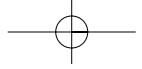


Ideas for Local Action in Water Management

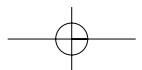
Many high-profile events have raised awareness on the need for better water management, but what we urgently need now is more action on the ground if we are to achieve water security through integrated water resources management. Of course, many actions have already been initiated and these are beginning to change the way we think about, manage and use water. But more needs to be done. The local actions documented in this volume provide readers with over 100 examples of what is being done in different parts of the world. This book, which brings together information on activities undertaken by local government, civil society and the private sector and by those that facilitate local water management, is designed to spread these ideas to others – on initiating local water resources planning, water saving, safeguarding water quality locally, clean-up programs, promoting transparency and turning organizations into water managers. This book follows on from 'Ideas for Water Awareness Campaigns', an earlier book prepared by the Global Water Partnership.



Ideas for local action in water management



Marten van Ittersum & Frank van Steenbergen



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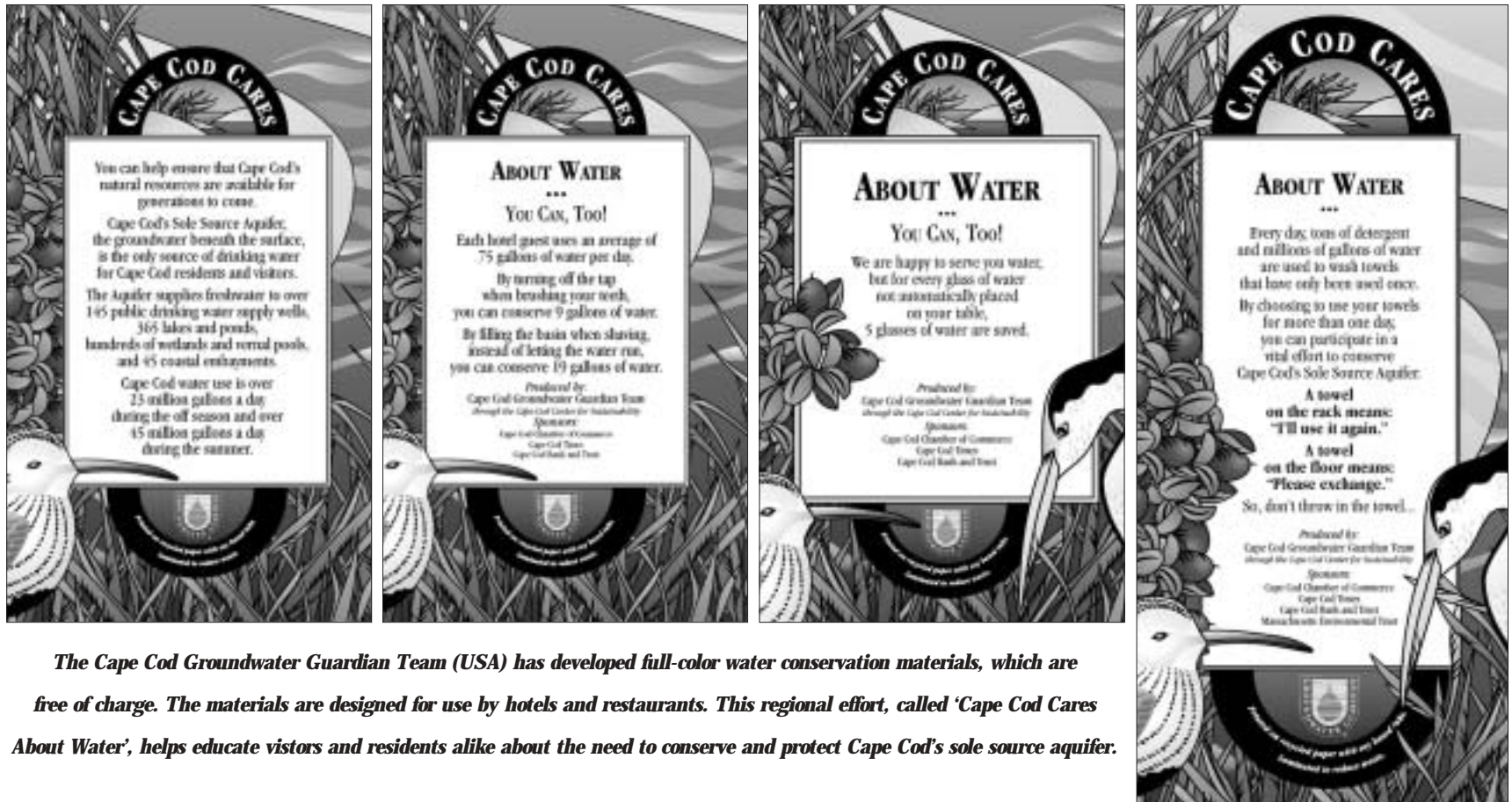
At the time of publication all website url addresses and website contents were checked to ensure and confirm that the content contained on each site was directly related to the topics covered in this publication. The Global Water Partnership does not assume any liability for changes that may occur in the content of these websites. The pictures included in this book are a sample of what is publicly available. They have been included to give a visual impression of the various local initiatives.



The Global Water Partnership (GWP), established in 1996, is an international network open to all organizations involved in water resources management: developed and developing country government institutions, agencies of the United Nations and multilateral development banks, professional associations, research institutions, non-governmental organizations and the private sector. GWP was created to foster Integrated Water Resources Management (IWRM), which aims to ensure the coordinated development and management of water land and related resources by maximizing economic and social welfare without compromising the sustainability of vital environmental systems. GWP promotes IWRM by creating fora at global, regional and national levels designed to support stakeholders with their practical implementation of IWRM. Internet: www.gwpforum.org, E-mail: gwp@gwpforum.org



Unilever is one of the world's leading suppliers of fast-moving consumer goods. The company has a 'Sustainable Water Initiative', through which it will play its part in the protection of water resources and has kindly supported the publication of this book. Internet: www.unilever.com/enviromentsociety/



The Cape Cod Groundwater Guardian Team (USA) has developed full-color water conservation materials, which are free of charge. The materials are designed for use by hotels and restaurants. This regional effort, called 'Cape Cod Cares About Water', helps educate visitors and residents alike about the need to conserve and protect Cape Cod's sole source aquifer.

Ideas for local action in water management



Roundabout play pump South Africa

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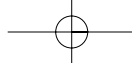
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Chapter

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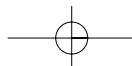
Introduction



Water should be managed at the lowest appropriate level.
Dublin Principles

The need to improve our management of water resources is becoming more and more urgent as the global water crisis affects more and more countries. Water issues have been raised in local fora and global conferences, including the World Summit on Sustainable Development and the G-8 Meetings. Such high-profile events have raised awareness of the need for better water management, but what is needed now is real action on the ground.

Rawa Pening, Indonesia. Devices with floating vegetation to attract fish and boost production on this artificial lake



AIM OF THIS BOOK

Many local initiatives have been started, and these are beginning to change the way we think about and use water. However, these ideas need to spread. This is the objective of this book, which brings together information on local action in water management, including activities undertaken by local government, civil society and the private sector and by those that facilitate local water management. The focus on local action is important, even for large international organizations such as the Global Water Partnership (GWP). GWP promotes local action through the development of water partnerships at area, country and regional level. The water partnerships form platforms for dialogue between many different stakeholders. They aim to be open and inclusive and to address local water issues at sub-basin or country level. Water partnerships try to bridge the gap between stakeholder groups and to create synergies that will lead to long-term solutions.

The examples of local action presented here have been drawn from a variety of organizations and many different places. They should provide a useful resource for:

- professionals in the water sector, at both a centralized and a decentralized level;
- local government groups interested in what is going on elsewhere;
- civil society groups trying to find ways to improve their reach and incorporate new ideas;
- policy-makers who want to strengthen the local dimension of water management;
- water partnerships such as those established within GWP, providing help to formulate their programs;
- anyone interested in what local action can do and what support organizations are available.

WHY EMPHASIZE LOCAL ACTION IN WATER MANAGEMENT?

There are several reasons why systematic emphasis on local action in water management is needed:

Responsibility center-stage

Recent years have seen considerable debate on what should be done to avert the

water crisis, highlighting the need for improved water governance, water reallocation, new financing mechanisms and better water wisdom. But what does improved water management mean in terms of local action? What can we, and the organizations or networks to which we belong, do? This book aims to explore opportunities at this level.

The subsidiarity principle in practice

The subsidiarity principle says that water should be managed at the lowest appropriate level. Yet, in spite of the subsidiarity principle, local water management is often the blind spot in overall water management plans. Local organizations are seldom involved enough and there is a need to activate many more players. Local government, local civil society and the local private sector all have important, and often unique, roles to play in water management, and need to be encouraged to participate.

Micro-environments observed

Robert Chambers (1990) has reported that microenvironments are often overlooked. This certainly applies in water management. The interaction between different land and water users at the local level is not the same as that occurring at the national or the regional level. Priorities vary and it is not correct to assume that issues and agendas are similar at different geographical scales and at different political levels. Local issues are often particular to the local scale and are not necessarily covered by policies coming from the top. However, there are thousands of microenvironments with common local issues, creating a need to scale some of these local issues up to higher policy levels.

Effective enforcement

Water management plans and regulations can only be enforced locally. Water quality provides a good example: although legislation and effluent standards exist in many places, experience shows that regulations are often ineffective. But regulations are enforced where local pressure is exerted by those directly affected and where local government assumes responsibility. This makes all the difference between water regulation on paper and water management in practice.

Testing grounds

Local action and local water management experiences provide opportunities to learn from reality and to find out what does and does not work in practice. This experience can then be used to create models that have the potential to be applied in a much wider context.

Examining water management issues at a 'real life' level helps to clarify the relationships between different players and the most urgent issues will often be quite obvious and tangible. Bringing these different players together and finding a balance between economic, social and environmental objectives is at the core of the concept of integrated water resource management (IWRM). Progress towards more integrated use of water resources can be enhanced by the presence of enlightened local leaders and/or effective local partnerships representing different interests. These occur often in the examples selected for this book. The principle of 'distributed governance' (Rogers and Hall 2002) appears to work particularly well in improving local water management. In distributed governance, water management is not dominated by a single player or by market conditions. Instead, consultations, coalitions and compromises are arranged between different local players, including government,

Integrated Water Resource Management (IWRM)

IWRM is a process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

GWP Technical Committee (2000)

civil society, the private sector and local community groups. The processes of building trust and synergy are just as important as employing the right techniques for water management.

ORGANIZATION OF THE BOOK

This book follows on from 'Ideas for Water Awareness Campaigns', an earlier book prepared by GWP. The step from awareness to local action needs no explanation. As

in the earlier book, particular ideas have been included because we believe they are compelling and worth sharing. Many of the ideas in this book show that local action can make a big difference and can lead to more widespread change.

Figure 1 provides an outline of the book. Chapter 2 sets out the basis for action in local water management and suggests how to initiate local water resource management and build local partnerships. Chapters 3 to 5 present examples of local action, grouped under three action themes: water saving and conservation, improving water quality and, finally, clean-ups.

Chapters 6 to 8 illustrate various supporting actions. Chapter 6 discusses the promotion of transparency in water management, an important issue that is often a precondition for building trust among the different actors. Chapter 7 looks at what organizations can do and how they can become active water managers. Finally, Chapter 8 provides practical examples of support and facilitation of local action. The reference annex provides a reference resource, pointing to institutions that may provide assistance or inspiration to local initiatives.

The ideas presented in this book have been taken from various sources: project documentation, information on the Internet, brochures and personal communications. Additional information was drawn from a survey of GWP members. Special sessions to generate ideas took place during the GWP Consulting Partners meeting in June 2002 and in the Water Dome during the World Summit on Sustainable Development in August 2002. We have tried to stay as close to the original initiatives as possible, however, certain ideas have been simplified and some aspects may be emphasized more than others. Please keep in mind that this book represents the authors' interpretation of the ideas. The fact that an example is mentioned does not imply that the local action was successful – only that the idea is of interest. Please note that ideas and the way they are applied may be very culture and context specific. Critical reflection is required before an idea can be adopted or adapted.

HOW TO USE THIS BOOK

- Don't feel that you have to read everything. The book has been organized in such a way that you can browse through it easily.
- Most chapters consist of an introduction to the topic, followed by ideas drawn from different initiatives. Usually these are arranged under three or four different headings.
- Most ideas are presented with reference to the initiatives from whence they originated, although some ideas are not particular to one specific initiative.
- We have tried to present a wide range of ideas; consequently only a brief description of each is possible. To access further information on any of the ideas, please refer to the reference annex.
- Remember that ideas can be very culture specific. While some ideas may be useful in your country/region, others may need considerable adaptation if they are to satisfy local cultural values and institutions.
- Although we have tried to bring together a large number of practical ideas, this book does not pretend to be a complete report of all local action.
- The reference annex provides a list of many global and regional resource organizations that can be of help to local initiatives. Many national and local sources of support also exist, but it would be impossible to mention all of them.





Chapter

2

Initiating local water resource planning



The main problem with local water resource management is not that it is done wrongly, but that there is not enough of it. Initiating local water resource planning can thus be an effective means of improvement and activating local government institutions is one way to achieve good planning. However, a local water vision or water resource plan can equally well be prepared by private sector organizations, civil society groups or a water service provider. Inclusivity is the key; in other words, all the important players must come on board. This is the essence of integrated water resource management. Effective local water resource planning will bring different parties together onto a common platform, will allow for different perspectives and will help to build commitment. The GWP country and area water partnerships are good examples of such a process.

Identifying problems and possible solutions at a wetlands scoping workshop in Phnom Penh, Cambodia

Strengthening local water resource planning can help to raise the profile of local water issues. Although planning is more often accomplished at the national and regional level, policy-makers often neglect to address local issues because the policies required are different from those needed at the national level.

2.1. CREATING LINKAGES AND ALLIANCES

Rather than defining a technocratic optimum solution, it is more useful to see water resource planning as a process of bringing different players onto a common platform. It is important, therefore, to engage the main players right from the beginning, including parties that are not normally involved in water resource planning, but whose activities have an important bearing on the way water resources are used. At the local level it will usually be easy to identify the relevant actors. An example is the Maha Oya Area Water Partnership (see Box 1), whose members include conventional and non-conventional players.

Use partnership approaches to watershed restoration

United States. The Forest Service of the United States Department of Agriculture (USDA) made a fundamental change in direction in 1999, when it began to stimulate community-based watershed restoration partnerships. A number of projects were selected to become national prototypes for more visionary management of ailing watersheds and ecosystems. Prior to 1999, there was no strong drive to work together. The USDA Forest Service determined what was right for the national forests while other land managers and landowners (both public and private) independently determined what was right for their land. No-one considered the total effects on the river basins; and no attempts were made to forecast catastrophic events. The USDA Forest Service then began to work in partnership with the various landowners within a watershed. By collaborating with other federal and state agencies, local communities, private landowners and organizations, the USDA Forest Service claims that it can now effectively restore large watersheds to a healthy and sustainable condition.

BOX 1: A broad-based partnership

The Maha Oya Water Partnership in Sri Lanka promotes improved management of the Maha Oya Basin. It brings together a broad range of players, both public sector institutes and civil society organizations.

Members include:

- Central Environmental Authority
- Sri Lanka Tourist Board
- National Chamber of Commerce
- National Water Supply and Drainage Board
- Geological Survey and Mine Bureau
- Department of Irrigation
- Municipal Council Negombo
- Water Resources Secretariat
- Provincial Environment Authority
- Divisional Secretaries
- Institute of Participatory Development
- Human Resource Development Foundation
- Wayamba Chamber of Commerce
- Forum for Communities in Sustainable Development
- Shrama Shakthi Foundation
- Community Development Association Galmaduwa
- Human Resource Development Center
- Community Development Center Aranayak
- Participatory Development Center Rabukkana
- Peoples' Development Foundation, Dehiovita
- Buddhist Temple, Yogyiana.

In addition, a number of companies take an active part:

Kabool Lanka
Unilever (Sri Lanka) Limited
Giriulla Mills
Hayley's Group.

Source: GWP Sri Lanka Water Partnership (Lanka Jalani)

Develop broad support from the beginning

Bihar, India. Dinesh Kumar Mishra is a female activist who has helped communities in flood-prone areas of India to document local and decentralized means of coping with floods. The movement was launched through countrywide education programs on traditional flood management systems and is empowering groups to re-establish their cultural ownership over rivers. The program consists of promoting non-confrontational management tools that respect the natural cycle of floods and respond with minimum technological interference. Since 1992, much work has been accomplished in Bihar, India's most flood-prone region. An umbrella network, the Barh Mukti Andolan, now facilitates interaction between 700 rural groups of 'flood historians'. There are also plans to develop a national platform for grassroots flood campaigners, who will maintain histories of their river basins and design region-specific responses to official flood control methods in their own states.

Take time and build capacity

Sao Paulo, Brazil. In 1990, the state of Sao Paulo adopted a law creating River Basin Committees with equal representation of the state, municipalities and civil society. Before this, water management in Sao Paulo was controlled by government agencies and focused on technical solutions, including water transfer. Water users were rarely involved in water management. This approach was not found to be cost-effective or socially acceptable.

The River Basin Committees now provide an open, decentralized, institutional space where all actors can interact and express their concerns. The decision-making process has also become more accessible to members of civil society. However, involving all users in establishing water management systems turned out to be a time-consuming political process. Building trust between stakeholders also took time; in this case it was six or seven years before the reforms were finalized. The lesson here is that building technical capacity must be accompanied by a positive effort to involve civil society if effective public participation is to be achieved.

Engage citizens in a systematic way

Bavaria, Germany. The cities of Schwarzenbach and Oberkotzau are located on the banks of the Saale River. In 1999, both cities decided to install flood protection measures. The State Office for Water Management started a planning process that

included contributions from all local citizens. Because of this very early public involvement, the subsequent legal procedures were implemented in a relatively short time. The initiative was successful because:

- all planning steps were presented in open sessions and discussed in public;
- all important information was distributed by local press and the Internet;
- residents were contacted personally;
- the sites were analyzed together.

Engage industry too

Laguna Lake, Philippines. When the Laguna Lake Development Authority and the San Pedro River Rehabilitation Foundation launched a program to clean up the 21 rivers flowing into the Laguna Lake, they made sure to include all stakeholders. In addition to local government units and residents from local communities, they involved the local manufacturing plants: Kimberly-Clark Philippines and Coca-Cola Philippines. Kimberley Clark in particular responded very well, donating the time of its employees to work alongside volunteer farmers and fishermen to rehabilitate the San Pedro River. The company also invested in a wastewater treatment facility.

Create linkages with research institutes

Malawi. Confronted with very slow adoption of new aquaculture technology, the WorldFish Center (previously known as ICLARM) and the National Agricultural Commission (NAC) invited farmers to field days where they could criticize the technology. Farmers clearly understood the new methods, but felt that many were not directly useful to them. To investigate this further, participatory tools were used to identify farm-level constraints and opportunities. The information collected helped the WorldFish Center and the NAC to develop a range of technologies that integrated aquaculture into existing farming systems rather than attempting to simply replace one enterprise with another.

Use women's associations

India. The Self-employed Women's Association (SEWA) represents a huge group of Indian women. The majority of self-employed women are poor and have a weak position in society, but they make a large contribution to the economy of the country. SEWA manages several programs, including a water campaign, that aim to raise the profile of these women and give them a greater voice. Rural women in particu-



Women participating in a SEWA water project

lar struggle to find adequate drinking water, fuel and fodder, basic commodities that limit their income and affect their well-being and survival. Many SEWA rural members live in areas with little or no rainfall and hence face perennial drought conditions.

Since the start of the water campaign in 1995, several improvements have taken place. Rainwater harvesting tanks have been constructed, women have been trained in hand pump repair, and dialogue has begun with the local authorities to extend piped water systems and to develop plastic-lined ponds and underground water storage tanks.

In eight villages in Banaskantha district, women have formed their own water committees. Through these they have been able to organize water-saving activities such as building contour bunds and check dams and repairing village ponds.

Create links with the national water resource commission

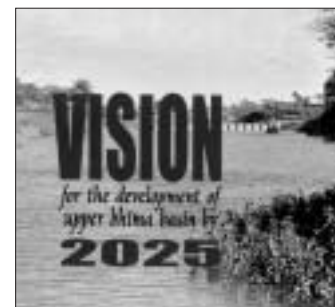
Ghana. The Water Resources Commission of Ghana coordinates and monitors the water-related activities of all agencies. The Commission is now promoting River Basin Partnerships, in which users, non-governmental organizations (NGOs) and government departments concerned with the basin take part.

2.2 INTERACTIVE PLANNING

Develop local water visions

Maharashtra, India. The GWP Purna Basin and Upper Bhima Area Water Partnerships

have developed water visions for their respective problematic sub-basins. The visions have been shared widely with decision-makers and parties that have a direct stake in the management of the sub-basins. Water visions provide a non-confrontational means to influence policy and to bring about change in water management. While detailed planning is generally assumed to be a government responsibility, developing visions can be initiated by other organizations and can be highly effective in influencing government planning.



Shared environmental perception workshops

Peru. The Research Center in Applied Geography of the Pontificia Universidad Catolica del Peru organized a number of 'environmental perception' workshops, which brought together representatives from civil society, irrigation associations, town councils and the private sector from the upper and lower parts of the catchment. The activity helped them to recognize their interdependence. One important outcome was that towns in the lower part of the catchment agreed to contribute funding to watershed protection in the upper catchment.

Involve stakeholders in collecting information

Rockland County, New York, United States. One of the first countywide public-private partnerships in the USA involved a groundwater protection program for Rockland County, New York. The partnership consisted of volunteers from local government, civil society and private organizations. Groundwater protection areas were delineated for public community-supply wells and non-community wells. Volunteers conducted door-to-door surveys within the delineated groundwater protection areas to identify potential and existing sources of contamination. The results were compiled into a database that was used for countywide groundwater protection.

Tap into local knowledge

Peru and Japan. Local communities play important roles when emergencies strike. Community-based flood mitigation in Peru shows that support given to community-based risk mapping led to the establishment of volunteer brigades that could

undertake emergency rescue. In Japan, the roles of local communities are defined in flood emergency legislation. Flood Defense Associations within the local communities develop their own preventive activities and emergency responses. There is usually no substitute for local knowledge.

