosystem/On-line%20Dokumente/Upload/Regional_Policy_Brief_02_WAF_Sanitation_Technology_PSDB.pdf

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# Events on Water, Health and Risk Communication

## August

**10th IWA Specialist Group Conference on Ponds Technology: Advances and Innovations in Pond Treatment Technology**
19-22 August
Cartagena, Colombia
http://www.iwawsp-2013.com/

**1st International Conference on TERRA PRETA SANITATION**
29-30 August
Hamburg, Germany
http://www.terra-preta-sanitation.net/

## September

**World Water Week 2013**
1-6 September
Stockholm, Sweden
http://www.siwi.org/

**Water and Society 2013**
4-6 September
Southampton, UK
http://www.wessex.ac.uk/

**17th International Symposium on Health-Related Water Microbiology**
15-20 September
Florianópolis (Floripa), Brazil
http://www.hrwm2013.org/

**WATERTECH INDIA**
26-28 September
Ahmedabad, India
http://www.exhiferencemedia.com/

## October

**Budapest Water Summit**
8-11 October
Budapest, Hungary
http://www.budapestwatersummit.hu/

**7th European Waste Water Conference & Exhibition 2013**
14-15 October
Manchester, UK
http://www.aquaenviro.co.uk/

**IWA Development Congress & Exhibition 2013**
14-17 October
Nairobi, Kenya
http://www.iwa2013nairobi.org/

**Water and Health Conference**
14-18 October
Chapel Hill, USA
http://whconference.unc.edu/

**AGUA 2013**
15-19 October
Cali, Colombia
http://www.eventoagua.com/

**Water Reuse: Blue Resource of the Future**
27-31 October
Windhoek, Namibia
http://www.iwareuse2013.com/

## November

**2013 Water Quality Technology Conference and Exposition**
3-7 November
Long Beach, USA
http://www.awwa.org/conferences-education/conferences/water-quality-technology.aspx/

**International Water Week Amsterdam 2013**
4-8 November
Amsterdam, The Netherlands
http://www.internationalwaterweek.com/

**SACOSAN-V - South Asian Conference on Sanitation**
11-13 November
Kathmandu, Nepal
http://www.sacosanv.gov.np/

**Small and Decentralized Water and Wastewater System Combined with Sludge Management**
28-30 November
Harbin, China
http://www.iwasmallwater2013.org.cn/

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