Adopt a water code

The International Council for Local Environmental Initiatives (ICLEI) works with local government to implement Local Agenda 21 programs. In its water campaigns it encourages municipal governments to sign up to a Water Code as the start of the planning process

BOX 2: The Local Government Water Code

1. Access to clean and affordable drinking water is a fundamental right. As such, governments have an obligation to ensure water and sanitation services for all.
2. Water must be governed as a common good.
3. Water must be protected as the ecological foundation of life.
4. Water must be managed as a finite economic resource.
5. Water must be preserved as a shared cultural asset.

Source: ICLEI



Minister of Irrigation visiting the Pinga Oya project

Use water resource planning to overcome ethnic and religious differences

Pinga Oya, Sri Lanka. The Pinga Oya flows through the densely populated multi-ethnic area of Akurana and Poojapitiya divisions in Sri Lanka. This catchment has a diversity of economic activities and there are many polluting industries including paddy mills, sawmills and factories. The Pinga Oya suffers from over-development along its banks and raw sewage is discharged into it causing a

major health hazard as the same water is used for bathing and washing. Uncontrolled pollution has also led to problems at Polgolla dam and tunnel. Unregulated building on paddy lands has not only reduced food production capacity but also increased the risk and frequency of flooding.

After a series of mobilization visits to the area, NetWater (an association of women water professionals) and Catalysts for Development Information conducted a first meeting involving young people and other stakeholders that had been identified as

possible participants. A support group of interested academics and students from the University of Peradeniya linked up to this activity as resource persons. Key informants indicated that there were constraints in carrying out a successful joint activity due to religious and language differences. For the first time in recent history there had been a flare up of ethnically related tensions between the Muslim and Sinhala communities in the region. It was evident that a special effort would be needed to bring the stakeholders in this system together.

The first stage therefore included a special mobilization seminar for the Akurana schools, bringing together Muslim religious, academic and social leaders from within and outside Akurana, as well as representatives of the local political leadership. The second meeting involved a problem identification workshop for all stakeholders, including Sinhala and Muslim representatives and schoolchildren from both Akurana and Poojapitiya. This assessed the current status of the Pinga Oya catchment. Follow up activities were identified as:

- A school awareness program coupled with extensive media coverage.
- A multi-stakeholder dialogue in Pinga Oya catchment to identify and carry out activities necessary for catchment conservation to involve political and local government decision-makers, the Department of Irrigation, Parent Teacher Associations, the Mahaweli Authority of Sri Lanka, the Department of Education, schools, the Bazaar Committees of Akurana and Poojapitiya and the University of Peradeniya.

The planning process received a boost when it drew the attention of the Minister of Irrigation. In a hard-hitting speech he made it clear that political friendships will not hinder action if river abuse is continued.

Water accounting for integrated water management

The International Water Management Institute (IWMI) has developed a water accounting system that provides a clear view of water resources in a river basin: where water is going, how it is being used and how much remains available for further use.

Strategies for achieving effective lake management

Good lake management should be based on a watershed-wide, participatory management plan that is founded on science and reviewed regularly. It should also be flexible to take account of changing conditions. Management strategies should also be prioritized. The first steps towards developing a good strategy include:

- Community discussion about the state of the lake and what can be done to protect it. Developing a consensus between diverse stakeholders is a gradual process that often begins with a survey of local citizens' concerns. Over time, citizens, scientists, industry, the teaching community and local and state government should be brought to the table.
- Lake watershed map, showing all political boundaries. Watersheds seldom match political boundaries, and many diverse agencies probably have responsibilities for different aspects of a lake and watershed. A good watershed map is important to educate local inhabitants and the media, and to identify which members of government are responsible for the lake.

- Responsibilities. It is useful to identify agencies and organizations with responsibility for some portion of the lake or regional or national environmental agencies, fisheries departments, recreation departments, urban planning, agricultural agencies etc. They can then be drawn into the management process.

- Regulations or legislation requiring cooperation. Cooperation between governmental agencies should be developed, especially when multiple countries are involved.

- Harmonize regulations and laws. If the lake is subject to multiple jurisdictions (most are) there are likely to be many conflicting statutes or regulations, from how to monitor the health of the lake to legal fishing limits and industrial discharge taxes. Look for opportunities to harmonize laws and regulations.

- Compliance. Are existing environmental laws and regulations fully enforced? Working with officials to obtain stronger enforcement of laws or regulations that protect some aspect of the lake or watershed can be very productive.

Source: Lakenet (www.worldlakes.org)

2.3 SUPPORTING LOCAL INSTITUTIONS

Effective water resource management at the local level often requires new institutions or new functions to be added to existing institutions. Some tasks are best performed by user organizations, while others require organization at a larger scale e.g. at the sub-district, district or basin level. New organizations can be developed as part of a planning exercise.

In supporting local organizations, 'peer effects' have worked well. Local organizations often learn best from other local organizations as they can compare themselves

directly, make the most of local knowledge and exchange practical support. Federating local organizations or at least bringing them in contact with one another can stimulate peer effects.

Area water partnerships

In South Asia and Eastern Europe the GWP has supported the development of broad-based local platforms to identify water issues and initiate actions to improve local water management. One example is the Malwathu Oya Area Water Partnership in Sri Lanka. Prior to the formation of the partnership, there was no civil society group capable of initiating and promoting the management of water resources, as all existing organizations had limited goals. The partnership presents the views of basin stakeholders on matters such as sand and clay mining in rivers (which is leading to the degradation of river banks and beds), extraction of groundwater, rehabilitation of water storage tanks and disposal of waste (see Box 3).

Association of community organizations for water resource conservation at basin level

Cali, Colombia. The continuity of community management in the provision of public services and the conservation of water resources has been strengthened through creating an association of community organizations. A total of 28 community organizations represent 112 rural and marginal urban communities in the departments of El Valle, Cauca and Risaralda. The activities they undertake include:

- protection of water resources through the conservation and recovery of the basins/watersheds that provide the water resources;
- purchase of land and forest areas;
- negotiation with other sectors (mainly agriculture and livestock) on water use including appropriate techniques of cultivation;
- control of pesticides and promotion of systems for wastewater treatment in rural communities;
- control of water quality and efficient water use;
- strengthening the capacity of communities in administration, operation and maintenance of their wastewater and sewage systems and in the protection of the water resource.

BOX 3: Malwathu Oya Area Water Partnership: influencing policy and action

The Malwathu Oya originates in the dry zone of Sri Lanka and feeds a large number of major and minor irrigation systems. Extensive use of water for irrigation results in severe water stress. In addition, river water is polluted by wastewater from Anuradhapura City, military establishments, a prison and general hospital, and also by a large seasonal influx of pilgrims. Furthermore, watershed degradation is threatening springs and storage tanks are silting up. Riverbanks and beds are also being damaged by excessive mining of sand and clay.

The Malwathu Oya Area Water Partnership was formed because there was no coordination in water management between different users and between stakeholders upstream and downstream. Getting the right composition of members and the right leadership has been vital for success. Religious, non-governmental and private sector organizations are important partners as they have the capacity to raise critical issues. The acceptance and recognition of these institutions by the general public is equally important to build the credibility of the partnership. The provincial governor has taken the leadership role, thereby ensuring the support of governmental organizations. The long-term mission of the water partnership is to provide answers to the problem areas through consultation, building consensus and finding workable compromises. To improve the quality of water, the partnership has already made neces-

sary contacts with the main polluters and worked with them to find a better method of waste disposal. The municipality, army establishment and many others have been brought into the partnership, but it has proved difficult to reach the entire community of irrigators, as the number of irrigation systems and people involved is so large.

The basin has been divided into five sections, and stakeholders have been encouraged to identify problems and solutions particular to their area. When solutions are beyond local problem-solving capacity, contact has been made with relevant authorities and follow-up actions pursued. The main function of the partnership is to facilitate, encourage and lobby for improved water management in the sub-basin. A number of 'on the ground' activities have been accomplished with the help of the Thanitirimale historical Buddhist temple, such as:

- renovating a cascade system, which included 81 small tanks;
- replanting riverbanks that were destroyed due to human activities and natural hazards;
- planting 50 hectares of teak trees under the community forestry program;
- establishing a pilot 60-hectare cashew plantation with organic manure;
- establishing a special foundation to work on conservation of the spring area.

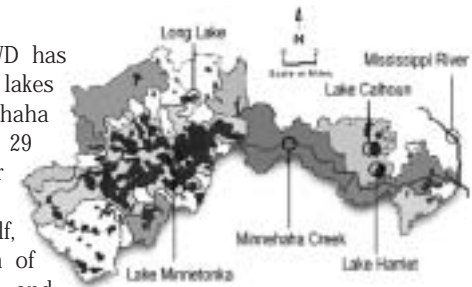
Source: GWP

These communities have invested funds and efforts in the conservation and recovery of their watersheds and basins with a minimum of institutional support. They have also developed a collective capacity to negotiate and reach agreement with the users, communities and representatives of other sectors.

Self-funding watershed district

Minnesota, United States. The Minnehaha Creek Watershed District (MCWD), USA, is the regional governmental unit chiefly responsible for protecting the water resources of this watershed, which is located in the Minneapolis area of Minnesota. The District covers approximately 181 square miles that ultimately drain into the Minnehaha Creek.

For more than 30 years, MCWD has monitored and investigated the lakes and streams that feed Minnehaha Creek across two counties and 29 cities and towns, from the upper watershed north and west of Lake Minnetonka to the lake itself, through the Minneapolis chain of lakes, to Minnehaha Creek and Minnehaha Falls. Working in partnership with cities, townships and citizen groups, MCWD has helped to improve the water quality in most of the lakes and streams in the watershed.



MCWD designs and builds projects to protect water resources, including lake restoration, wetland enhancement, erosion repair and flood control. The District also works with cities, counties, park districts, developers and others within watershed boundaries for compatible and efficient water resource management. The autonomous body is funded by small additions to property taxes from the households in the District that benefit from water resource management, with occasional interim funding from cities, counties and the state. The District is also funded through special levies.

Local disaster committees

Cox Bazar District, Bangladesh. Cox Bazar District is probably the most cyclone-prone area in the Bay of Bengal. Preparation for disaster is facilitated by local village committees, which have responsibility for maintaining cyclone shelters and conducting a range of disaster preparedness activities before, during and after a cyclone season. Besides reducing the impact of cyclones on women and children, the committees aim to ensure active participation of all sectors of the community, especially women's groups.

Local groundwater quality control board

Tennessee, United States. The local community of Shelby County in western Tennessee has formed a Groundwater Quality Control Board. The board's mandate is to preserve the water quality of the Memphis aquifer. The group is funding a program of research that uses environmental tracers to foster understanding of recharge and vulnerability of the Memphis aquifer.

2.4 FINDING INTEGRATED SOLUTIONS

Local integrated water resource planning often helps to identify improvements to water management systems that have not previously been considered, such as combining the strengths and priorities of different sectors, combining land and water management and combining different water functions. At the local level, these integrated solutions are generally clear-cut.

Ecological water resource management at the local level

Freiburg, Germany. The city of Freiburg has developed an ecologically oriented water resources policy to protect and regenerate the natural water cycle and to ensure the supply of clean drinking water. The basis of this policy is a set of precautionary measures in the areas of domestic gardens, leisure and drinking water.

Flood prevention with recreation and nature conservation

Austria. 'Vienna at the Danube' is the name of a multifunctional flood protection project in the Danube region near Vienna. The central component of the project is a flood protection system in the form of a bypass canal. But from the first beginnings

of the project, the system was designed for a variety of uses and is intended to increase the recreational value of this urban area and to combine several different social, ecological and economic functions. Several ecological zones have been created by landscaping and maintaining old channels of the Danube and excavating ponds. On the surface it may seem that certain areas of the island and its embankments are given little care, but, in fact, this low key management encourages several species of flora.

Restoring stork nests for visible results

Poland. The Polish Society of Wildlife Friends (Pro Natura) has developed a program to encourage nature conservation activities among local communities. The main objective was to build up public support for wetlands conservation in recognition of their unique ecological value and the vital role that local communities play in sustaining small



White storks

wetlands. To raise awareness of the program, the white stork was chosen as the flagship species. The first phase emphasized quick results to draw attention, inspire confidence and generate support for the program. Fifteen hundred stork nests were restored, and the activities were covered by a large media campaign, including environmental education and demonstration of the mutual benefits of wetland conservation for nature and the local economy.

Water storage through local action

Mafi-Kumase, Ghana. Mafi-Kumase is a rural agricultural community in the Volta region of Ghana. Until 1975, it had suffered severely from acute water shortage every year. Having failed to obtain assistance from the government or NGOs, the local chief and his elders mobilized the villagers to solve the problem themselves and they erected an earth dam to collect surface run-off water. Since 1975, the small dam has developed into a lake, serving as the only source of drinking water for the entire Mafi-Kumase community. As with many standing surface waters, however, the lake became infest-



ed with guinea worm and bilharzia diseases. This health problem has now been solved by the introduction of a slow sand filtration system.

Integrating land and water management

Rijssen, The Netherlands. In August 2002, the village of Rijssen suffered from a period of severe rainfall. Streets and houses were flooded on three occasions because the drainage system could not handle the enormous amount of rainwater. To reduce the risk of flooding in the future, the local government took a number of measures for both land and water management. Larger diameter storm water discharge pipes were installed, while storage basins and direct infiltration of rainwater into the ground were improved to take the pressure off the drainage pipe system. Several similar additional measures were put forward in a public meeting, such as low-level retention sites, to which water can flow under gravity during heavy rainfall. Parks in low-lying parts of the village can also provide additional storage capacity.

2.5 UP-SCALING LOCAL INNOVATIVE EXPERIENCES

Systematic efforts to improve planning in water management at the local level can also be relevant at higher levels, while innovations developed in one place can be of use in many others. Local planning may also help to identify generic policy issues or develop alternative policies.

Roundabout outdoor play pump

South Africa. Many people in rural South Africa have to travel long distances twice a day just to collect water. The chore usually falls to women, young girls and children, who collect water from springs, rivers, farm reservoirs etc. Hand pumps are hard work for women to operate, but modern alternatives are costly and have high fuel and maintenance costs. In 1999, the organization 'Roundabout Outdoor' came up with an innovative idea – to combine the need for pumping with

the fun of playing. This can be achieved by coupling a low maintenance pump to a roundabout on which children can play. As the roundabout rotates, the water is pumped from a borehole to a water storage tank. Naturally, these play pumps are only useful where children gather, but they can be highly effective if located outside a school. A roundabout outdoor play pump costs US\$ 5000 to install and provides water for up to 2500 people. The project received the World Bank Development Marketplace award in 2000.

Individuals provide the inspiration

Zimbabwe. The Zvishavane project is helping Zimbabwean farmers to manage land and water resources in a sustainable manner and involves the government working closely with agricultural technicians. Farmers are able to approach the project for assistance and receive hands-on knowledge. The main role model for the project was an individual named Zepheniah Phiri. He developed his own water resource system for his farm. Using terraces, pits, sand traps, ponds and tanks, Phiri was able to control more than 50% of the runoff from rain, while in most places it is only possible to store and control 20-50%. As a result, he can obtain two more harvests a year than most farmers in the area, and he was able to maintain crop production during two years of drought. The basis of his work is more ethical than technical. His belief drives him towards stewardship of nature and making the most of local resources and communi-

ties. He believes that new techniques alone will not be sufficient to bring about the sweeping changes required in water management; they must be accompanied by a real commitment to change.

Identifying policy issues

Pakistan. While investigating drinking water supplies, the Potohar Area Water Partnership discovered that far fewer families had access to clean drinking water than was suggested by official records. As a result, the partnership effectively lobbied the district government water department to implement more accurate monitoring and to provide drinking water to areas that had previously been overlooked.



Roundabout play pump: combines the need for pumping with the fun of playing

Developing water policy from the bottom up

North Bengal, India. Micro water resource management planning has been undertaken in three districts of North Bengal by two NGOs: the Centre for Development of Human Initiatives (CDHI) and the Indian Institute for Bio-social Research and Development (IBRAD), covering approximately one hundred locations. The initiative involves women's groups, water management associations and other local stakeholders in watershed development areas. The micro planning includes resource mapping, joint appraisal of the local water situation, identification of problems and action planning. Apart from initiating local action, these exercises generated a number of common issues, such as distorted drainage due to road construction, water pollution and over-drainage from commercial tea gardens and inadequately defined fishery rights on small inland lakes. These generic issues were raised during water conventions at sub-district and district level, to which a large group of stakeholders and decision-makers were invited. The exercise has therefore been successful in facilitating bottom-up water policy development and regulation.

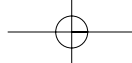


Identifying local water issues
in North Bengal, India



Small-scale water resource management as an alternative to dams

Tichy Potok, Slovak Republic. 'Blue Alternative' is a proposed water management policy that utilizes numerous small reservoirs and depressions to catch and store water, takes necessary measures to slow runoff, restores wetlands and transfers control of water resources from central government to local self-government. The approach contrasts sharply with official Slovak water management policy, which was defined in the early 1950s and concentrates on the building of large dams. The government has so far rejected 'Blue Alternative' on the grounds that there is insufficient evidence that it would successfully generate enough water for local needs. A pilot project was therefore developed in the Tichy Potok area, where the government had earlier declared its intention to build a large dam. Careful monitoring is gathering evidence to show that the alternative approach, together with repairs and efficient use of the existing water system, can generate a sufficient supply of water at a lower cost and with less environmental damage, even with a growing demand from consumers in the cities downstream.



Chapter

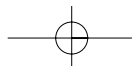
3

Promoting water saving, recharge and retention



Water saving can, in principle, generate significant win-win situations. More efficient use of water in one place releases water that can be used elsewhere. Water saving can also lead to monetary savings for the water consuming party itself, particularly where the water price is significant and volumes are large. In considering water savings, one should, however, take a broad perspective. Not all water 'savings' will benefit local people or the environment and not all water 'wasted' is lost: at the level of a river basin, water spilled by one consumer can provide a resource for another. In the last few years a large number of programs have started promoting water saving measures among urban users, in industries and, to a lesser degree, in agriculture.

Watering a vegetable plot along the Mekong river, Cambodia



3.1 SAVING WATER IN RURAL AREAS

Irrigated agriculture is the largest global consumer of water. Saving water in agriculture is, therefore, a first priority. Furthermore, current food and water demand projections assume that significant increases in water productivity (the value of crop produced per unit of water) will continue to be needed. Several local initiatives have been successful in reducing water losses and in changing cropping patterns and practices. But apart from promoting 'more crop per drop', the productivity of entire water control systems has to be improved, by better water management at system level. This may include measures such as water recharge, re-use, controlled drainage and water retention. Implementing these different local measures can be helped by adopting a framework that provides the necessary legal, institutional and financial incentives.

3.1.1 ENABLING AND SUPPORTING FRAMEWORKS

Local groundwater committees created by law

Mexico. The National Water Law, which was accepted by the Mexican Congress in 1992, permitted establishment of technical groundwater committees (Comités Técnicos de Aguas Subterráneas or COTAS). One example of a COTAS is the Querétaro aquifer, which is used primarily by urban and industrial consumers with agriculture taking 20% of abstracted water. An intense effort to organize groundwater users in Querétaro was undertaken in 1998 on the directions of Vincente Fox, then Governor of Guanajuato. A team of sociologists worked for eight months to organize meetings at the national, state and local level. The core groundwater management issues were identified with local experts and then presented to an assembly of authorities and groundwater users. The users formed a COTAS and identified a series of water saving activities in irrigation improvement and wastewater re-use. The COTAS also formulated a number of groundwater use regulations. The model and process were then adopted as a model for other aquifer systems in Mexico.

Participatory hydrological monitoring

India. The Participatory Hydrological Monitoring (PHM) program developed in Andhra Pradesh, India, under the Andhra Pradesh Well Irrigation Project (APWELL) provides a promising experiment in trying to counter overuse of groundwater. Under

the PHM, farmers are being trained to measure groundwater parameters themselves. They are provided with:

- a drum and a stop watch to measure the discharge in a number of their wells;
- a water table recorder to measure the depth of water table;
- a rain gauge, installed in a sheltered place;
- ready reckoner tables and training to allow them to estimate water balances.

The farmer group reports its findings to a field hydrologist, who helps to analyze the results. The PHM has had a marked impact in the areas where it has been applied. It has been combined with agricultural extension focused on crops and cropping techniques with high 'water productivity'. Growing flowers, castor seed, cotton and maize have been promoted as alternatives to the more traditional, but high water demand, rice cultivation. At present, rice accounts for less than 5% of the area under crop, a marked departure from other groundwater dependent areas.

Water trade

In dry regions, farmers often have entrenched rights to large volumes of irrigation water, while nearby cities experience water shortages. Taking water away from agriculture is socially and politically sensitive, yet paying farmers to forego part of their water share could help a region cope with droughts. In some countries, mechanisms are in place to transfer entitlements to water from one user to another. Sometimes water rights can only be transferred as part of land transaction, but elsewhere, water can be sold independently. In California, a water bank mediates between sellers and purchasers of bulk water. Water transfers also encourage agricultural conservation and can help farmers pay for more efficient irrigation and change to new, less water demanding crops. Some environmental organizations also purchase water rights to increase base flows in rivers.



A farmer checks the ground water level in a pump borehole, India PHM program, Andhra Pradesh

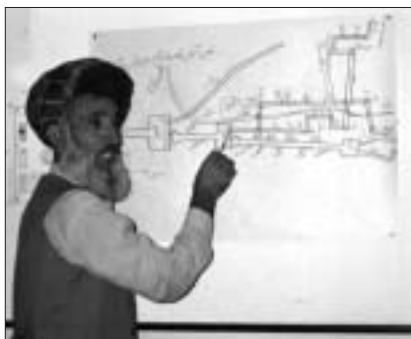
Improving the reliability of water supplies

Overuse of water is often the result of unreliable supplies. Unpredictable irrigation services or, in the case of pumping, erratic power supply encourages water users to 'hoard' water. Restoring reliability in water supplies is a precondition to improving water use efficiency.

3.1.2 WATER-EFFICIENT AGRICULTURE

Better local water distribution rules

Ziarat, Pakistan. Farmers in several small irrigation systems in Ziarat District have reviewed their water distribution rules. They found that a substantial portion of scarce water supplies were lost in transport because water was brought first to one part of the irrigated area and subsequently channeled to different areas. Once they realized this, they were able to streamline and systematize their system of irrigation, leading to water savings of 30%.



Farmers in Balochistan reviewed and improved their water distribution rules

Low-cost micro-irrigation

In recent years there has been a considerable movement towards developing low-cost micro-irrigation that is affordable and manageable by small-scale farmers. Low-cost micro-irrigation is promoted in several countries, such as India, Ethiopia and Kenya, and in some of these countries local manufacturers are helped to set up facilities to produce the necessary equipment.

Low-pressure drip irrigation

A number of organizations have promoted low-cost bucket and drip systems for use by small-scale farmers. A related technique is the use of a low-cost plastic hose. Holes of 1.5 mm (which are easy to clean) are made by hand with a small punch and hoses are connected with short pieces of polyvinyl chloride (PVC) pipe. The advantage of this low-pressure system is that the users can expand it according to their

needs. Since the pressure needed for this system can be as low as 0.5 meter, water tanks do not need to be elevated and the drip system can be filled directly by, for instance, a hand pump.

Pepsi drip system

The ultimate low-cost drip system is the 'Pepsi' system, developed in Maharashtra, India, on the basis of disposable ice cream tubes. The cost of the system is as low as US\$ 120/ha, but the system only lasts for one short cotton or vegetable growing season. The Pepsi system fills a useful niche and is being further developed.

Lay-flat hoses

Lay-flat hoses have become a popular complement to irrigation pumps in India and China. Their water loss is close to zero, which is important in the case of intermittent groundwater irrigation. The tubes also help to avoid right of way and gravity problems, allowing farmers to irrigate higher land. The hoses can be rolled up and are easy to transport. The usual length of the tubes is 100-300 m. At longer lengths, the back-pressure on the pumps is too large to handle. The two most popular materials used are PVC and polyethylene.

Low-cost pivot systems

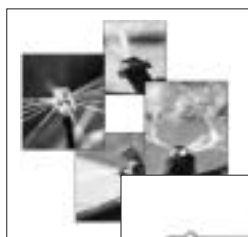
Low-cost pivot systems have been manufactured and used in Kenya. These need less labor than conventional field channel irrigation systems and the water is distributed more



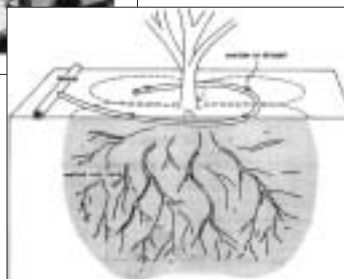
Pepsi drip system



Farmer-made bucket drip system



Sprinklers systems



Efficient irrigation through drip system

evenly, leading to an increase in crop yields without increasing the cost of irrigation.

Changing cropping patterns

Ruhuna-Walawe Basin, Sri Lanka. In Uda Walawe, irrigation system crop diversification is one of the main strategies introduced by the local irrigation agency in an attempt to save water and increase farmers' income. As a result, 35% of the irrigated area is now under non-rice field crops, with a high proportion

put to growing bananas. This percentage is much higher than is the case in Sri Lanka as a whole and demonstrates the value of intensive efforts for change.

Retiring marginally productive land

California, United States. In some parts of California, agricultural use of marginally productive land has been ceased to alleviate problems of overproduction and to reduce the extent of environmental degradation. Instead, these areas are being restored to their former habitat: forested land.

Water saving in agro-industry

The Netherlands. In Dutch agro-industry, a new system of cleaning agricultural products such as bulbs, potatoes, carrots and onions has been introduced. It consists of an improved three-step process (soaking, rinsing and after rinsing) and achieves water savings of more than 80% compared to conventional crop-cleaning procedures.

3.1.3 RE-USE OF LOW QUALITY WATER IN IRRIGATION

In areas of severe water scarcity, low quality water, such as semi-treated wastewater or drainage water, is increasingly being used for irrigation. Egypt is probably the world leader in this area and here, nearly half of the drainage water is re-used in agriculture.

In other countries, wastewater is used to irrigate crops, parks or forests. A case study by IWMI in Mexico found that land rents for plots irrigated with wastewater were five to six times the going rate for land irrigated by canal water because wastewater irrigation allowed farmers to grow high value crops and to save considerably on expenditures on fertilizer. The downside, however, was the accumulation of heavy metals in wastewater irrigated soils. Correct management is therefore required. Unless properly managed, wastewater irrigated land may be degraded and the crops may become unfit for consumption (see Box 4).

BOX 4: **Positive and negative effects of wastewater irrigation**

Positive effects:

- conserves water;
- low-cost method for sanitary disposal of municipal wastewater;
- reduces pollution of rivers, canals and other surface water resources;
- conserves nutrients, reducing the need for artificial fertilizers;
- increases crop yields;
- provides a reliable water supply to farmers.

Potential negative effects:

- health risks for irrigators and communities from prolonged contact with untreated wastewater and consuming crops irrigated with wastewater;
- contamination of groundwater (e.g. with nitrates);
- build-up of chemical pollutants in the soil (e.g. heavy metals);
- creation of habitats for disease vectors;
- eutrophication of canals carrying wastewater.

Source: IWMI

Developing local standards for wastewater use

Amman Zarqa basin, Jordan. There is a strong case for developing local standards for wastewater re-use, and these will depend on the types of applications made locally. Standards and regulations tailored to specific uses are likely to gain a wider acceptance than one standard for all uses. In the Amman Zarqa the introduction of wastewater irrigation was preceded by a number of steps:

- local standards for water quality and regulatory processes were proposed to ensure crop marketability;
- the search for appropriate standards was accompanied by a public dialogue on water use plans;
- supporting actions were developed and presented as an integral part of the plan. Supporting actions included proposals for improved on-farm water management, a regulatory framework, water quality improvement plans, monitoring and information management and crop marketing plans.

Joint monitoring

Moose Jaw, Canada. Moose Jaw City re-uses sewage effluent to irrigate marginal land. The process of wastewater treatment removes phosphates and these are then utilized as a nutrient for growing crops. The system is complex yet effective and relatively low in operational costs. The success of the project depended on cooperation between farmers and urban stakeholders in operating, monitoring and maintaining the natural soil-water treatment system.

3.1.4 WATER RETENTION

Many water saving initiatives have focused on what is called 'blue water'. Blue water is the water tapped from rivers, lakes or aquifers. Yet it is equally vital to maximize the productivity of 'green water', i.e. rain and soil moisture. In some areas (e.g. Gujarat and Madhya Pradesh in India) water harvesting programs have achieved remarkable breakthroughs and have reversed both the decline of groundwater levels and the degradation of ecosystems. Opportunities for increasing water retention still remain under-utilized, e.g. improving soil water retention capacity, increasing system-level water retention and avoiding over-drainage.

Improving soil water retention capacity

Andhra Pradesh, India. Vermiculture is a soil improvement method that uses worm action to transform any kind of organic waste into compost. The process significantly improves soil water retention capacity and reduces groundwater consumption. Local people have been very keen to adopt vermiculture as it also improves soil fertility and reduces the need for chemical fertilizer.

Better water retention at system level

Water Management Project, Central Benelux. Small weirs have been placed on the rivers flowing through a sandy area on the border of the Netherlands and Belgium. The weirs help to retain water for agriculture, recharge groundwater tables and restore natural vegetation. Local farmers and water boards decide the location of the weirs. Other water retention measures, such as closed culverts and canal beds, are less popular. Unlike the weirs, these measures do not allow farmers to manage their own groundwater levels.



Transboundary water management
Belgium-Netherlands to
improve local water retention

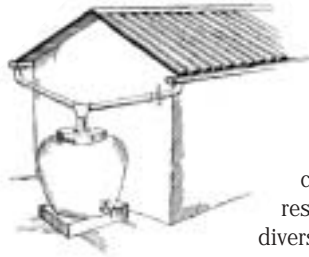
North Bengal, India. Local water harvesting programs are working to raise water levels by placing permanent gully plugs in scoured-out natural drains. This raises the water table during the critical monsoon season and ensures more reliable rain-fed paddy yields. A number of other water retention measures complement the water harvesting program and include contour bunds and guide bunds, which aim to slow down the sheet flow during the rainy period.

Uttar Pradesh, India. The University of Roorkee has undertaken a ten-year experiment in channeling surplus river flows through the unlined channels of the Madya Ganga Canal during the monsoon period. These monsoon flows recharge local aquifers. During the dry season, the stored water is used by farmers for a second crop. The draw down of the aquifers during the dry season helps to maximize their water storage potential during the subsequent monsoon period. The recharge also secures an irrigated dry season crop, reduces pumping costs and stabilizes groundwater tables. The University of Ludhiana is working along similar lines, exploring the potential of disused drainage canals to recharge groundwater tables during monsoon flows.

Use unorthodox sources of water

Spain. In coastal areas of Spain, desalinization of water from the Mediterranean is increasingly being adopted to provide domestic and industrial water. Orange producers have recently adopted the same technology as the value of local orange crops is sufficiently high to pay for the costly desalinization process.

Chile. Researchers in the coastal desert of Chile have undertaken experiments with 'fog catching'. Fog catchers are placed in the damp wind, where water condenses on the filaments and can be collected. The system works well and researchers are now trying to reduce the costs and improve the robustness of the equipment. Fog catchers have also been introduced in Yemen.



Example of a rooftop water harvesting system

Rooftop water harvesting

Gansu, China. The loess plateau of Gansu province is one of China's driest and poorest areas, with per capita availability of water only one-fifth of that in the rest of the country. Unsuitable topography prevents the diversion of river water. Following a serious drought in the mid-1990s, the '121' project was started with the aim of supplying additional water for drinking and courtyard irrigation. The project promoted rooftop rainwater harvesting by collecting and storing rainwater. This now supplies the basic water needs of the population and provides an excess for cultivation.

3.2 SAVING WATER IN URBAN ENVIRONMENTS

The global population is becoming increasingly urbanized, placing ever-greater emphasis on urban water management. There are several examples of city governments that have launched successful water conservation drives. Some of these have been so effective that investment in new water treatment facilities has been postponed. Many cities have also promoted rainwater harvesting or water retention measures.

Urban water resource foundation

Fukuoka, Japan. The great drought of 1978, which forced the city administration to curb the supply of water for most of the year, triggered a concerted campaign to



Fog catching in Chile

make Fukuoka a 'water conservation conscious city'. In addition to an intense program to raise water conservation awareness among the city residents and promote water saving measures, the Fukuoka City Forest and Water Resource Foundation was established, financed by a one yen per cubic meter surcharge shared equally by all water consumers. Per capita water consumption per day in Fukuoka City is now less than it was before the drought, despite more flush toilets being used. The city now consumes almost 20% less water than other Japanese cities of a similar size.

City water conservation plan

Santa Monica, California, United States. The city of Santa Monica prepared and implemented a city water conservation plan that aimed to reduce the city's water usage by 15% and wastewater flows by 20%. This allowed the city to defer the purchase of costly water treatment infrastructure. The measures in the plan included:

- changing the plumbing code, which required the installation of ultra low flush toilet fixtures in all new constructions;
- introducing meter water supply and a two-tier tariff, whereby the cost per unit of water increases as volume used goes up;
- implementing the 'Baysaver Plumbing Fixture Rebate Program' to encourage residents to replace existing water-intensive plumbing fixtures with water conserving fixtures;
- mounting a promotional campaign including inserts and flyers in water bills, displays at plumbing stores and home improvement centers, newspaper advertisements, radio and video public service announcements to publicize the need to conserve water.

Awareness campaigns

Zaragoza, Spain. Zaragoza, a city of 700,000 inhabitants in the northeast of Spain, suffers from limited and irregular rainfall, but the urban water supply was cheap and the citizens were using it wastefully. Consequently, the local government implemented a project entitled 'Zaragoza: the water-saving city', which aimed to

promote a new water-saving ethos among city residents and businesses. The project aimed to reduce domestic water consumption by 1,000 million liters yearly. With the help of the main players (manufacturers, retailers, consumers, distributors and plumbers) nearly 60% of the target has been achieved. This saving was sufficient to cancel the planned construction of a new storage reservoir.

Public education combined with monetary instruments

Tucson, United States. The city of Tucson is situated in a desert environment and faces a limited and dwindling water supply. The state government, driven by reduction goals and a desire to avoid costly infrastructure expansion, has developed a multi-faceted conservation initiative. This includes a series of public education programs, which, over the past two decades, have taught and encouraged individuals in the public and private sectors to conserve water. The campaign appeals to homeowners, business enterprises, facility managers, children and other segments of the population, and provides each group with tools and tips on the steps they can take to save water on a daily basis. By forming partnerships with other agencies and groups, and by combining financial incentives and sanctions (those who waste pay) and education with regulations and enforcement, the city has been able to instill a strong water conservation ethos in the vast majority of citizens and has achieved significant per capita reductions in water use. Finally, the city involves the public in other tangible ways, such as through the formation of a stakeholder group that is responsible for setting water tariffs for the city.



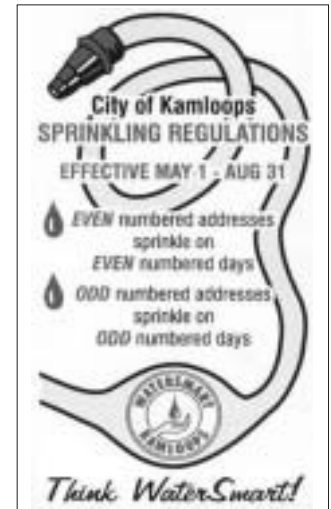
Zaragoza: the 'water-saving city'



Chatham County Groundwater Guardian Team made this education booth in order to teach water wisdom

Xeriscape gardens and sprinkling regulations

Kamloops, Canada. Kamloops City has planted 'xeriscape' gardens to demonstrate the possibilities of low water-use planting and landscaping schemes. Xeriscape gardening uses plants that consume very little water; these are often native species and are well adapted to the local environment. The city has also introduced regulations on garden sprinkling during the summer, with odd- and even-numbered houses permitted to water their gardens on alternate days. Teams of students on mountain bikes are employed to check that households are complying with the regulations.

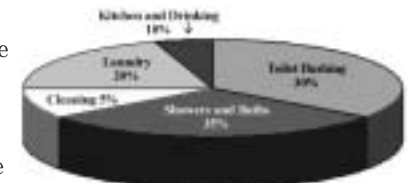


Minimizing leakage

Bulgaria and Romania. Leaking water distribution systems are a major cause of water loss. Even in a rich country like the UK, leakage from broken pipes can be as high as 25% of the water that enters the distribution network. Water use per capita in Central European cities is higher than in the rest of Europe, often exceeding 300 liters per day. Water companies and local government have consequently taken action to minimize leakage. In Troyan, Bulgaria, a water saving of 10% was achieved by repairing 70 leaks and renewing a 1 km pipeline. In Iasi, Romania, the local water company has detected the leaks in its 600 km water network using specialized leak detection equipment.

Practical water conservation tips

Practical water conservation tips can be given to both domestic and commercial water users as part of an urban water awareness campaign. The tips given will depend on local culture, wealth, climate and water consumption patterns. As an example, the detailed water saving tips offered by 'Water Watch Penang' are given in Box 5.



Water use in the home

Creating awareness about domestic water use: an example from Canada

BOX 5: Simple steps to help conserve water

- **Cooking:** Try not to cook too much by deep frying or with oily food. Cleaning and washing up pots and pans, as well as the walls and floors, after oily cooking can waste a lot of water, not forgetting the hard work. Instead, prepare more fresh food (e.g. salad and fruits) and cook more steamed food, all of which are healthier for the body. Water used for washing vegetables can also be recycled for other uses.
- **Clothing:** Try to wear cotton clothes that are not too thick or woolly. For those working in airconditioned places, clothes can be worn twice before they are washed. However, be careful not to carry this to the extreme and sacrifice hygiene.
- **Washing clothes:** Wait until a full load is accumulated before washing. Use a brand of environmentally friendly washing powder. These are less soapy and are not harmful to the environment. If using this kind of powder you can collect the effluent water for re-use (washing cars, watering plants, washing shoes etc.). When hand-washing clothes, use water sparingly.
- **Sports:** Limit your participation in sweaty sports that require frequent changes of clothes. For example, some sports like squash and badminton need several T-shirts for one single session. Imagine coming home with all those sweaty clothes when your mother/wife has no water to wash them! Choose something like swimming or running. For all sports, use only one T-shirt.
- **River water:** Those living within the vicinity of a river should attempt to use the river water for washing purposes but not as drinking water. In the remote areas, rivers are the common bath and launderette for all. However, a word of caution here: check out the quality of the river water first. If you are not sure, check with the Department of Environment.
- **Springs:** Those living within the vicinity of hills should attempt to locate springs from which water can be collected. Spring water can be used for drinking (after filtration and boiling) as well as for general washing purposes. In the remote areas and islands (such as Perhentian and Redang), springs are important water sources. However, to be sure that the water is okay, check with the Department of Environment first.
- **Wells:** Wells are important water sources in the rural areas. Those living in low-lying areas (where the water table is shallow) with a large house compound can dig and construct wells. Well water can then be used for general washing but not for drinking. Built nicely to blend in with the surrounding environment, a well can be aesthetically pleasing and add character to a house. However, check with the town council/local authority concerned before you dig a well.
- **Report leakage, damage and water thefts immediately:** Report leakage of all pipes and mains. Don't wait for others to do the job or hope/think that others have done it. Report all suspected water thefts to the relevant authorities. You may even get a reward for it.

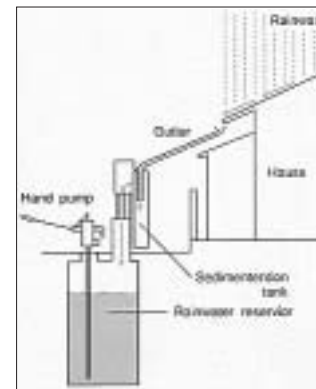
- **Shower:** Cut down on the number of showers. If possible, shower only once a day after work. Switch off the shower when soaping and shampooing. Do not over-use soap or shampoo as this will need more water for rinsing. Use 'organic based' soap and shampoo. They are less soapy and less water is needed to rinse them off. Do not switch the shower on full blast. Cut down on your shower time.
- **Brushing teeth:** Use a cup of water for brushing your teeth. Never let the tap run while you are brushing.
- **Washing face:** Use a wet towel instead of a running tap.
- **Hair style:** Short hair definitely requires less water to wash and clean.
- **Toilet use:** Use the squatting toilet for short calls. Pour used water (from washing hands or vegetables) into the toilet instead of flushing. For those without a squatting toilet, install a 'dual flush' mechanism to your flush system. This system is available in the market. Compared to the conventional flush, which uses 10 liters per flush, the dual flush method uses only 6 liters for a full flush and 3 liters for a half flush. Based on this system, a person can save at least 50 liters per day (The Sun, 30 May 1998). A simple way of reducing the amount of water flushed would be to put a brick or two into your WC cistern. This way, the water flushed is automatically halved. If you need a full flush (in the case of defecating), then just remove the bricks temporarily.
- **Washing car:** Reduce car washes and, if possible, stop washing your car. If you really need to wash it (for those who really love their cars), use a bucket and a cloth. Never use a hose.
- **Recycling - Collect used water for other uses:** Collect used water by putting a bucket beneath the tap. Water used for washing hands, vegetables and rinsing dishes can be used again for watering plants or for flushing the toilet.
- **Rainwater harvesting:** Collect rainwater and use it for washing the car, the floor or for watering plants. In many remote kampongs and villages, rainwater harvesting from rooftops is a viable and practical method of trapping water.
- **Collecting water from upstairs:** People living in houses/apartments with more than one storey can ask the plumber to do a minor connection to collect used water from showering and washing hands to be re-used for watering plants or washing the car or floors.
- **Stay home more:** Reduce going out, especially during the day when it is hot. You will need to drink less water, wash less clothes and take fewer showers. In fact, it also helps save money and this will help the country's economy as well.
- **Watering plants:** Use recycled water. Never use the garden hose. Use a water bucket instead. Water sparingly. Put a plate under each flowerpot to retain water from leaking out of the pots.
- **Cleaning floors:** Never use a hose or pour water over the floor for washing. Always use a mop. Use a 'no-rinse' washing liquid. Sweep the floor more often. This clears dust fast and stops it from accumulating.

Source: Water Watch Penang, Malaysia

Effective rainwater utilization

Tokyo, Japan. In the municipal district of Sumida Ward, local government has been working with citizens and commercial enterprises to promote the efficient use of rainwater. The program had three main action points:

- Public facilities such as the ward office, schools, libraries, and cultural centers have been equipped with rainwater storage facilities.
- The stored rainwater is utilized for flushing toilets, sprinkling gardens and as cooling water in air conditioners.
- Rainwater storage is promoted and facilitated at private facilities. The initiative is supported by an information campaign and a subsidy program.
- Community rainwater storage facilities store water for both emergency and daily use.



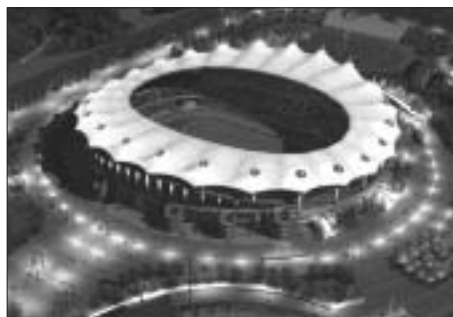
Schematic view of a rainwater storage facility in Sumida Ward

Encouraging schools to save on utility bills

Hamburg, Germany. The Environmental Authority of the City of Hamburg offered city schools a financial inducement to save water. They were promised that they could keep half of the money saved by reducing their gas, electricity and water bills. This is a real win-win solution, benefiting the schools, the city and the environment.

Soccer stadium rooftop water harvesting

South Korea. Five soccer stadiums in South Korea are catching rain to keep the turf green. One of them is the Incheon Munhal Stadium, built to host the 2002 World Cup. It has a doughnut shaped roof that acts as the catchment area. A network of pipes diverts rooftop runoff to an underground tank, which has the capacity to hold 600,000 liters of water. This initiative is the result of a revision in the country's water supply laws in 2001.



Inchon soccer stadium used for water harvesting

Building codes

India. The city of Hyderabad has changed its building code. It is now compulsory for new buildings to incorporate rooftop water harvesting facilities.

Retaining storm water

Den Bosch, The Netherlands. When the sewage system of the De Vliert residential area in Den Bosch was due for renovation, the city took the opportunity to introduce a new and more natural water management system. Instead of combining storm water and sewage in one system, rainwater is collected locally (e.g. in private cisterns) and allowed to infiltrate the soil. The wastewater treatment plant is thus no longer burdened with large volumes of rainwater, and rainwater is used to recharge groundwater. However, the implementation of such a system requires a new way of thinking about water by the people affected. Realizing this, the project started with

an information meeting for the residents of the area. Their ideas and remarks were then used as a starting point for the plans.

The key factor for the success of the retention project is the willingness of the city, the water board and the residents in the area to work together. Practical lessons include the fact that old, zinc gutters cause problems as the water coming from these gutters is contaminated with zinc. Initially, oak cisterns were planned but it was later realized that these would be likely to rot and cause offensive odors. The cooperation of residents is another very important factor and they had to change some of their habits, for example, car washing in the streets is now banned. Instead, they can use designated car-wash spots, which drain to the sewage system rather than infiltrating the soil.

Fiscal incentives to promote urban rainwater harvesting

Germany. Households in Germany are taxed according to the amount of storm water they discharge into the municipal system. The tax is calculated on the basis of the paved area of the property. It provides an incentive to the resident to store the rainwater and to recharge groundwater in order to avoid being taxed. The state also benefits as it saves on its storm water removal costs.

3.3 WATER SAVING BY INDUSTRY

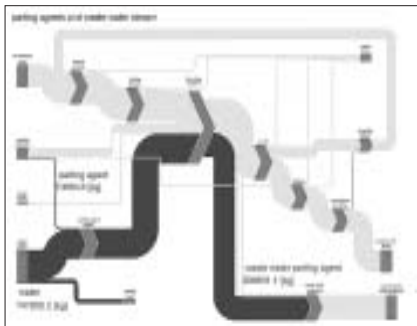
Saving water is of particular concern to large companies, such as chemical and food and fiber industries, that use large volumes of water. The costs of industrial process water may rise by up to 50% in the coming five years. At the same time, treating wastewater is a costly undertaking. Programs to promote water saving and wise water use in industry have often revolved around disseminating information, providing incentives and encouraging systematic review of the use of water. Water saving initiatives have often been combined with energy saving and recycling of process water. More ideas are given in section 7.1: Turning organizations into water managers.

Integrating water management in industrial processes

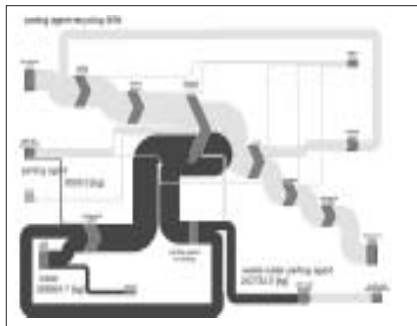
Several tools have been developed to make water management an integral part of industrial process management and to give water and water quality management

prominence in efforts to streamline technological and financial processes and identify improvements. Examples of such tools include water cycle closing (trying to come to zero wastage of water), utility scans and checking how cost-efficient small businesses manage their water supply and treatment operations.

BEFORE



AFTER



Example of reducing the wastewater stream: before and after measures have been taken

Water management as part of environmental vision

United States. Hutchinson Technology Incorporated, a producer of computer equipment, has introduced the 'zero factor' as part of its environmental vision. This stands for the corporate goal of zero environmental discharge. Efforts to achieve this involved a project to reduce the use of glycol ether, phosphoric acid, caustic cleaner and water in cleaning operations. A 66% reduction in de-ionized water usage and diluted waste treatment (40 million liters of water saved per year) was achieved.

Water and energy audits

Bulgaria. Water saving and cost reduction have been achieved simultaneously by Galatex AG, a cotton processing plant in Bulgaria. As a result of its high energy and water usage, Galatex's average annual energy costs were approximately US\$ 1.5 million. Galatex hired an external consultant to undertake a water and energy audit while within the company, a water and energy council was set up to encourage employees to participate and to coordinate the project. A preliminary audit made

Rooftop water harvesting: design and construction

Alacrity and Chitra Viswanath from Bangalore, India, are an architect and engineer couple. They have formed the 'Rainwater Club', a confederation of like-minded architects and engineers. The club has published a booklet in English and Kannada (Tamil and Malayalam versions are due shortly) on how to harvest rainwater.

The initiative started when they incorporated rainwater harvesting in the building plan for their home in 1995. This was calculated to yield 80,000 liters of water every year. The method involves designing downpipes for rain, separating the first 2mm through a first flush system, filtering the rainwater through a gravel-and-sand filter and storing it in sumps. The overflow is used to recharge groundwater whenever feasible (a rule of thumb for Bangalore is about 6,000 liters of storage for 100 square meters roof area). The system is also suitable for public buildings and factories. They provided the following information:

Do it at home

Dig a hole 4 m wide near your house down to the water level. Go down an additional 1 m deep and put down a layer of charcoal, which acts as a strainer. If required, use an iron sheet all around to keep the pit from collapsing. Remove the sheet after you put down the charcoal and 1.5 m of river sand. Insert two 2-inch PVC pipes, perforated at the lower ends, and 25 cm apart. Cover the perforated ends with net to prevent stones and other particles from coming up. Connect one pipe to the roof. A strainer at the top will keep leaves and other waste from going down along with the rainwater. Insert a hose in the other pipe, which has a foot valve at the bottom. Connect this pipe to an electric pump.

Rainwater displaces the dense hard water underground. If water comes up to the surface, put 0.5 m of ordinary sand on top of the river sand. This will prevent the water from overflowing. Once a week, pour bleaching powder solution through the pipe on the roof. This will keep the water pure underground.

For a good harvest

The best time to harvest is during intermittent rains. Harvesting cannot be done when there is a constant downpour since the soil will not absorb beyond a point.

To collect rainwater in houses and apartments, direct rainwater from the terrace to the ground through drainpipes to a filter tank and open wells or to percolation or absorption pits and wells below the soil surface. These can be covered with slabs to facilitate pedestrian and vehicular movement on the ground.

You can also use a percolation pit 4 to 8 m deep, depending on the nature of the soil, and 25 cm wide. It is filled with pebbles and river sand and should have a square or circular collection chamber to arrest silt at the top.

Another option is an absorption well, constructed using cement rings of 0.6 to 1.8 m diameter. Depth depends on the nature of the soil, and the diameter depends on the number of rooftop pipes likely to be connected.

In areas where the soil is clayey up to about 4.5 m, go for a percolation well of 3 to 4.5 m and a hand bore pit within this well up to a similar depth. Insert a PVC pipe of 15 cm diameter into the bore.

In apartments, water falling in the open space around the complex can be collected through a gutter with a perforated lid. Lead the collected water through pipes into a recharge well 1 m wide and 5 m deep.

Designer roofs

- Slope the roof to drain water towards the storage system. Keep the roof uncluttered and easy to clean.
- While casting the roof, place a 'floor trap' near the inlets of the water pipes to the ground.
- Roofs should have a gutter of PVC or zinc sheet to collect water and channel it to the pipe.
- To carry water down, use 90 mm diameter PVC pipes resistant to UV rays. Four pipes would be sufficient for 90 to 110 square meters area.
- Use a floor trap where the water enters the drain below or a piece of sponge at the mouth of the pipe.
- Filter rainwater before storage. A PVC bucket with gravel, sand and charcoal is a good filter. A PVC drum with sponge at the inlet and outlet is also a filter.
- Plan your storage system beforehand. It can be a rooflevel storage tank, ground level drum or masonry tank, underground sump or a tank partly below ground.

Keep it clean

If water does not contain any organic material and if it is stored in a clean container it can stay fresh for a long time. Use alum or chlorine to clean the water. Always boil and filter water before drinking.

Sources: Sekar Ragavan, Alacrity and Chitra Viswanath / www.rainwaterclub.org

the biggest problems clear and suggested solutions. A detailed energy audit was then performed with more systematic data collection, in which the energy and water use was measured and an energy balance prepared. Water saving of 44% was achieved, resulting in an annual cost saving of US\$ 800,000.

Ensure that water and energy is measured

Bulgaria. In implementing the water audit, Galatex AG Bulgaria found that the availability and condition of the plant's existing measuring equipment can have important implications on the costs for developing and implementing an energy conservation program.

Focus on low-cost immediate measures

Levice, Slovak Republic. De Miclen is a Slovak producer of beauty products. Energy consumption in the plant was high due to outdated production facilities and also because water and energy use patterns were insufficiently understood. Consequently, a comprehensive water and energy saving strategy was developed, which resulted in energy savings of 30%, a decrease in emissions of 30% and a wastewater volume reduction of 85%. The company saved 50% of current energy and water costs while decreasing total volume of environmental burdens (emissions) by 82%. On the basis of screening critical energy flows and an audit, a list of possible improvements was generated and a number of immediate low-cost measures were short-listed. 'Best packages' of measures were compared in terms of cost efficiency and environmental impact.

Making water saving and re-use pay for itself

Talgar, Kazakhstan. Low-cost improvements and changes in management practices may bring significant results not only to the environment, but also to the company's financial record. The Almaty Snack Food Company potato chip plant originally had no on-site wastewater treatment facilities and was not linked to the city sewage system. Substantial quantities of untreated wastewater were discharged from the plant into a nearby stream and energy use was 30% higher than at comparable plants. While implementing an environmental management system (EMS), measures were identified to make more efficient use of resources in the production process. As a result, a wastewater filtration and partial water recycling system was installed and improvements in processing and management practices significantly reduced water

and energy consumption at the plant. Following implementation of these practices, production costs fell by more than 50%.

Air cooling instead of water cooling

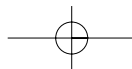
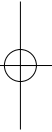
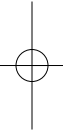
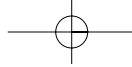
Canada. Colgate-Palmolive, a large detergent plant, has made several process changes in an effort to reduce and re-use materials and improve production efficiency. All the water-cooled compressors and chillers have been replaced with air-cooled units. This reduces both water use and discharge to the sewer. Also, warm air from the cooling units is vented into the building in winter and outside in summer. This helped to save approximately US\$ 10,000 per year in heating costs.

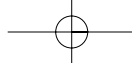
Replace running water with basin cooling

Andhra Pradesh, India. A pipe factory close to Hyderabad used to cool their newly manufactured pipes with running water pumped from a well. The activities of the company were contributing to the depletion of groundwater resources. Inspired by the 'Neeru Meeru' ('Water and You') campaign of the Chief Minister of the State, the plant owner constructed a basin for pipe cooling, thus saving on water consumption.

Water harvesting around a factory compound

Khamgaon, India. Hindustan Lever operates several large soap factories in India. In this dry part of central India, rainwater harvesting structures were constructed on and around the factory compound. They consisted of a series of trenches and earth bunds stabilized with vetiver grass. The improved water retention provides water for domestic use and irrigation of crops during the dry periods.





Chapter

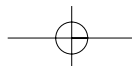
4

Improving water quality locally

Water-borne diseases are the major cause of death globally, thus the need to improve water quality is of paramount importance. Diseases such as gastroenteritis, cholera and leptospirosis not only cause premature death but also stunt growth and retard development in children. If the incidence of death and disability caused by poor quality water is to be reduced, people need to become more aware of the need for good sanitation and safe water use. The pressure is also on local government to avoid contamination or to treat polluted water.

With increasing urbanization and industrialization and more intense use of agro-chemicals, the need to protect water resources from pollution becomes ever more poignant. Particularly in countries of water scarcity, water re-use is becoming ever more important. Yet the quality of water largely determines the possibilities for bulk re-use. This chapter presents a number of ideas to activate local regulation, prevent local pollution and treat water locally.

A Cambodian girl fills her kettle from the middle of a village pond, where the water is clearer



4.1 LOCAL REGULATION AND PUBLIC DISCLOSURE

While water quality legislation and effluent standards are in place in many countries, they are of little use if not actively enforced. There is a large role to play here for local government and civil society. In the past few years, a number of significant improvements have been made, prompted by making information on water quality available to the public. A well-documented example is Project GREEN in Indonesia, where disclosure of pollution levels and water quality standards triggered strong local regulatory responses. It also forced polluters to self-regulate. Local pressure can also help to put effective regulation in place to prevent pollution from mining, industrial or shipping accidents.

Pollution charges to improve water quality

Antioquia, Colombia. Economic development is often accompanied by a reduction in water quality. In Colombia, regulations stipulated limits on effluent discharge, but polluters ignored them for several decades. In the early 1990s, community support for cleaner rivers in Antioquia district finally crystallized into demands for reform. The result was the introduction of pollution charges. All polluters, including towns, factories and farms, had to pay for each unit of organic pollution they discharged into the waterways. After just one year, organic discharge had decreased by 18%. The most striking change has occurred along the Rio Negro, where factories account for over 40% of organic pollution. These factories have now reduced their organic discharges by 52%.

Attempts to control pollution using traditional regulations, which made discharges above designated limits illegal, had yielded disappointing results. Under traditional regulation, pollution above the legal limit is punishable by fines, plant shut-downs, or even imprisonment of offending managers. But such an approach required strong and unpopular enforcement mechanisms: regulators had to monitor and analyze pollution from each plant, determine whether it violated the rules, and institute legal proceedings in cases where violation was clear. These steps are not cheap. In contrast, the pollution charges method adopted in Antioquia ensures regular measurement of water quality and generates the resources to pay for it.

Community pressure on fertilizer plants

Bangladesh. Investigators from the World Bank conducted a review of four fertilizer factories in Bangladesh, all located near rivers into which they discharged their wastewater. The investigators discovered that the factories that had been subject to substantial public scrutiny were the ones with the lowest pollution loads, even though they had considerably older equipment.

Low-cost water quality testing kits

Split Lake, Canada. The International Development Research Center (IDRC) has developed simple tests for water quality to enable local testing in locations far from conventional laboratories. The goal was to encourage people in isolated communities to conduct their own water quality tests and to take preventive or remedial action based on the results. The initiative has several advantages:

- the simplicity of the tests enables people in isolated communities to perform the tests and interpret the results themselves;
- on-site water tests cost less than one-fifth of the cost of taking a sample to a remote commercial laboratory;
- testing can be performed more frequently;
- rapid results mean water problems can be remedied more quickly.



On-site water testing

Self-regulation

Maryland, United States. Fertilizer management plans are an example of voluntary regulation in Maryland. To improve or maintain water quality, farmers can implement a fertilizer management plan, developed by a nutrient management advisor. These nutrient management professionals are certified by the Department of Agriculture.

Big companies assisting small subcontractors

Guadalajara, Mexico. Eleven large companies agreed to provide assistance to 22 of their small- and medium-scale suppliers who were interested in improving their environmental performance. The project, which enlisted the private sector, local academic institutions, the Mexican Government and the World Bank, entailed several two-month cycles of intensive training, implementation and review sessions. The Guadalajara project shows the feasibility of introducing environmental management in relatively advanced small- and medium-scale subcontractors to large firms. Project funds financed the development of local consulting skills to contribute to future pollution reduction initiatives in the private sector.

Product boycotts

Jalpaiguri, India. Some fishermen were operating the unsustainable practice of catching fish by damming small rivers and poisoning all the fish. Villagers in Jalpaiguri District decided to organize boycotts to stop this. They went around the markets and announced that no fish should be bought that day as it was poisoned. The product boycott caused a drop in sales of poisoned fish.

4.2 REDUCING POLLUTION

Local initiatives to reduce water pollution include improving rural and urban sanitation, improving industrial production processes and finding alternative means of disposal.

Promoting good rural sanitation

Mohales Hoek, Lesotho. A pilot scheme to build 400 ventilated improved pit (VIP) latrines in southern Lesotho was supported by the United Nations Development Project (UNDP) and the United Nations Children's Fund (UNICEF). The scheme led

to a mass national campaign when people in rural areas became so convinced of the benefits that they were willing to pay a month's wages to buy one. It would have been possible for the pilot scheme to build many latrines a week and meet the target. Instead, the whole of the first year was devoted to building a team, finding the best way to build latrines locally and getting to know local communities. Over time, this investment paid off. A series of planning workshops allowed local people to review the designs and building methods. Studies were conducted of local knowledge and beliefs and sanitation-related messages were integrated into primary health education, while 4,000 village health workers were trained to promote latrine construction and use. The Government contributed to the cost of organization and training, but the costs of building the latrines were met by individual families.



Pay-and-use community toilets

India. A Patna-based NGO, Sulabh International, has provided considerable help to improve sanitation in India, where nearly 85% of the population face health hazards due to defecating in the open or using unhygienic bucket privies or dirty community toilets. These practices also contribute to serious contamination of local water supplies. In addition to constructing over one million hygienic toilets, Sulabh International operates over 4,000 pay-and-use community toilets serving more than 11 million people daily. The organization has rehabilitated and retrained 40,000 scavengers formerly employed in human waste collection.



Sulabh International's pay-and-use toilets

Economic instruments help to change production processes

Manila, Philippines. The Laguna Lake Development Authority (LLDA) is a government agency responsible for protecting and managing the Laguna Lake and its watershed. They have introduced a program of industrial effluent charges to reduce water pollution in the watershed. The program aims to create economic incentives for industry to reduce wastewater discharge and to raise revenues to finance management of the program. Since introduction of pollution charges, local industries have changed their production processes and implemented other measures to reduce the volume of effluent and pollutants discharged into the lake. The biochemical oxygen demand (BOD) from direct discharges has reduced by 88% after just two years. In addition, the government has collected over 28 million Philippine pesos (US\$ 0.6 million approx.) from Metro Manila firms discharging wastewater into the Laguna watershed. LLDA has also closed around 50 companies for significant violations.



Satellite image shows the shape of Laguna Lake

Partnerships and industry-to-industry learning

Minnesota, United States. After introducing a policy of zero discharge of toxins within the Lake Superior basin, the Western Lake Superior Sanitary District shared its experience with others in the 'Blueprint for Mercury Elimination Program'. The local wastewater treatment facility also initiated the 'Lake Superior Partnership'. The two initiatives brought industries and regulators together and helped businesses to comply with environmental regulations and to work toward additional measures to prevent pollution.

Spill prevention and response

Grand Rapids, Minnesota, United States. Rivers and other water bodies used for inland navigation and where major industries are located need to have measures in place to reduce the chance of oil or chemical spills. In addition, contingency plans need to be prepared for delivering a quick response if such emergencies occur. In the spring of 2000, a large oil spill and fire occurred in Grand Rapids. Several thousand gallons of motor oil, antifreeze and other products escaped from a factory. Quick

action by firefighters prevented any serious contamination of the nearby Mississippi River. Firefighters immediately capped storm sewers and used 'booms' to confine runoff to one channel. The River Defense Network (RDN) in Minnesota played a significant role in protecting the Mississippi river from harm, by producing a 'spill response manual', a contaminant transport computer model, an atlas of areas that would be sensitive to spills and possible spill recovery locations. RDN has also hosted a number of training sessions. RDN members include state, county and local agencies and several industries. Partnerships like RDN are rather unique, but this example proves their value. The spill response manual provided the information needed by the Grand Rapids Fire Department. Good preparation made quick and adequate action by the firefighters possible.

Alternatives to intensive pesticide use

In many parts of the world, integrated pest management (IPM) techniques are promoted as an effective and environmentally beneficial alternative to the intense and indiscriminate use of pesticides. IPM advocates a very limited and targeted use of pesticides and promotes alternatives such as light traps and cover crops. The philosophy is to avoid killing the natural enemies of the pest and to rely instead on beneficial predators. The benefits for water resources are that IPM can have a marked effect on improving water quality by reducing pollution of water by pesticides.



Ichneumonid wasps kill insects which are harmful to crops

Pesticide-free parks

Seattle, United States. The city of Seattle has designated six large feature parks and eight smaller parks as pesticide-free. Besides providing park users with the opportunity to enjoy parks maintained without the use of pesticides, they are also designed to demonstrate best management practices for managing landscape resources. Special education is provided for park staff and for interested members of the public.

Target special professional groups

Minnesota, United States. A public education program called MercAlert managed to reduce mercury concentration in the wastewater discharge from dental clinics from 16 grams per day to 5 grams per day. Other targeted campaigns have concentrated on sectors such as the washing industry, automotive repair shops or boat operators to reduce contamination by detergents and oil.

Collection points for disused motor oil

Disused motor oil is a major source of water pollution. The oil from a single oil change can affect the taste of a million liters of drinking water. Just one liter of oil can produce a one-hectare oil slick on the surface of water. In several places, collection points are in place for disused motor oil. Often the used motor oil is recycled into lubricating oils that meet the same specifications as non-recycled motor oil. Otherwise it can be burned in special furnaces to produce heat, or used in power plants.

Storm water disposal permits

Great Lakes, United States. To reduce urban pollution, storm water disposal permits were introduced for municipalities and industries. This helped to control the points of possible pollution.

Turn waste into a resource

What is waste to one is a resource to another. Across the world there are several examples of waste re-use that have served to prevent or reduce the contamination of water bodies. In some countries waste exchanges are in place that facilitate the exchange of waste between factories.



Reduce water pollution at home

What you can do to reduce pollution by runoff water:

- Grass can be a good fertilizer. After mowing, use grass clippings as fertilizer by keeping the clippings on the grass.
- Use fertilizers wisely. Be careful when fertilizing to avoid untimely or excessive application. Use fertilizer on flat areas and not near sensitive areas like waterways. Use phosphorus-free or low-phosphorus fertilizers. Don't apply if major storms are anticipated.
- Now that I've changed the oil in my car. Dispose of used oil, antifreeze and paints properly, and clean up accidental spills. Pouring them down the storm drain or hosing the spill into the drain could wash the toxic chemicals directly into your local river or lake.
- Phase out phosphates. Avoid using phosphates in detergents. Phosphates create algal blooms in waterways. Phosphate-free detergents are available commercially.
- Watch out for hazards. Properly store and use (as well as dispose of) household hazardous chemicals such as auto fluids, pesticides, paints, solvents, fertilizers etc.
- What? No garbage disposal in the sink? If you are hooked up to a septic tank, try to minimize use of your garbage disposal unit. This will reduce the buildup of solids in your septic tank and reduce the frequency of pumping. Even if you are not hooked up to a septic tank, most of what you'd ordinarily put down your disposal unit can be composted into fertilizer which, if properly used, could save you money.
- Go biodegradable. Use biodegradable cleaners and other alternatives to hazardous chemicals. Reduce your use of chlorine-based cleaners and bleach.
- Inspect your septic. Inspect and maintain your septic tank regularly.

Source: The National Wildlife Federation, USA

Water hyacinth utilization

Nairobi, Kenya. One of the pilot projects of the Nairobi River Basin Project is a water hyacinth utilization project. Water hyacinth purification ponds are constructed to demonstrate good management of this invasive species, and its use in the purification of polluted water systems. Expertise is being developed for the use of the water hyacinth as a natural raw material in the production of high-quality household products, furniture, and paper, as well as other uses for briquettes, compost and biogas. Income-generating opportunities will thus be created for the neighbouring communities.



Water hyacinth covering the Nairobi Dam near Kibera informal settlement



Water hyacinth

dirty liquid draining from the composter is fed into a small wastewater garden, where kangkon and fast-growing water hyacinth are planted. The plants are then used as high-protein, low-cost pig feed. Construction- and furniture-grade bamboo is grown to utilize the remaining water and nutrients.

Dairy waste as a nutritional supplement

Maharashtra, India. The waste from a dairy plant in Maharashtra used to be discharged into the public sewer system. Without effective water treatment, this caused serious pollution downstream. Although the creamy liquid effluent could not be used to make commercial dairy products, it retained worthwhile nutritional value. When employees of the dairy plant realized this, they made arrangements with a number of local schools in the vicinity who were happy to give the liquid to the children as a lunch-break supplement.

Biodegradables

Non-biodegradeable plastic often ends up in water bodies. Plastic causes pollution and tends to clog up water systems. A new generation of biodegradable packaging materials is currently being introduced that will have a marked effect in reducing this man-made environmental hazard.

4.3 CLEANING POLLUTED WATER

Pollution cannot always be prevented and water treatment often becomes necessary. When financial projections were made to establish what it would cost for the world to become water-secure, water treatment took the largest part (GWP 2000).

From pig waste to pig feed

Micronesia. The Pacific island state of Pohnpei was experiencing problems with pig waste, which was contaminating soil and waterways and causing diseases such as leptospirosis. As a result, the South Pacific Region Environmental Program developed an ecologically integrated system. First, the pig manure and spilled feed is composted.

Conventional water treatment plants have an optimum minimum scale, which puts them out of reach in many localities. Recently, several initiatives have begun to promote domestic filtering of water and the natural cleaning capacity of rivers and wetlands has been explored. In constructing artificial wetlands the costs of the land can be a bottleneck – particularly in areas where land prices are high.

Practical ideas to help an automotive repair shop become more water-minded

Getting started:

- Make a commitment to pollution prevention. This commitment must start at the top, with the owner or manager of the shop, and extend to every employee.
- Involve the employees in designing and implementing pollution prevention measures.
- Provide training in waste reduction techniques and practices. Don't let this be a one-shot effort: periodic refresher courses will help to increase employees' awareness of the importance of waste reduction.
- Establish incentives to encourage workers to use waste reduction techniques and to suggest changes in design or operating procedures that would further reduce waste generation.
- Assess the shop's waste. Identify sources, types and amounts of waste being produced. This will make it easier to pinpoint areas where waste reduction techniques can be applied and to measure the success of your efforts.

Water measures:

- Locate and repair all leaks to prevent loss of raw materials. Practice preventive maintenance to avoid future losses.
- Install flow meters, flow control devices and shut-off nozzles to cut down on water usage.
- Minimize the amount of cleaning solvent lost during drainage of cleaned parts. Remove parts from the bath slowly to prevent spillage, install drip trays or racks near the bath for draining cleaned parts, return the drainage to the bath.
- Use on-site recovery techniques to make solvents reusable. Consider leasing or purchasing solvent recovery equipment. Common methods of recovery include:
 - Decanting: drawing off liquids from the settled sludge. Alternatively, the bottom sludge may be drained out.
 - Filtration: passing solvent through a porous medium to remove the solids.
 - Distillation: separating liquids from each other by taking advantage of their different boiling points.

Source: Small Business Environmental Assistance Program (SBEAP), Pollution Prevention Institute, Kansas State University, USA

Community pressure to improve wastewater treatment

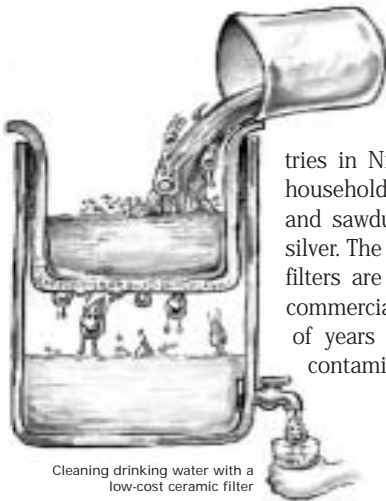
Texas, United States. The chemical manufacturer, DuPont had, for many years, been discharging wastewater into the Guadalupe River and Victoria Barge Canal. Local communities, through an official Community Advisory Panel, proposed that the company should change its wastewater discharge method for the nylon and polyethylene manufacturing plant operating in Victoria, Texas. The injection of contaminants in deep soil strata was replaced with biological treatment and cleaning through a constructed wetland. Dupont also modified its production processes.

Cutting costs by recycling materials from the wastewater stream

Niagara Falls, United States. The chlor-alkali plant of Olin Corporation has been successful in reducing the amount of waste it generates. Interestingly, the company found that waste reduction activities can also result in increased revenues and improved relationships with critical customers. Olin's chlor-alkali plant in Niagara Falls recently received the New York State Governor's Award for Pollution Prevention. The project introduced a new recycling system, which has been operating since January 2000. The system eliminates the daily discharge of 16,500 gallons of wastewater to the city's sewage treatment facility and captures former waste materials for re-use to make saleable products such as liquid bleach and hydrochloric acid.

Low-cost domestic water filters

Nicaragua. 'Potters for Peace' is a local organization that has been working with local industries in Nicaragua to make low-priced water filters for household use. The filters are made from a mixture of clay and sawdust, which is fired and treated with colloidal silver. The cost of the filters ranges from US\$ 5 to 15. The filters are produced by a local manufacturer and sold commercially. Surveys showed that even after a number of years the filters effectively eliminate all bacterial contamination.



Cleaning drinking water with a low-cost ceramic filter

Common effluent treatment plants

India. Common effluent treatment plants have been established at several industrial estates in India to collect and treat wastewater, sometimes from over 1000 manufacturing units. Usually, a limited number of larger companies initially sponsor the effluent treatment plant while smaller companies subsequently subscribe to the services.

Restoring a river's natural cleaning capacity

Drenthe, The Netherlands. The small Hunze River in the province of Drenthe was formerly canalized, but has now been restored to its original meandering course. One major objective is to restore the purifying capacity of the river. In its natural course, the river will deposit sediment, and the reeds along its bank will act as water filters. Restoring this natural cleaning capacity will, hopefully, improve the water quality of the Zuidlaarder Lake into which the river flows. The river can now also act as a water storage facility, as storm water no longer has to be drained out of the area immediately.

The cleaning capacities of wetlands

Calcutta, India. Five kilometers from the eastern edge of Calcutta is a large area of wetland. One third of the sewage produced by the city drains into these wetlands, but there is no apparent pollution. This is because wetlands have a natural ability to filter and clean the water. In fact, the sewage waste supports a large fishing and agricultural industry. Over 20,000 people live and work in the East Calcutta Marshes, producing 20 tons of fish and 150 tons of vegetables a year. There are 250 fishponds, covering about 3,500 hectares. In addition to domestic waste, industrial effluent enters the wetlands. Water hyacinth is used to leach out heavy metals, and other plants are used to absorb grease and oil. The government has recognized the value of this natural recycling system and has forbidden urban encroachment into the area.

Constructed wetlands

Lima, Peru. Effluent water from the city of Lima is treated by flowing through a series of ponds that support a large population of algae and other organisms. After 20 days in the ponds, the water can be used to supply fish ponds with nutrients. The fish are harvested for human consumption and the sludge from the treatment ponds is used as a fertilizer on the fields.



Biological cleaning at a chocolate factory

Industry applications

Las Vegas, United States. Ethel M's Chocolate Factory uses living technologies to treat

the wastewater produced by confectionery manufacture. 'The Living Machine' consists of a series of large tanks containing a wide range of organisms, which work together to digest and break down organic pollutants. The system has the capacity to treat 32,000 gallons of wastewater per day. The company re-uses the water for onsite truck washing, toilet flushing and watering their cactus garden.

Duckweed in wastewater treatment

Mirzapur, Bangladesh. PRISM-Bangladesh, a local NGO, has developed a successful duckweed system (using *Lemnaceae* spp.) for the production of fish protein and the treatment of wastewater generated by the Kumandini Medical Complex in Mirzapur. Approximately 0.5 million liters of raw sewage are pumped daily from the complex into the waste treatment system, which successfully treats the waste stream of 2,500-3,000 people. Duckweed is an aquatic macrophyte that can be used in wastewater treatment. It has high nutritional value, and can be a profitable crop. If grown in domestic wastewater that is free of heavy metals, duckweed can be used as an animal or fish fodder and as a green fertilizer. Duckweed is also successful in suppressing algal growth, since it competes successfully for sunlight and nutrients.

Chapter

5

Clean-up programs

Many rivers, lakes and wetlands have been neglected or badly managed over a long period of time. As a result, their water resources have become degraded and polluted. Riverbanks and flood plains have been invaded by unplanned human development and many wetland areas have been converted to other uses. Poor management and neglect are often symbolized by dramatic events, such as massive fish deaths or the disappearance of species, which can mobilize political and public support for change. Efforts to clean up rivers, lakes and groundwater reservoirs can become a powerful rallying point for wider changes in water management.

A clean-up program consists of several aspects. Analyzing the situation is a good start, but subsequent action needs the commitment of many different stakeholders. Therefore, awareness and participation of relevant actors is essential. A program consists of a set of measures and actions. Technical and organizational skills and tools are necessary for correct decision-making and good implementation. These aspects are illustrated here, with several examples and ideas.

Clean-up of the Assabet river, Massachusetts, United States

5.1 SYSTEMATIC PROBLEM IDENTIFICATION

A systematic understanding of the problem – its causes, extent and impact – is the best way to start a successful clean-up program. Analysis is required, not only to grasp what caused the damage, but also to understand how to prevent it from happening again. Preparatory investigations can also establish strong working relationships that can be built on during the later stages of a clean-up campaign.

Systematic analysis

Laguna Lake, Philippines. The Laguna Lake clean-up program offers a good example of systematic analysis. Before undertaking the clean-up program, local stakeholders did a comprehensive survey and the results were shared by all affected parties, including local municipalities, local industries and other water users.

Hazard maps

Central Europe. Prevention is better than cure'. That is the lesson learned after accidental release of toxic wastewater containing cyanide and other heavy metals from mining factories into the Danube River in 2000. Following serious damage to water quality and the river environment, urgent actions were required to identify, manage and reduce environmental impact and minimize risks to human health. An inventory of potential accident risk spots along the Danube has consequently taken place. The next step is to take preventive measures at local level, which involve developing local hazard plans and enforcing stricter safety regulations.

5.2 RAISING SUPPORT FOR CLEAN-UP PROGRAMS

The success of a clean-up program is, to a large extent, influenced by the support it can mobilize in terms of cooperation of key players, financial resources and public pressure.

River festival as a trigger

Brisbane, Australia. Using leisure in the fight for a clean river is an original and attractive approach. Riverclean is a



community-based event, bringing together volunteers, school children, corporate supporters and catchment and environmental groups in a major effort to clean and revive the city's waterways. The Riverclean event achieves in one day what bush care groups would normally take months to accomplish – a complete clean-up of an affected area. Volunteers are assigned to a carefully selected site along the river, and asked to remove all rubbish and litter. They also undertake tree planting, eradicate weeds, and look out for areas of turbidity in the water. Volunteers are attracted to this enjoyable community event, which provides food and drink and free giveaways. Some clean-up days also provide guest speakers, who explain the historical and environmental significance of the clean-up area.

Threatened animal species symbolize the clean-up campaign

Western Europe. The extinction of the salmon became the trigger for a concerted campaign to clean up the Rhine in the Netherlands, Germany, France and Switzerland. Securing the return of the salmon became the slogan for the campaign and the benchmark for improved river water quality. A similar initiative has taken place to clean up the River Thames in the UK.



Salmon return to the Rhine and the Meuse

Hungary. The Foundation for Otters in Hungary aims to protect otters and their wetland habitat. The endangered otters are an emotive symbol of environmental degradation throughout Europe, and can be used to mobilize public support for wetlands conservation and the development of 'green corridors'. Because otters are at the top of the food chain, they can represent the whole system. Using otters as a means of galvanizing public support for environmental protection, the foundation has built a comprehensive program focused on public education and community involvement.



The Otter as a symbol of wetland restoration

Local action sparks a national campaign

Lake Biwa, Japan. Pollution and eutrophication of Japan's largest lake, Lake Biwa, caused by synthetic detergents, sparked a local movement in Shiga district to promote the use of powdered soap. The movement was so successful that it triggered a national campaign to ban synthetic detergents. The Detergent Industry Association of Japan originally resisted the clean-up measures, but eventually altered its manufacturing methods to produce phosphorus-free detergents. As a result, detergents containing phosphorus have disappeared from stores throughout the country. This story illustrates how local action can influence national policy. Although Shiga district represents only 1% of the country in both area and population, the residents' movement that started here was able to influence national policy regarding the composition of synthetic detergents.



Accidents become a force for change

Ohio, United States. In Cleveland, Ohio, during the summer of 1969, water quality – quite literally – became a hot issue. On June 22, the Cuyahoga River, which runs through the city and flows into Lake Erie, caught fire. Flames up to 15 m high engulfed two railroad bridges. The fire prompted a grassroots movement to clean up the mess and the situation has improved dramatically. Now, nearly 30 years after the Clean Water Act of 1972 forced the clean-up of the Cuyahoga, the foul odor is gone. Although problems still exist, more than 25 species of fish have returned and many people enjoy fishing along the riverbanks.



The Baja Mare spill triggered new efforts to restore the Tisza River

Baja Mare, Romania. Accidental pollution of the Baja Mare with cyanide in January 2000 caused serious environmental damage in the Tisza River basin. The disaster was the trigger for an extensive program to restore and improve the natural value of the river and reduce the risk of similar spills in the future.

Public information boards

Santa Barbara, Florida, United States. To improve awareness and gain public support, the Santa Barbara County Water Agency developed permanent information boards at beachfronts, with displays on beach status and water quality. This approach can equally well be used alongside lakes and rivers, with signs at visible spots informing the public about the importance of maintaining water quality and local biodiversity.

Programs to activate local citizens

United States. The US organization 'Walton League' has developed several programs to improve water quality. The focus is on communities, groups and individuals. The 'Save Our Streams' and 'American Wetlands' campaigns aim to educate and motivate citizens to clean up stream corridors, monitor stream health, restore degraded stream banks and protect dwindling wetland acreage. This approach has been proven to have a positive effect on the quality of water by making people more aware and encouraging them to become involved in maintaining their local environment.

School adopts a water body

Minnesota, United States. St. Olaf College in Northfield, Minnesota has adopted a local wetland. Rather than supplying financial resources, the school is providing labor. Students undertake several nature conservation projects in their adopted wetland every year. Real life experience gained working with wetland conservation is likely to have a great impact on the students and can be more influential in gaining their commitment to the environment than many other awareness-raising activities.



St. Olaf College adopted a wetland

The 'Chain of Lakes' project: a clean water partnership

Minneapolis is famous for its spectacular chain of five lakes located within an urban regional park in the heart of the city. The lakes – Brownie, Cedar, Isles, Calhoun and Harriet – draw locals and visitors to their shores for fishing, swimming, sailing, walking and running, concerts and picnics. With an estimated 5.5 million visitors annually, the intensive public use of the chain of lakes exceeds that of Yellowstone National Park.

However, draining of wetlands and urban development have resulted in a steady decline in water quality, and the lakes have become cloudy with algae and sediment. In 1992, a 38-member citizen's committee completed a study of the problems and presented possible solutions to the Minneapolis Park and Recreation Board. The resulting project became one of the largest successful urban lake restoration programs in the country. This six-year, US\$ 8.1 million program was a team effort headed by the Chain of Lakes Clean Water Partnership, which included Minnehaha Creek Watershed District (MCWD), the city of Minneapolis, the city of St. Louis Park, the Minneapolis Park and Recreation Board and Hennepin County.



Measuring water clarity with a secchi disc

Source: Minnesota Office of Environmental Assistance (www.moea.state.mn.us)

Overall program goals were to improve water quality and wildlife habitat while increasing lake users' awareness of sources of polluted runoff. To accomplish these goals, the Chain of Lakes Clean Water Partnership implemented these projects:

- Extensive lake restoration through wetland rehabilitation and pond construction with native plant landscaping, dredging, removal of rough fish and lake alum treatment.
- Ongoing municipal work, such as shoreline stabilization to prevent erosion, street sweeping and grit chamber installation.
- Municipal ordinances to reduce pollution in runoff from thousands of acres, and community outreach and education, including neighborhood education efforts to encourage lake-friendly lawn care practices.
- For a complete and lasting solution, the Chain of Lakes Clean Water Partnership combined environmental engineering strategies and community involvement, which continues to significantly improve water quality in the chain of lakes.

The project showed the following results:

- Cedar Lake water clarity rose from 1.7 to 4.2 m of depth clarity in three years.
- Lake Calhoun phosphorus levels reduced by more than 66% in 1999.
- Newly landscaped ponds and wild areas have been planted with native flowers and grasses.
- New bridge and walking paths have been added to Lake Calhoun ponds.
- Wildlife observation areas have been added to Cedar Meadows, which used to be a mowed field used primarily for hitting golf balls.

5.3 BUILDING COMMITMENT

Partnership in integral regional wastewater strategy

Northumbria, UK. When disposal of sewage sludge into the sea was prohibited by the EU in 1998, the Northumbrian Water Authority (which serves 2.6 million people) had to find an innovative alternative solution. In partnership with the UK's Environment Agency, regional industries and legislative bodies, Northumbrian Water developed a new wastewater treatment strategy that enabled itself and neighboring industrial companies to meet EU regulations and produce useful end products. The new facilities were constructed on a brown field site created by the capping of a chemical waste tip. The initiative resulted in a dramatic improvement to the quality of the River Tees and proved to be energy efficient and environmentally effective. The end of direct discharges into the estuary has resulted in the return and passage of migratory fish.

Cooperation between landowners and NGOs in wetland restoration

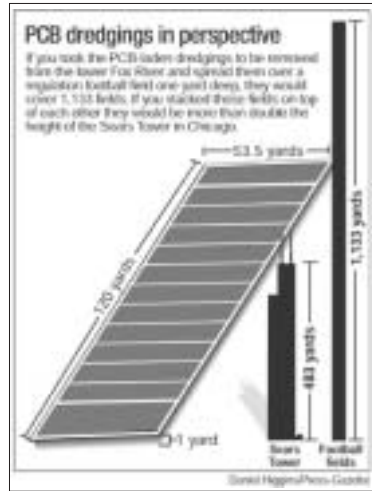
Florida, United States. The Mallory Swamp Restoration Project is a partnership between several private landowners and a non-profit organization called Florida's Legacy. The goal of the project is to promote conservation by private landowners and demonstrate that natural land restoration can be effective, efficient and economic. The land is managed under the umbrella of Florida's Legacy. Landowners focus on sustaining ecosystems as well as individual species. Additionally, the project supports local communities and engages students in environmentally and socially meaningful activities. As more landowners join in the program, the project will further its objectives to increase the protected habitat base of the Florida black bear and to establish corridors to other nearby public conservation lands.

Involve communities in improving rivers

Barra Mansa's County, Brazil. A program of education was started to encourage communities in Barra Mansa's County to clean up their rivers, streams and borders. The project succeeded in removing 2000 tons of waste from the Cotiara River and the Vila Coringa and Vista Alegre streams. The clean-up was achieved by involving local communities and training local representatives. Although garbage is still thrown into the rivers, water pollution has reduced significantly since the project began.

Involve the polluters in cleaning up

Wisconsin, United States. The principle ‘the polluter pays’ is a good principle, but is sometimes hard to achieve, because of lack of legislation or because the polluter ceases to exist. In Wisconsin, the principle holds and is enforced. Here, the Fox River has been polluted by several paper producing factories. The factories are now united by the Fox River Group, which is actively engaged in decision-making on the clean-up. For example, the Fox River Group helped to decide what clean-up method should be used and proposed the (cheaper) capping method instead of dredging. Capping means that the contaminated river bottom will be covered with special cover-



sheets to make sure the polluted material stays where it is. The Fox Group preferred capping, because it would be cheaper and, according to them, dredging would harm the ecosystem. Although the government did not agree with the proposal, it investigated the possibilities of the capping method. The viewpoint of the polluters is taken seriously, because they are going to pay for the clean-up.

5.4 CLEAN-UP MEASURES AND ACTIONS

Clean-ups of fresh water bodies are often preceded by years of neglect, and therefore generally involve more than simple remedial measures. Integrated approaches

are common and, in many cases, the clean-up itself has become the central element of a much larger program of economic and environmental rehabilitation for the area concerned.

5.4.1 INTEGRATED MEASURES

Integral lake cleaning project

Norfolk, UK. The aim of the Clear Water 2000 project was to restore Barton Broad to a healthy and attractive state for the benefit of wildlife and public recreation. Barton, on the River Ant, is the second largest lake in the Norfolk Broads waterways system. Barton Broad has been severely affected by decades of nutrient enrichment from phosphates and nitrates that have been washed into the water from the surrounding arable land. The nutrient enrichment led to the growth of algae, loss of water plants and a serious decline in the wildlife interest of the broad. The water has become murky and lifeless.



Barton Broad



Specially designed mud storage lagoons

- A range of integrated measures has been undertaken to improve the water quality:
- the whole of the broad has been suction dredged to remove nutrient-rich mud;
 - the mud was dispersed onto nearby arable land, where it could improve the soil;
 - work is being carried out to restore clear water and aquatic life in parts of the broad using biomanipulation (see section 5.5);
 - the reed swamp fringe to the edge of the broad is being restored;
 - pleasure Hill, a small island, that had been almost completely eroded away, has been rebuilt;
 - new facilities are being developed to provide information, education and access, including a walkway and a boat trip.

Integrated River Basin Project

Nairobi, Kenya. Studies of the Nairobi River Basin indicate that river pollution, due mostly to human activity, is causing serious environmental and health problems. Many people lack access to clean drinking water and sanitation, and there is a general lack of environmental awareness and law enforcement. The Nairobi River Basin



Industrial wastewater flows straight into a tributary of the Nairobi River

Project was started to address these widespread issues, and is being carried out in three phases under the auspices of the United Nations Environment Program. Phase I (1999-2001) undertook an analysis of the situation and began building capacity at local level through stakeholder and community involvement. Phase II is now underway and aims to coordinate efforts and form partnerships between different stakeholders, especially between

the Nairobi City Council, Ministry of Local Government, Ministry of Environment and Natural Resources, the private sector, NGO's, neighbourhood associations and community-based organisations. These partnerships will help to improve planning and implementation and create a supportive policy and legal environment. Consultation with the chief polluters will be used as a basis for managing and rectifying the situation.

Phase II demonstration projects include:

- providing sanitation and clean drinking water to 1200 households;
- pollution monitoring;
- public awareness and education;
- construction of wetlands;
- water hyacinth utilization.

Phase III (2003-2006) will replicate successfully implemented strategies throughout the Nairobi River Basin.

River clean-up drives a wider program

San Jose, Costa Rica. The problems of the river Torres became the focus of a major urban environmental initiative in San Jose, which included urban land use management and planning, economic development, recreation and the protection of marine resources. The clean-up of the river became the driving force in a comprehensive strategy for the rehabilitation of the capital. Environmental management now plays a key role, not only for its contribution to urban sanitation and economic development, but also as the emblem of social and political responsibility for development.

The strategy consisted of:

- riverbank development for neighborhood improvement and tourism;
- the extension of the existing wastewater collection pipe network;
- the cleaning and restoration of the river bed;
- better arrangement for solid waste collection;
- improvement of water distribution services and charges for wastewater treatment.

Chengdu, China. In Chengdu, a similar approach has been followed. Environmental pressure on the Fu and Nan rivers, and the danger of flooding, caused the city of Chengdu to advocate a comprehensive approach. In order to prevent future flooding, restore the ecological balance and flow of the rivers and improve water quality, several goals were pursued in tandem:



Renovated waterfront, Chengdu, China

- finding alternative housing solutions for the 100,000 inhabitants of low-quality settlements bordering the rivers;
- relocating or closing down over 1000 enterprises and factories to reduce or eliminate industrial effluent and emissions;
- implementing a comprehensive wastewater collection and treatment system;
- adopting the necessary policies that would enable all of the above to be implemented in a transparent and accountable manner.

To finance this project the local government adopted a strategy of partnership and participation. This resulted in a rise in environmental awareness and the mobilization of central and provincial governments, domestic and foreign investors and the general public. Over 30,000 households previously inhabiting the slums on both banks of the two rivers have been re-housed in new housing estates. The vacated land has been used to create a green zone, with parks and recreational and cultural facilities. The two rivers have been de-silted, widened and their ecological flow restored, reducing flood vulnerability to a 1 in 200 year risk. A series of concomitant projects dealt with solid waste, sewage collection and treatment, industrial effluent, road infrastructure, transport and communications and parks and gardens.

5.4.2 FINANCING CLEAN-UP PROGRAMS

Develop special funding lines

Minnesota, United States. The Clean Water Partnership program in Minnesota was created to provide local government with technical and financial resources to protect and improve streams, lakes and groundwater. Local governments can use the funds to set up their own programs or to pass on to other parties through loans.

Corporate sponsorship

Lake Constance, Germany and Michigan, United States. As part of its contribution to the 'Living Lakes' project, Unilever invested some US\$ 1.3 million in the rehabilitation of Lake Constance. However, Unilever is not the only company active in sponsoring and partnering water programs and clean-ups. Dow Chemical is involved in the Saginaw Bay Watershed Initiative in Michigan, USA, where the company has worked with local communities, conservationists, activists, foundations and businesses to maintain the area as an economically and environmentally sustainable community.

Adopt a river, lake or wetland

Korea. Some 450 companies in Korea have joined 'adopt a river' and 'adopt a mountain' clean-up campaigns. For example, each of the Samsung Electronics plant sites nationwide has chosen one mountain and one river to care for in an attempt to promote conservation and to fulfill its responsibility to society. The companies also benefit from positive public relations coverage of their activities.

Create value by upgrading waterfronts

Ohio, United States. Work to upgrade rivers usually results in an increase in the value of waterfront properties. These properties may be marketed for redevelopment or for a variety of high value uses, including commercial activities, entertainment and residential purposes. Through strategic real estate management the clean-up investment can be recouped. For example, in Cleveland in the late 1960s, the river Cuyahoga was effectively environmentally dead, with only a few species of bottom-living fish scavenging the depths of its rancid waters. The stench was unpleasant and, on particularly hot days, unbearable. Since the river has been rehabilitated, property prices along the waterfront have soared and the once unsightly riverfront area is now a desirable place to live.



Cleveland: Upgrading waterfronts creates economic value

Promote ecological tourism

Estonia. Clean water bodies have an important economic value and investment in clean-ups can be recouped from the proceeds of ecological tourism. In Lake Peipsi in Estonia, a network of NGOs and state bodies engaged in tourism has been developed to improve the coordination and promotion of tourism in the region.

Proceeds of gravel mining

The Netherlands. Part of the restoration works to the River Meuse required the excavation of gravel pits in the river. The proceeds of this were used to finance river improvements such as the development of ecological zones, improved protection against flooding and better navigation.

5.4.3 ACTIONS AND MEASURES

Step-by-step introduction of permit system

The Netherlands. In the 1970s, the Dutch government introduced a permit system to stop the dumping of waste in rivers and to reduce water pollution. The legislation was introduced in steps. Every company was given a permit and, to maintain the

permit, companies had to reduce their polluting activities bit by bit every year. Companies were thus able to reach the desired standards in reasonable steps, but were penalized if they failed to perform.

Ordinance to improve water quality

Japan. The 'Lake Biwa Ordinance' was set up to regulate the use of synthetic detergents and to prevent the general eutrophication of Lake Biwa. It prohibits the use, sale and exchange of phosphorous-containing synthetic detergents within the Lake Biwa basin, sets the world's first regulatory standards for factory effluent related to nitrogen and phosphorus, and promotes appropriate use of fertilizers. Disposal of agricultural wastewater is also regulated.

Alternative disposal arrangements

India. One of the main sources of pollution in Lake Bhopal was found to be chemicals and mud originating from the effigies that were ceremoniously drowned in the lake during religious festivals. Water quality improved after an alternative disposal arrangement was found for these mud statues.

Organize a clean-up day

Massachusetts, United States. Organizing a clean-up day can meet two goals: raising awareness in the community and improving the quality of the environment. A clean-up day may conclude with a festive event, such as a joint meal or a prize draw. The Assabet annual clean-up day is a good example. It was first organized in 1987 by the Organization for the Assabet River, a non-profit group whose mission is to preserve, protect and enhance the Assabet River, its tributaries and watershed. The organization currently has 740 members, a 15-member board of directors, and a part-time staff of five. In 2001, the fifteenth annual river clean-up was attended by over 200 volunteers, who pulled hundreds of tires and bottles and tons of metal out of the water.



Assabet River clean-up day, September 8, 2001

Mitigation banking

United States. The Clean Water Act requires landowners wishing to develop land in the US to avoid or minimize damage to wetlands. If destruction cannot be avoided, landowners have to compensate or mitigate for the loss. When local compensation is not possible, as a last resort, developers and landowners have the possibility to buy credits at so-called mitigation banks. There are about 150 wetland banks in the USA, active on 300 sites, with 140 more planned. At first, mitigation banks were public or non-commercial, but now, commercial banks have discovered the mitigation banking business too. Wetland banking holds great potential, particularly because the bank operators – as opposed to developers – aim to secure wetland restoration. Mitigation banking restoration and preservation could be more effective than local mitigation, because there are benefits of scale. The threat of small, fragmented wetlands can be dealt with more effectively. The next step in this development could be the rise of 'conservation banking', to preserve, protect and restore wetland ecosystems.



Flyer promoting a clean-up day in Medford, USA

5.5 CLEAN-UP TECHNIQUES

The range of techniques used in clean-ups is large, and new ones are continually being developed. Several measures were mentioned in the cases described earlier. A few more are discussed below.

Clean-up boat

Manchester, UK. Several canals flow through the city center of Manchester and these are increasingly being used for recreation. Although recreational use of the canals and tow-paths is encouraged, this inevitably leads to littering as discarded drinks cans, fast food cartons and cigarette boxes find their way into the waterways. Cleaning up takes a lot of time and money. Four men used to work from boats with rakes, physically taking out the litter by hand. Now, a special clean-up boat has been developed with a two-meter-wide metal mesh basket that scoops up the litter. Keeping the canals clean now needs only two men and the job can be done five or six times faster.

Use of natural filters

Pines River, Australia. Planting vetiver grass is well known to reduce the velocity of floodwater and to limit soil erosion. Vetiver grass also has filtering properties and can be used to improve water quality by filtering out polluting matter like herbicide residues. In Pines River, the realignment of a new bridge on a major rural road had caused serious flood erosion to the river-bank. The eroded section was repaired and vetiver grass was planted on the bank. That section of the river is now completely stabilized and has withstood several minor floods in the last few years.



Vetiver grass waiting to be planted

Great Lakes clean-up

Great Lakes, United States. In 1990, the Canadian Government initiated the 'Great Lakes 2000 Clean-up Fund', an ambitious program that aims to restore water and environmental quality in the Great Lakes area. Projects have started in 17 designated areas of concern, under the Fund's priority issues of contaminated sediment remediation, fish and wildlife habitat rehabilitation, municipal sewage treatment plant optimization, urban runoff and storm water control, rural pollution control and communications. Many projects are showing success in terms of improvements to water quality and rehabilitation of aquatic habitat. For example:

- The City of Hamilton has created three coastal wetlands, two beaches, underwater reefs and spawning beds.
- Underwater habitat modules have been placed offshore for fish and over 50 different shoreline configurations have been installed at the harbor edge to increase biodiversity.
- There has been a significant improvement in aquatic vegetation and many more fish have been observed at the site compared to other areas of the harbor.
- Following fish habitat improvements in LaSalle Park, up to 18 different fish species have been recorded near the shore instead of the 6 to 8 species observed prior to the restoration project. Turtles have been seen and migratory ducks visit the site in large numbers.

- Approximately 571 ha of wetland and 175 km of riparian habitat have been restored and another 2832 ha of wetland and 206 km of riparian habitat have been protected.

In addition to cleaning up the environment and rehabilitating habitat, several projects have generated documents that will help to transfer useful knowledge and technology.

Bio-manipulation

Norfolk, UK. After a number of clean-up measures (see section 5.4.1), 'bio-manipulation' was used to restore aquatic life to Barton Broad. Lakes tend to be either nutrient-rich and dominated by algae, or clear and full of plants with low to medium nutrient levels.



Electro-fishing in Barton Broad

Bio-manipulation involves manipulating a number of biological factors, thereby causing the lake to switch from one state to the other. Microscopic animals, such as water fleas, are needed to create clear water. They thrive on eating algae, the tiny plants that, in large numbers, make water cloudy and prevent larger plants from growing. In summer, water fleas can clear an entire lake of algae. Water plants can then grow in the clear water and these provide a refuge for the water fleas, which continue to keep the water clear of algae. Without somewhere to hide, water fleas are eaten by young fish.

In case of Barton Broad, even after suction dredging had removed the nutrient-rich mud from the bottom, there were no plants, so the fish continued to eat all the water fleas, allowing the algae to thrive and make the water cloudy. To break this cycle, the fish had to be temporarily removed and the plants allowed to re-establish themselves. The fish were removed by a technique called electro-fishing, where an electric current is passed through the water, stunning the fish. They can then be scooped up and put into tanks or released into another broad or river where they will do no harm. Bio-manipulation also benefits fish-eating birds such as kingfisher and grebe. Once the water has cleared, the birds can see their prey more easily.

Biological groundwater remediation

United States. Working with poplar trees and specialized microbes, researchers are proving that groundwater and soil can be cleaned up naturally. Modified microbes that grow on tree roots, and on the trees themselves, can break down the pollutants. This process is known as phytoremediation and may be a viable alternative to more conventional clean-up methods. One major benefit of the method is that it assists the natural environment and ecology, while some other pollution clean-up strategies, such as incineration. In some locations, microbes can provide an alternative to labor-intensive groundwater sampling as a method to monitor water quality. This is called phytomonitoring.

Cleaning up underground petroleum pollution

Romania. The Astra Romana Oil Refinery has been active for more than a century. Although an economic asset to Romania, it has led to a dangerous accumulation of petroleum residues in underground water resources and soil in the area surrounding the refinery. Leaked petroleum has accumulated in the layers above the groundwater (up to 7 m deep underground) over 400-500 ha surrounding the refinery. In addition to soil and water contamination, leaked petroleum residues are a source of hydrocarbon vapors that may infiltrate the basements of surrounding homes. After a number of trials, a double-pump system was installed to recover petroleum from two extraction wells in the refinery. The pilot system recovered 5 tons of petroleum per month. The simple payback time of the pilot system, as well as of the complete, 12-well system, which will be installed in the near future, is between 3.5 and 4.5 years. The project not only applied new knowledge, it also aimed to disseminate it to others.

Passive treatment technology

Slovak Republic. In 1991, the Smolnik Mine in eastern Slovakia was abandoned. The mine, like many other inactive mines in Slovakia, has since become a significant source of water pollution and is adversely affecting water quality both locally and internationally. A creative and low-cost solution was needed to address this serious environmental problem. The feasibility of using passive treatment technology to improve the water quality of mine effluent was explored. This technology appeared to be useful and applicable for reducing water pollution. Passive treatment technology is based on the immobilizing of metals by bacteria and plants in man-made wetlands. A pilot test revealed that heavy metal pollutants such as aluminum,

copper, and zinc could be reduced by almost 70% and acid levels were significantly reduced. The pilot study demonstrated that the materials needed to build a passive treatment system are attainable and inexpensive compared to active water treatment systems. While active water treatment requires ongoing maintenance that is costly, passive treatment is low in maintenance costs. The pilot project has also helped to develop a network of expertise and information.

Benefits and disadvantages of onsite constructed wetlands for wastewater treatment

The benefits of constructed wetlands for wastewater treatment are:

- they are relatively inexpensive to construct and operate;
- they are easy to maintain;
- they provide effective and reliable wastewater treatment;
- they can tolerate both great and small volumes of water and varying contaminant levels;
- they can be aesthetically pleasing and provide habitat for wildlife and human enjoyment.

The disadvantages of constructed wetlands for wastewater treatment are:

- depending on the design, they may require a relatively large land area compared to a conventional facility;
- the design and operating criteria for this new science are not yet precise;
- the biological and hydrological processes within a constructed wetland are not yet well understood;
- there may be problems with outbreaks of pests, such as mosquitoes.

Source: www.waterrecycling.com



Chapter

6

Promoting transparency

Transparency is often a precondition for effective local water management. Corruption, inefficiency and the cynicism and distrust they create present major obstacles to local initiatives, to change and to improved management of common water resources. The water sector is no stranger to the phenomenon of corruption. Given the importance of water, this sector is probably subject to at least as much corruption as any other:

Local action, however, can be a powerful force against corruption. The 'Bonn Keys', formulated at the International Conference on Freshwater in December 2001, suggest: 'local authorities – if delegated the power and the means, and if supported to build their capacities – can provide for increased responsiveness and transparency in water management, and increase the participation of women and men, farmer and fisher, young and old, town and country dweller'.

Public hearing, Valencia Water Court, Spain - a centuries old institution

Many things can be done to promote transparency, such as improving information disclosure, changing the culture so corruption is no longer the norm, building capacity to report on unwanted practices and capacity to enforce the law.

6.1 PUBLIC DISCLOSURE AND ACCESS TO INFORMATION

The importance of public disclosure has already been described in the chapter on water quality management. Public disclosure is an effective means to expose water-related hazards and to alert a large public to the need to improve the management of local water resources. Public disclosure can be reinforced if mechanisms are in place to ensure complaints reach receptive decision-makers.

Transparency also means that information is easily accessible and not hidden behind artificial barriers. Moreover, good practices of companies or public service providers should be recognized, while mismanagement should be exposed. Several reporting systems that give insights into the performance of different organizations have come to light in recent years. Some of these reporting systems are based on self-regulation, while others are undertaken independently.

Easy access to information on sources of pollution

United States. The Environmental Defense Fund has published a website (www.scorecard.org), providing information on different companies and the pollution they cause, extent of pollution, and the potential effects on health. The site can be searched for information on polluting companies in a certain area (by putting in the US zip code) and for water pollution problems specifically.



The website of the Pesticide Action Network hosts a pesticide database (www.pesticideinfo.org), providing information on pesticides from many different sources together with their levels of human toxicity (chronic and acute) and ecotoxicity. The

site also has regulatory information for over 5,000 products, together with the adjuvants and solvents used in pesticides.

E-transparency at local level

Yalova, Turkey. The city of Yalova maintains a website with a declaration of possessions and property of key administrators and online information on tenders. Making information on government procurements publicly available helps to improve scrutiny and reduce the risk of closed deals.

'She brought a small town to its feet and a huge company to its knees'

The Oscar-winning movie 'Erin Brockovich' is based on a real life story. In the movie, Julia Roberts plays a research assistant who, in 1992, helped attorney Ed Masry to win a US\$ 333 million settlement against the Pacific Gas & Electric Company (PG&E): the largest settlement ever awarded in an environmental dispute. Masry and Ms. Brockovich represent 650 people who blame PG&E for contamination to their water supply originating from a power plant. The contamination causes cancer and other illnesses among the population of the small desert community of Hinkley, California. Erin Brockovich gathers evidence, which was earlier carefully suppressed, gains the confidence of the residents of the small community and wins the trial. Although the story is extraordinary and worthy of Hollywood treatment, it is an example of promoting transparency and justice through single-minded action.



The movie Erin Brockovich was based on real life litigation on groundwater pollution.

The fight against corruption must start with awareness building and should aim at maximizing transparency to the public in the entire decision-making process; from planning through procurement to construction and operation. It must focus on all parties to any corrupt practices.

Recommendations for Action, International Conference on Freshwater, Bonn, Germany, December 2001.

Acts on access to information

Aarhus Convention, Europe. In June 1998, delegates from 36 European countries signed the Aarhus Convention on Access to Information, Public Participation in Decision-

making and Access to Justice in Environmental Matters. The convention establishes a uniform set of standards for involving citizens in environmental decision-making and emphasizes the importance of fully integrating environmental considerations in government decisions. Citizens should have access to information, be allowed to participate in decision-making and receive justice in environmental matters. The convention therefore ensures transparency for its citizens. In the USA, the same result was achieved by the 'Right to Know Act'. This law was designated and enacted by Congress in 1986 to help local communities protect public health and the environment from chemical hazards. Such conventions and acts are important tools to ensure openness and transparency of information.

Make transparency compulsory by law

Maryland, United States. Here, 'right to know' legislation was introduced to govern pesticide use, forcing schools to adopt IPM strategies. Maryland schools must notify parents and students in advance of a pesticide application. This legislation alerts students and parents to the risks incurred by pesticide use and gives them the chance to demand non-toxic alternatives.

Remove jargon and expert-speak

Nevada, United States. The Division of Water Planning has developed a water words dictionary, to make the water management profession more transparent for its users. The dictionary contains a compilation of technical, quality, environmental

and water-related terms. Several other water dictionaries can be found on the Internet and some of these are mentioned in the reference annex.

Introduce imaginative communication tools

Morocco. The Hassan II University Faculty of Literature and Human Sciences in Casablanca organized a workshop: 'Comics with an Attitude'. The aims of the workshop were to combat corruption and to introduce comedy as a means of communication in raising awareness. Training was given to local artists and writers. The participants learned that it is important to tailor comedy to the culture and geography of the target audience.



World comics uses cartoons to advocate transparency

Dial your chief minister

Andhra Pradesh, India. The Chief Minister of Andhra Pradesh appears on a regular television program, where viewers can phone in. During this 'dial your chief minister' program, viewers can ask critical questions on the key programs of the government of Andhra Pradesh, such as the water conservation program.



Network of water journalists

East Africa. The Lake Victoria Basin is faced with many threats. Accurate and informed reporting on the lake and its environs can help to raise awareness and improve the relevance of local decision-making. Journalists from Kenya, Uganda and Tanzania are now working together in a project

to improve the flow of information about environmental issues. The initiative aims to improve environmental ecosystem management within the lake basin and to encourage the participation of all stakeholders.

Independent monitoring and publishing the results

Moldova. In Moldova, the association Terra Nostra has been carrying out annual ecological expeditions to the transboundary River Prut. The river is polluted by untreated wastewater from Moldovan and Romanian cities, by municipal rubbish-heaps on the riverbanks and by erosion. Terra Nostra monitors the whole Moldovan sector of the river, with journalists, representatives of ecological NGOs and students from the State University taking part in the independent evaluations. The results are handed to the Ministry of Ecology. In addition, proposals for improving the situation are circulated to radio, television, newspapers and magazines.



River Prut

Reporting on sustainable development

The Global Reporting Initiative promotes reporting on sustainable development by corporations to a level comparable with the standards for their annual financial reports. The initiative aims to avoid self-congratulating environmental reports, and to introduce a system of fair and accurate assessment of companies' achievements and failures. Reports are circulated to the general public and shareholders and over 100 companies have now adopted the sustainability reporting standards.

Company indices for socially responsible investments

FTSE4Good. The Financial Times Share Index (FTSE) is one of the world's leading share index calculation specialists and is co-owned by the London Stock Exchange and the Financial Times newspaper. FTSE



has designed an index for socially responsible investment, called the FTSE4Good. It is a series of benchmarks and indices guiding investment in companies with good records of corporate social responsibility. The criteria cover three areas:

- working towards environmental sustainability;
- developing positive relationships with stakeholders;
- upholding and supporting universal human rights.

At present, 2063 companies are listed with a rating of low, medium or high. The next step is to grade all listed companies with respect to their environmental impact and to relate this to their business type. Depending on their grade, companies will be requested to provide evidence of a publicly available environmental policy or environmental management system. The Dow Jones Sustainability Index is a similar system to assess the economic, social and environmental performance of companies.

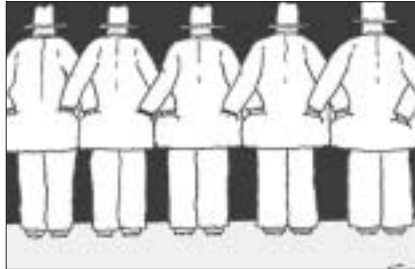
Mining report cards

United States. The Mineral Policy Center makes independent judgments on the environmental performance of mining companies and gives them a report grade. The 14-step assessment consists of measurements such as:

- phasing out existing operations at biologically, ecologically and culturally fragile sites;
- banning the riverine disposal of mine tailings;
- use of best available technology to prevent environmental degradation;
- design and implementation of water treatment;
- increasing financial commitments to clean water;
- ensuring long-term protection from acid mine drainage;
- practising full disclosure and consultation and adopting a policy of corporate transparency.

6.2 CREATING NEW NORMS

Corruption is associated with another major problem: honest behavior and real achievements tend to be discouraged. Several local initiatives have tried to break this negative spiral by redefining the way business is done and by explicitly welcoming insiders' and outsiders' comments and views. Organizations such as Transparency International have valuable experience on changing the culture of corruption, and much of their advice is relevant to the process of making water management more transparent (see Box 6).



Cartoon from the Toolkit of Transparency International

BOX 6: **The Lima Declaration**

The Lima Declaration is a landmark document agreed by an international audience at the 8th International Anti-Corruption Conference, held in Lima, Peru in 1997. The declaration articulates a broad strategy for combating corruption and suggestions for local action to promote transparency:

- make public accounts open to public scrutiny
 - open access to decision-makers and the holding of public hearings on matters of importance
 - de-politicization of the judicial system
 - periodic multi-stakeholder reviews of accountability features of all relevant organs of the state
 - transparent budget processes
 - independent surveys of public satisfaction with services
- legal reforms, in particular:
 - monitoring of the assets and lifestyles of decision-makers
 - appropriate protection for witnesses and whistle-blowers
 - providing a system for the recording of gifts received by officials
 - no immunities from corruption laws
 - blacklisting of corrupt bidders after fair investigation independent reporting by media giving the public a 'voice' to counter corruption, and in raising awareness of complaints mechanisms
 - media itself to guard against accepting bribes and inappropriate hospitality
 - educational initiatives to promote transparency and codes of conduct
 - 'anti-corruption days' or 'accountability days'.

Source: Transparency International

Anti-corruption charter

Mauritius. The local corruption problem was assessed and found to be related less to the level of education or personal wealth, and more to the fact that corrupt behavior has become the norm. In an effort to redress the balance, the government of Mauritius has designed an 'anti-corruption' charter. The charter is designed to increase awareness of corruption, and to promote terms like 'corruption' and 'integrity' more into everyday language. The charter is available in leaflet and electronic format and provides practical advice through 'do's' and 'don'ts' for individuals.

Integrity pacts

Colombia. Companies and governmental organizations in Colombia are working with 'integrity pacts' to fight bribery and corruption in contracting procedures. The integrity pacts are voluntary agreements, underwritten by all directly involved parties in a contract process, and funded with public resources. The approach has been employed with success in several recent large projects. The agreements are meant to redefine the rules of the game and consolidate transparency, justice and honesty.

Nepal. Transparency International Nepal implements integrity pacts at municipal level to curb corruption, instigate reform and promote integrity in the working environment. The main focus lies on securing public pledges by elected members at local government level. Public grievance systems have also been put in place and monitoring committees have been established.

Outsiders' review of government programs

India. The government of Andhra Pradesh has set up a water conservation mission to coordinate all watershed-related programs in the state. Every three months, the mission invites a group of 12 experts and activists to visit various activities and to review the approach and methodology used. The results of these reviews are subsequently discussed in a videoconference with all project directors of the watershed programs.

Third party verification

United States. In 2000, the US National Biosolids Partnership (NBP) management committee accepted an independent third-party verification component to its voluntary Environmental Management System (EMS) for biosolids. As a result of

Water services ombudsman

Sydney, Australia. The Energy and Water Services Ombudsman provides an independent means of resolving customer complaints about electricity, gas and water services. Consumers can submit their complaints, which are investigated by the independent ombudsman. The ombudsman itself is supported by the combined energy and water utilities, but operates under an independent council made up of consumers, small business and industry interests.

Staff rotation

Alto Rio Lerma District, Mexico. Water Users Associations (WUAs) employ several levels of management with responsibility for allocation and distribution of, and payment for, irrigation water. Following several incidents of corruption, the WUAs are frequently moving the responsibility of the 'ditch tenders', the managers who liaise directly with farmers, from one canal to another. The objective is to prevent the ditch tenders from establishing close personal relationships with water users, thereby limiting the potential for them to succumb to corrupt practices.

Introducing a transparent and digital administration

Alto Rio Lerma District, Mexico. The WUAs have introduced additional initiatives to combat corruption. They obtain an annual financial audit conducted by external independent auditors, and they have started to use computers for administrative and financial management. This has helped to improve the accuracy of financial statements and the transparency of administration. When farmers come to pay their fees, both the staff and the farmer can see immediately the number of irrigation turns he is entitled to, for how many hectares, for what crops, what he has paid and what he owes. Although financial malpractice has not disappeared altogether, it has been considerably reduced.

Approval of budget and annual plan by users

The Netherlands. All water boards in the Netherlands are governed by councils, with the council members representing all the different categories of water users. Representation is based on the amount of water charge paid by the concerned category of water users. The councils review, discuss and ultimately approve the annual plan and budget of their water board.

Participatory budgeting

Porto Alegre, Brazil. In Porto Alegre, citizens actually decide on municipal priorities through the participatory budget. In addition to the usual city councilors, citizens are elected every year from 16 geographically and socially distinct sectors that handle local problems. Each of the 16 citizens' assemblies, in addition to electing their representatives on the city-wide budget council, decide what service and spending priorities they want to see in the coming year. These proposals are forwarded to the municipal council. At the same time, the delegates to the city-wide budget council attend training sessions on municipal finances. What is special about the participatory budget in Porto Alegre is the interaction between active citizens, elected politicians and career officials. Instead of playing an advisory or advocacy role, as many citizens bodies do, the assemblies actually discuss and debate budget priorities.

6.4 CREATING THE CAPACITY TO ENFORCE LEGISLATION

In several countries, legislation exists to safeguard proper water management, for example legislation on water quality control, groundwater abstraction, wetland protection, the delivery of water services and others. But, however good these laws or other regulations may be, if citizens do not know about the laws, they cannot use them. Instead, such legislation risks being monopolized by a small insider group. Legal education and legal awareness are therefore important if laws are to be used effectively. At the same time, law enforcers should be easy to approach. There should be no financial, procedural or other thresholds to discourage the use of legal or regulatory mechanisms.

Information toolkits

United States. The Mineral Policy Center has developed a 'Toxic Release Inventory Toolkit'. The toolkit can be used to promote environmentally responsible mining in communities. Toxic release inventory (TRI) is a legal requirement in the US that forces industrial facilities to disclose the levels of pollutants they have discharged annually into the air, water and land, or transferred to other sites for recycling and disposal. The toolkit gives practical advice to citizens and action groups on what to do with the data, how to use them in discussions with miners and governments, and how to involve the media in attracting publicity. The toolkit also contains several case studies.

Legal clinics

United States. The Hudson River Keeper Organization operates the Pace Environmental Litigation Clinic where students and law professors work on cases to prosecute Hudson River polluters. Over 100 environmental lawbreakers have now faced prosecution.

Legal education

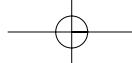
Slovak Republic. The GWP Slovakia has helped the government of Slovakia to adopt new water legislation (in line with the EU Water Framework Directive) by providing implementation courses. The training familiarized the implementers with the concept and provisions of the new law (such as water quality standards), with which they were not familiar.

Promote transparency by doing a 'mock trial'

A mock trial is a 'pretend' trial, staged to make people more aware of problems or unfair practices. Mock trials can be held in schools, on the street, in community houses etc. If companies behave irresponsibly, this is a dramatic way to teach people about the situation, attract publicity, and create an impetus for action.

Facilitate access to regulators

UK. WaterVoice operates through nine regional committees in England and one in Wales. The ten WaterVoice committee chairmen form the WaterVoice Council, which deals with issues at national and European level. If a customer or potential customer of a water company has a complaint, they are advised to first contact their local water company. If this does not result in a satisfactory solution, they can contact the Water Voice committee dealing with the concerned water company. Complaints even can be made anonymously if required.



Chapter

7

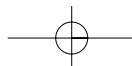
Water management within organizations



As corporate citizens, organizations have a responsibility to improve water management within their own remit. The earlier chapters have provided examples where organizations have tried to secure more efficient water use, better treatment and re-use of effluent and raised water quality. Improving water management within an organization brings several benefits such as cost savings, a good public image and a strong work spirit among its employees.

This chapter provides more ideas on what organizations can do, such as water audits, sustainable building, reduced pollution and water-wise business processes.

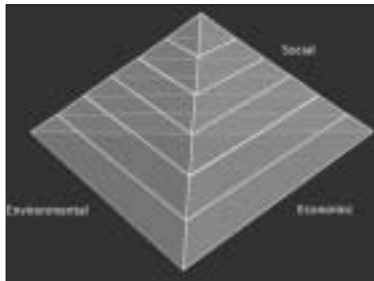
Malaysian Department of irrigation & drainage engineers explain why certain civil engineering structures are required for water storage near Kuala Lumpur



7.1 TURNING ORGANIZATIONS INTO WATER MANAGERS

Water audit

Completing a water audit can help organizations to identify their current water use requirements. This information can then be used to adapt current practices and to reduce water use. Several manuals for completing a water audit can be found on the Internet (e.g. www.gtz.de/p3u/ and www.inem.org/htdocs/inem_tools.html/).



Flygt's sustainability pyramid

Environmental year plan

Sweden. ITT Flygt (a manufacturer of water pumps) publishes a complete sustainability report in accordance with United Nations Global Reporting Initiative guidelines. The report includes facts on production, salary, environmental activities and human rights. The aim is to raise awareness of sustainable manufacturing practice among the company's employees and to compare the performance of its production facilities in different countries.

Environmental conservation committees

Japan. After introducing an environmental strategy paper: 'Green Management 2005', the electronics company, Sony, is encouraging its business units to develop local action plans. Regional and global communication is taking place through environmental conservation committees. An annual conference facilitates information exchange and shares solutions, and a series of other interim events and communication tools enable ongoing dialogue and capacity building.



Sony's environmental conservation committees

Repairing damage and addressing global issues

Norway. Norsk Hydro operates globally in sensitive and technically complex fields such as plant nutrients, offshore oil and gas, aluminum, magnesium and petrochemicals. Because of the company's size (one of the largest in the country) Norsk Hydro has been extensively regulated, monitored and challenged. In response to continual pressure, Norsk Hydro's environmental work has evolved in four phases:

1. The repairs phase: efforts concentrated on cleaning up local pollution and making up for past sins.
2. The preventive phase: the focus changed to developing and installing cleaner technology, i.e. technology that prevents pollution from occurring in the first place.
3. The business development phase: efforts concentrated on analyzing and minimizing the environmental impact of products throughout their entire life cycle, from raw materials, through production and use, to their subsequent recycling or deposition.
4. The globalization phase: Norsk Hydro began to address the challenges of globalization of economies and markets, as well as global environmental issues such as climate change and the Kyoto protocol.

Manual for retailers

Minnesota, United States. The Minnesota Office of Environmental Assistance has written a manual for retailers to help them reduce the amount of waste they produce. The 'Retail Hardware Best Practices for Waste Management' demonstrates that better waste management, reducing waste disposal costs, improving operating efficiency and reducing materials costs can all save significant amounts of money. Specific strategies are set up for different branches. Additional benefits include creating customer goodwill, selling resource conservation products and making cost savings on water consumption and waste disposal.

Shareholder activism

Churches, pension funds, universities etc. often make significant investments in the stock market. Individuals can influence investment policy to favor organizations that act in an ethical and responsible manner towards the environment. In addition, a shareholder or a group of shareholders can try to influence company policy regarding investment in a similar way.

7.2 WATER MANAGEMENT IN BUILDINGS AND REAL ESTATE

Sustainable real estate

The Netherlands. The Netherlands Center for Sustainable Building provides advice on practical site design strategies, for example measures to keep rainwater on site and, where feasible, to use on-site treatment and re-use of gray water and wastewater, low flow plumbing fixtures and appropriate landscaping. Several example projects illustrate the application of their ideas in practice. One of the best examples is the Van Hall Education Institute, Friesland.

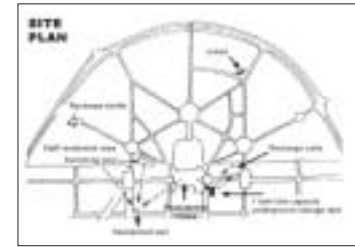


Van Hall Education institute, the Netherlands

Racine, United States. The new S.C. Johnson facility was designed as an environmentally responsible building. The facility cost 10-15% less than the US average for traditional office and laboratory buildings. The low-maintenance site design incorporated a major regional drainage system that was discovered beneath the site and uses ponds and wetlands to clean contaminated upstream runoff before release. Native and drought tolerant plants, such as prairie grass and wild flowers, were restored to the site, saving S.C. Johnson as much as US\$ 5,000 per hectare in annual maintenance costs. During construction, 86 tons of material waste, including metal, glass, wood, cardboard, concrete and drywall, were recycled. Material suppliers were also required to take back pallets and packaging, and scrap wood was made available to the local residents.

Rooftop water harvesting

India. The Office of the President of India has been prepared for rooftop water harvesting. Apart from the effect in recharging falling groundwater tables, the initiative created enormous publicity for the country's urban water-harvesting program.



Water harvesting at the Indian presidential office

Porous surfaces

Using porous surfaces in urban development helps to reduce storm water surges and increases recharge of groundwater, because rainwater will percolate into the soil rather than disappear as runoff. Porous surfaces can be constructed from many different materials including turf, gravel and permeable tiles.

Building green workplaces

Korea. Samsung Electronics plants in Korea invested in several methods for wastewater treatment and water re-use:

- The Suwon plant adopted a bio-reactor system to remove odors from surplus sludge produced from the biochemical processing facility during wastewater treatment.
- The Onyang plant improved production processes and filtered wastewater to reclaim 80% of the wastewater produced daily. The filtered water is re-used to produce de-ionized water.
- At the Gumi plant, ultra pure water that was used to clean hard disc drive computer parts is reclaimed, tested and re-used in other production processes.
- The Giheung plant installed a fluorine acid wastewater treatment system.

Rainwater harvesting in a prison complex

India. Tihar Prison in New Delhi is one of the largest in the world. The NGOs Scope Plus and Centre for Science and Environment have helped the prison to install a rainwater harvesting system. Prior to the installation, prison officials and prisoners attended workshops to make them more aware of the need for rainwater conservation.

BOX 7: Suggestions for improved water management for companies

Companies can save a great deal of money by using water more efficiently. Management commitment to take action is essential. Once management is committed, then the job of significant water conservation may begin.

Here are some tips on getting started:

- Include water in your waste reduction efforts. Form a water conservation committee or workgroup. Include both management and line workers, as they will be the ones affected the most by specific changes.
- Evaluate water usage throughout the facility. Install meters and monitor flow rates in order to determine problem areas and those that are showing improvement.
- Set goals for water conservation. Determine realistic percentage reduction goals and make people aware of them.
- Educate all employees on the importance of water conservation. Start with the basics. Discuss what conservation is, why it is important to the company and the individual, the benefits of reduced water use, personal responsibilities etc.

Once management philosophies and goals are in place and employee education has begun, there are specific ideas that can be implemented to reduce water usage such as:

- Re-use or recycle water where permitted. Ideas such as recycling chiller water or recycling wastewater in waste flumes will reduce creation of new flows.
- Implement dry clean-up techniques wherever possible. In other words, don't use hoses as brooms.
- Install high pressure, low volume and automatic shut-off valves on hoses. This will reduce the amount of water used when wet clean-up is necessary.
- Don't let water run continuously unless necessary.
- Maintain water usage equipment.
- Preventive maintenance will cut down on unnecessary losses.
- Reduce lawn watering and unnecessary cleaning.

Source: Environmental Protection Agency, USA

7.3 WATER-WISE BUSINESS PROCESSES

Industries and large corporations are major water users – increasingly so in industrializing countries. Improved water management by industries can have a large impact on water consumption and water quality (see Box 7).

Water-wise manufacturing

Ramos Arizpe, Mexico. General Motors' Ramos Arizpe factory has improved production efficiency and reduced water consumption through re-using both industrial and sanitary wastewater. The facility employed a variety of physical, chemical and biological wastewater treatment processes to recover and re-use 70% of its industrial wastewater. The selective use of different processes – whether advanced (micro-filtration), simple (solar evaporation ponds) or high-tech (membrane filtration) – enabled the facility to make its water conservation and recovery program as efficient and cost-effective as possible. Through such efforts, General Motors has reduced annual well water withdrawal by half: from 1,470,000 m³/year in 1986 to 700,000 m³/year in 2000. The average amount of well water needed to produce a vehicle has been reduced from 32 m³ to 2.2 m³. At the same time, the complex has increased annual production seven-fold. In 2001 the plant received the Stockholm Industry Water Award.

Link safety and environmental care

Korea. Samsung Electronics managers and employees work with the Employees' Council to organize 'Environment and Safety Inspection Days', which help to create a healthy and clean work environment.

Waste minimization programs

United States. Compaq has established waste minimization programs at their sites worldwide. Energy consumption and waste generation at different facilities is affected by the size, location, function and even the local weather conditions of the various operations. To be able to track progress in the different locations, Compaq has chosen to use energy consumption per employee as the benchmark standard.

Procurement policies

Unilever is committed to only buy fish from sustainable stocks by 2005 and is working with suppliers to meet this target.

Waste vendor audit program

United States. Hewlett Packard has implemented a waste vendor audit program to ensure that waste materials from its operations are sent to reliable third-party waste management vendors.

Voluntary self-regulation within industry sectors

Europe. There are several examples of branch organizations promoting better water use and environmental management among their members. For example, the European Chemical Industry Council (CEFIC) is a network representing the biggest chemical companies in Europe. CEFIC has set up a program called 'Responsible Care', which it calls 'an effective self-help network'. The network helps companies and federations to share best practices and to coach and help others. In some instances, the voluntary program goes beyond the standards required by industry regulation. Over the years, industrial water pollution from phosphorus, heavy metals and nitrogen has decreased markedly.

Unilever's sustainable water initiative

Unilever, one of the world's biggest producers of food and soap products, has laid down a clear view on how the company wants to meet the challenge of sustainability. The company's underlying philosophy is based on the 'Brundtland definition'. In 1987, the Brundtland Report, also known as 'Our Common Future', alerted the world to the urgency of economic development that could be sustained without depleting natural resources or harming the environment. Published by an international group of politicians, civil servants and experts on the environment and development, the report provided a key statement on sustainable development, defining it as: 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.

Achieving water security, in Unilever's view, is based on understanding its own impact on water resources. The company has therefore examined its water use through the full life cycle of its products, and right across the product range. This 'water imprint' has helped to develop a water vision and a structured approach to the way the company deals with water issues.

Its approach is to:

- Deepen understanding of Unilever's impact on water resources by looking at regional differences in water imprints.
- Continuously improve water management in the factories to minimize quantities of wastewater.

In five years, Unilever cut water pollution loads from factories by 20 percent. Many of the factories, particularly those in developing countries, discharge no effluent as a result of investment in on-site waste treatment and water recycling facilities. Unilever measures water consumption in all its factories. The data includes water used as an ingredient in products as well as uncontaminated cooling water and wastewater. Some factories use large amounts of water because of the type of products they make. Water conservation initiatives, such as recycling and collecting rain, have led to large savings.

- Help others, particularly suppliers and customers, to do the same.
- Work in partnership with others to protect water catchment areas around the world.

An example is the Sustainable Water Integrated Catchment Management (SWIM) principles. SWIM is used as a management tool to assess partnership catchment projects and to guide their implementation. Through long-term partnerships, individual Unilever operating companies are working together with their local communities to improve catchment management. Unilever is also the global partner of 'Living Lakes', an international partnership of environmental organisations set up by the Global Nature Fund. The overall objective of the network is to protect lakes and drinking water and to further sustainable development objectives at international level. Local water projects have been set up to protect fresh water and biodiversity and to help develop sustainable economies, e.g. tourism, agriculture, renewable energy and mobility, in lake regions.

- Contribute to finding effective solutions by sharing knowledge and best practice.

Unilever South Africa has developed a partnership with Rhodes University to open the Unilever Centre for Environmental Water Quality. With the availability of clean, freshwater resources being a primary concern, the role of the centre is to improve environmental water quality management in South Africa. This will be achieved by focusing on research, teaching and training, applied consulting and policy development and implementation. Researchers at the center are investigating the effects of chemicals in water ecosystems and developing a new method of combining water chemistry, biomonitoring and ecotoxicology information. The center also offers training to tertiary students and employees of the Department of Water Affairs and Forestry.

- Promote water awareness and action by informing the public about more efficient water use and wastewater disposal.

Source: Unilever

Environmental management

Romania. Sidex, the biggest iron and steel works plant in Romania, produces various steel plates, sheets and pipes. The company used to have a serious negative impact on the environment. It generated vast quantities of wastewater and solid waste, and consumed an unnecessarily large amount of energy. In order to improve the position of the company's products on the world market, improve compliance with environmental regulations and limit adverse effects on the environment, the company's management decided to develop an Environmental Management System (EMS) under the ISO 14001 standard. Recovering oil and recycling waste improved Sidex's environmental performance and saved money. The following lessons were learned during this process:



Sidex production site

- The success of an EMS requires physical changes in company operations as well as changes in the perspectives of employees.
- Establishing a fully equipped office at Sidex for the implementation team was a big help.
- Site visits to plants where EMS had been implemented facilitated specific knowledge transfer.
- It is important to accurately estimate in advance the financial and human resources required for the implementation of an EMS.
- Communication can be improved by clarifying individual tasks before work starts.
- Outreach and media relationships should be strengthened to share the benefits of the EMS for the company and for the local community.

Consumer education

Europe. The detergent industry's 'wash right' initiative influenced consumers to use detergent less wastefully. An extensive advertising campaign was designed to change washing habits, to save consumers money and to benefit the environment, particularly water resources.

ISO 14000 as a marketing tool

ISO 14000 is an international standard of environmental management. The Institute for Environmental Research and Education (Washington State and Iowa) Sustainable Agriculture Program is using ISO 14000 in a program designed to help farmers produce improved quality meat, dairy and other farm products that cause no harm to the consumer or the environment. Ultimately, the produce of individual farmers will have an eco-label, which identifies the farm from which the produce originated. Consumers will be able to check up on the environmental performance of individual farms. The improved quality and accountability will be used as a powerful marketing tool.

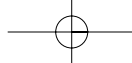


Responsible entrepreneurship

Several companies have explicit policies on responsible entrepreneurship. Some of these have embraced water management as the main program and implement water-wise programs within their own operations while supporting and sponsoring civil society water programs.



www.washright.com



Chapter

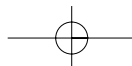
8

Facilitating local initiatives

Local action can be initiated and facilitated in several ways and this chapter gives some examples. A more extensive overview of sources that can be of help in supporting local initiatives is given in the reference annex.



Sheela Patel spoke at the 25th Special Session of the UN General Assembly (Habitat II). She represented the Society for the Promotion of Area Resource Centres (SPARC) a Bombay partnership of local actors, which initiated a program in three cities whereby municipalities pay for sustainable sanitation facilities created and managed by communities.



8.1 CATALYZING LOCAL INITIATIVES

Local initiatives can be catalyzed by high-level support or by examples of other local actions – or by a combination of both. Ideally, local initiatives become self-evolving, social movements of spontaneous action. There are a number of examples of such water movements, for example the groundwater recharge movement in Saurashtra, India. This was initially inspired by religion, but over time, a large number of people came to invest in local water recharge structures. The effectiveness of these structures then encouraged many more people to invest. In some places, communities even stopped unlimited use of groundwater. The process that makes movements evolve is still not well understood, however, exchange of information between local organizations that results in learning and a kind of gentle competition, and establishing support organizations that federate and promote the different local initiatives, are known to help the process of self-evolution.

Ministerial support for local action

Pinga Oya, Sri Lanka. Local water managers dealing with the Pinga Oya river had a good relationship with the Minister of Irrigation and Water Management. The Minister, in turn, was impressed by the Pinga Oya way of dealing with problems, which included multi-stakeholder dialogue (see section 2.2). Local initiatives in the Pinga Oya basin were accelerated when the minister called a special meeting and made sure that every stakeholder in the system knew that the Pinga Oya program had his ministerial backing.



Political support: Chief Minister of Andhra Pradesh championing water harvesting

Clean water partnership program

United States. The Minnesota Pollution Control Agency (MPCA) operates a 'clean water partnership program' to facilitate and stimulate the cleaning of state waters by local action. The program provides local governments with resources to protect and improve lakes, streams and groundwater. Clean water partnership projects begin with requests from local governments to improve water resources. The idea is to combine local leadership and expertise with technical and financial resources from the state and create an effective program for controlling pollution and restor-

ing water quality. The first steps are to undertake a diagnostic study and prepare an implementation plan. As part of the diagnostic study, local sponsors work with the MPCA to collect data and information on the water resource and its drainage area. This information is used to identify pollution problems and their causes and to define water quality goals and objectives. Next, an implementation plan identifies the combination of education, management practices and other activities needed to protect and restore water quality.

Inter-village network

Thailand. Yadfon (raindrop), a Thai NGO, works with poor and socially isolated fishing villages along the Andaman seashore. Their livelihoods have been seriously threatened by the large-scale fishing industry and by mangrove cutting in the wetlands. Training, building an inter-village network and creating publicity has helped the villages to stand up for themselves. They petitioned the government, started replanting mangroves and invited the governor to see the dreadful situation for himself. These actions led to a more serious governmental approach to support the fishing villages and better protection of their habitat.

Groundwater guardian program

United States. Groundwater Guardian is a program that supports, recognizes and connects communities involved in groundwater protection. Groundwater Guardian is a catalyst for groundwater protection programs such as local wellhead protection or source water protection. Groundwater Guardian is not a regulatory program, but instead aims to support local social entrepreneurship.



8.2 CAPACITY BUILDING

Capacity building is sometimes too narrowly defined as transferring skills and knowledge from an all-knowing source to a mind devoid of knowledge. In reality, capacity building is not only about learning what to do, but also about learning how to do it, understanding the mechanisms of effectiveness and creating leaders and

agents of change. The best learning environment is generally not the individual in the classroom, but an exchange between interested and like-minded organizations.

Umbrella organization facilitates mutual learning

Tanzania. The charity WaterAid Tanzania and the People's Voice for Development (PEVODE) have helped to set up water user groups in seven settlement communities in the Temeke area of Dar es Salaam. PEVODE acts as an umbrella organization to the seven communities. It helps the local groups to learn from each other, to manage and expand their water systems, and to speak with a common voice on water and sanitation issues for the urban poor.



People in Dar es Salaam wait for clean drinking water

Rainwater utilization network

Tokyo, Japan. Several measures have been taken to promote rainwater harvesting in the Sumida district of Tokyo. The success of the program prompted local governments nationwide to form a committee: Local Authorities Promoting Rainwater Utilization. A forum enabled interested local governments to exchange information and discuss the implementation of appropriate measures. In addition, Sumida district supports NGOs who promote local initiatives, hosts seminars with the building sector and supports inter-sectoral organizations to develop facilities to collect water.

Exchange between municipalities

The International Council for Local Environmental Initiatives (ICLEI) is an international environmental organization that supports local governments. The Water Campaign is an ICLEI initiative that supports local councils in identifying practical approaches and solutions to their water management challenges. The campaign also promotes the inter-municipal exchange of ideas and lessons learned.



Matching information supply and demand

France. The Innovation Relay Centre in Paris organizes technology transfer days in the fields of water treatment, recycling and recovery. The purpose is to initiate technology transfer between enterprises, universities and research institutes in different countries.

Workshops

Zambia. As part of the restructuring of the water sector in Zambia, nine commercial utilities were created from former municipal water departments. The Water Supply and Sanitation Act established the legal framework for the reforms. In 2000, 'Water for People', a US-based international development organization, launched its 'Water for Africa' initiative. The project managed a workshop program for the Water and Sanitation Association of Zambia, the University of Zambia and the International Water Association Foundation. The workshops covered practical topics such as reducing non-revenue water use, developing billing systems, improving customer relations and the essentials of regulation in the water and sanitation sector.

Create employee commitment

Romania. When the steel producer Sidex implemented an Environmental Management System (EMS), the employees involved went on an international study tour. The employees visited iron and steel plants in the Slovak Republic and the Czech Republic. Seeing for themselves how other plants had implemented EMS helped to stimulate the commitment and imagination of the Sidex employees.

Lake and Stream Leader's Institute

Michigan, United States. Michigan has a wealth of water resources, including 11,000 lakes over 2 ha and 58,000 km of streams. Although many lakes and streams have good quality water and substantial economic and recreational value, most of these water resources have no strategic plan to guide their development and use. The Michigan Lake and Stream Leader's Institute is sponsored by the Department of Fisheries and Wildlife, Michigan State University and Michigan Lake and Stream Associations. The institute provides education and training to prepare local stakeholders (e.g. property owners, concerned citizens and local agency personnel) to participate in water resource management planning and program implementation. The goal is to develop a core of local water and land resource leaders who will

promote lake, stream and watershed management partnerships with state natural resource agencies and encourage and instruct other citizens in resource management.

Lower government levels as agents for change

West Bengal, India. The West Bengal Department of Water Resources decided to organize training for lower-level government employees, such as recently recruited irrigation system operators and mechanics. The training was provided by a local NGO, which was well versed in catalyzing micro water planning by village groups. The government workers were challenged to become water managers and to facilitate action planning by water user groups. Building the interest of these workers enhanced cooperation within the entire water department, as employees realized that managing water resources was not an esoteric and highly technical exercise.

Volunteer training

Rockland County, United States. The groundwater protection program in Rockland County involved contaminant inventory surveys that were conducted by over 50 volunteers. The volunteers were educated about the history of the protection program, basic hydrogeology and sources of groundwater pollution. They were also told about numerous examples of potential contaminant sources (e.g. drums, septic tanks, underground storage tanks) and their probable locations in the neighborhoods and industrial areas of Rockland County. Engineers explained the difficulty and expense involved in treating contaminated groundwater. Finally, the volunteers had to do a role-playing exercise in which they conducted mock door-to-door surveys. This helped the volunteers learn how to explain the program to the public.

8.3 PROVIDING INFORMATION

Access to information and new concepts is important for the success of local initiatives. It is not just the quality of information, but also the shape in which it is presented, that can influence a successful outcome. Extensive technical reports are often ineffective in conveying information. Concise case studies, well-illustrated guidelines or clear practical designs are far more useful. It is important to avoid providing too much information, but instead to give an inspiring idea, assuming that those that are interested will then find their own way.

Toolkit for local organizations

United States. The 'American Rivers' organization spreads information, initiates programs and organizes activities to improve water quality, control floods and prevent pollution. The organization critically follows the river policy of the US government. American Rivers has also developed a clean water toolkit and a stream restoration toolkit for citizens and organizations to use in their fight against river damage.

Another example of a toolkit is the IWRM ToolBox on integrated water resources management of GWP. This toolkit brings together many examples of best practice on enabling frameworks, institutional policies and management instruments.

Appropriate technical manuals

India. Prasad Rasal, an educational activist, diagnosed two principal constraints to effective watershed management in rural India. First, there was a high level of dependency on 'technical experts', who were generally unavailable. Second, there was an absence of appropriate technical education and other support materials that would allow local villagers to manage an alternative approach. In response, Prasad established an 'appropriate technical manuals' publishing program. The material is distributed through local service centers, extension workers, community organizations and schools. The intermediaries are given training in how to use the materials correctly. Another distribution plan involves partnering with commercial producers and sellers of farm tools who are asked to package the educational material with an agricultural tool, for instance a water pump or a plow.

Information telephone link

Australia. The Catchment Information and Education Program (CIEP) is a knowledge management program for watershed managers. Water resources management professionals and users can exchange best practice information for land and water management for different parts of a watershed, catchment or river basin. Apart from an interactive community education program and a catchment information center, CIEP also includes a freephone link.

Web-based experiences database

Canada. The Canadian Water and Wastewater Association and Environment Canada have developed a database website to encourage the exchange of information on

water efficiency. Interested readers can search the database and/or enter their own experiences (www.ccwa.ca).

Who's who

India. The Center for Science and Environment has prepared a 'who's who' in water harvesting. This directory of resource persons is called Waterlinks and it provides contact details for a range of experts in water harvesting.

Making land and water resources audits available

Australia. A common problem with information is not so much its quality or relevance but how to make it available to the right people. In Australia, a special effort was made to provide appropriate information to resource managers by making the National Land and Water Resources Audit widely available. The audit provides a clear understanding of the status of, and changes in, land, vegetation and water resources and the cost and benefits of changes and remedial actions. The audit also points the way to other relevant initiatives.

8.4 RECOGNIZING SPECIAL EFFORTS


Governments and NGOs often reward good initiatives for water management and conservation. Several prizes are awarded every year to outstanding individuals or organizations. A useful spin-off from these awards and prizes is that they help to identify and disseminate ideas and examples of best practice. Awards also help to highlight issues in the media. Eco-rating has a similar effect on recognizing special efforts.

Dragonfly awards

Mersey Basin, UK. The Mersey Basin Campaign is a 25-year-old partnership of local government, enterprise and voluntary organizations. The partnership works to improve water quality and upgrade the riverside environment in Northwest England. Among other things, it presents annual 'dragonfly awards' to local organizations, schools, community groups and individuals that have made outstanding contributions. The Mersey Basin Campaign has recently initiated another award for the best business performance in protecting the Mersey Basin.

BOX 8: Eco-rating MyTravel

Each year MyTravel follows up on how their hotel partners work with energy, water, chemicals and production of waste in the so-called 'property audit'. The hotel contract contains a demand for environmental work. MyTravel offers hotels that want to do more an action plan: 'the 50 steps program'. MyTravel labels hotels in their catalogues:

Hotels working for the 50 steps program: 

Hotels that have finished the program: 

Source: Scandinavian Leisure Group (www.slg.se/default_en.htm)

Eco-rating by local authorities

The Scandinavian Leisure Group (MyTravel) works towards ensuring environmental sustainability at all the company's locations. To this end, the group has developed an eco-audit, but instead of asking its hotels to answer the questions, local authorities are requested to complete the audit. In addition to monitoring environmental performance, this helps to increase the group's own knowledge, and that of its customers. Involving local authorities often helps to stimulate dialogue and the group can then offer support to local environmental action plans. (see Box 8)

8.5 FUNDING MECHANISMS FOR LOCAL INITIATIVES

There is a range of financial support mechanisms to facilitate local action in water management. Some of these have been discussed in earlier chapters. A general lesson that can be drawn is that local fundraising often works best and that easy money may attract the wrong players. Small, flexible grants and seed funds have often been more effective than large financial donations that come with many 'strings' attached.

Challenge grants

Kazakhstan. The Global Environment and Technology Foundation is building partnerships to help improve the local environment through its 'Ecolinks' program. One-year partnership projects or activities are supported through challenge grants and address specific urban and industrial environmental problems. One example of an activity assisted by this program is in Kazakhstan, where partners are introducing technology to reduce wastewater pollution from car wash centers. Pollution of

aquifers, from which the City of Almaty obtains 70% of its drinking water, is a major environmental problem. Almaty has seen a rapid rise in the number of vehicles and car wash centers recently, and this has led to a significant increase in contamination from petroleum products.

NGO obtains funds

Malawi. Water for Africa modestly funded (US\$ 5000) the local NGO 'Nkhomano' to help improve sanitation in part of Blantyre. This work entailed organizing local residents into sanitation committees and negotiating solid waste removal with city officials. Several feet of waste used to block footpath intersections, creating a serious health hazard, and these have now been cleared. Nkhomano has also used the 'sanitation corps' as a voice to negotiate better drinking water. In February 2001, a US\$ 20,000 grant was made available to improve health and hygiene practices in five townships in Blantyre and to train water committees at 64 public water kiosks. Better management of the water kiosks will help to collect fees, pay bills to the Blantyre Water Board and ensure that safe drinking water continues to be provided to the locality. This case illustrates how small NGO 'seed' funds can lead to great changes.

Solidarity funds

Tunisia. In Tunisia, the National Solidarity Fund (NSF) makes it possible to improve the lives and livelihoods of the poorest communities of the country; the so-called 'shadow areas'. These are isolated rural areas that have poor housing and no running water, electricity, health care, education or roads. The intervention criteria of NSF prescribe that that the eligible areas should be isolated, lack two basic amenities, such as drinking water, and have few opportunities for income generation. NSF is funded by voluntary contributions from Tunisian citizens. Every year, a 'National Day of Solidarity' is organized to promote the organization's activities and nearly 220,000 families have now benefited from the program.

Subsidize water conservation

Ontario, Canada. The City of Barrie avoided having to make a substantial investment in new wastewater treatment and water supply facilities by introducing a 'retrofit' water conservation program. The city supplied subsidized ultra low flow toilets, showerheads and aerators to local residents over a two-year period, which dramatically reduced water use and wastewater production.

Incentives for groundwater protection

Michigan, United States. As part of the Northwest Michigan Groundwater Stewardship Program, direct financial incentives were provided to landowners actively protecting groundwater. In a similar program, insurance companies offered a reduction in premiums to farmers who conduct a farm risk assessment, provide for emergency preparedness and utilize proper pesticide and fertilizer storage techniques.

Company social stewardship programs

Cargill, a seed company, established its 'Water Matters' program to encourage employees, retirees and their families to learn about local water quality issues and to get involved in water conservation programs and activities at home, at work and in the community. The company financially supports a range of community service projects, and local businesses, customers, schools and community organizations are also invited to join in.



Water-saving showerhead



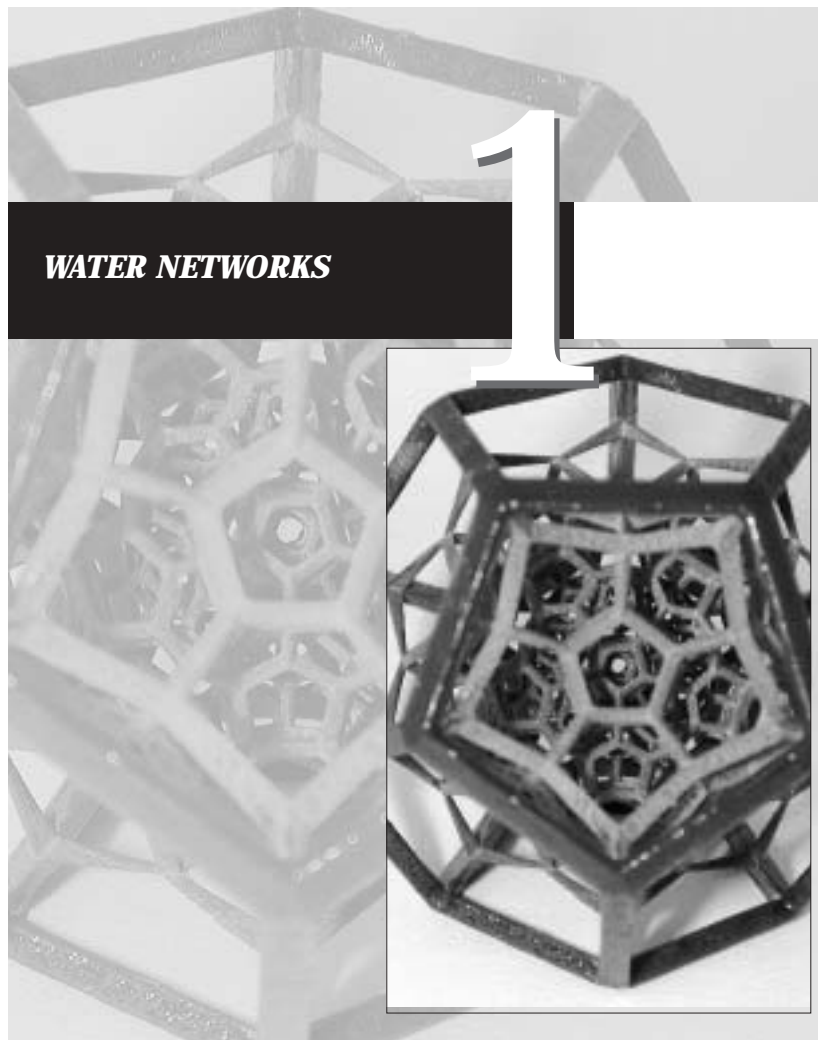
Annex 1:

Reference Sources

This annex provides a list of reference sources, including the names of organizations, short descriptions of their activities and their contact details. These organizations can help you directly, or you can draw on their wealth of experience. This annex does not pretend to be all-embracing or complete. It has been compiled by the authors as a result of the searches made during the preparation of this book. We hope it will be useful. The references are arranged by topic and ordered alphabetically.

Topics:

1. Water networks	70
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6. Capacity building services	92
7. Awards and prizes	95



The Africa Water Forum (AWF)

AWF is a regional, non-governmental and non-profit organization open to individuals involved in developing and implementing water resources management policy in Africa. It promotes networking and exchange of experiences and lessons learned amongst African professionals and policy-makers engaged in water resources policy reforms. The most important element of the network is the establishment of thematic groups in order to mobilize the expertise of AWF members and generate materials related to specific themes of water resources management policy. Executive Secretary, Dr. Daniel Adom, African Development Bank, BP V316, Abidjan 01, Ivory Coast. E-mail: dan-watrecom@ighmail.com

Drylands Coordination Group (DCG)

DCG is a Norwegian NGO that exchanges knowledge on food security and natural resource management in the drylands of Africa. DCG facilitates this exchange of experiences between NGOs, their partners in the South and research and policy-making institutions. Technical assistance to individual projects is undertaken, workshops and seminars are organized and studies are carried out. Outcomes and results are spread to a wider audience through seminars, publications and the DCG website.

Secretariat,
c/o Noragric, Agricultural University of Norway, P.O. Box 5001, N-1432 Aas, Norway.
Tel: +47 64 94 98 23, Fax: +47 64 94 07 60
E-mail: grete.benjaminsen@noragric.nlh.no
Internet: www.drylands-group.org

European Rivers Network (ERN)

ERN is a non-profit NGO, with the main goal to link groups, organizations and persons working for the protection of rivers, and to improve communication between them. ERN also links organizations from different working fields such as environment, culture, education and human rights. ERN seeks to promote the sustainable and wise management of living rivers in opposition to the exploitation, pollution and degradation that has occurred in the past.

ERN,
8 Rue Crozatier, 43000 Le Puy, Southern France.
Tel: +33 471 02 08 14, Fax +33 471 02 60 9
E-mail: ern@rivernet.org
Internet: www.rivernet.org

Global Environmental Management Initiative (GEMI)

GEMI is a non-profit organization of big companies dedicated to fostering environmental, health and safety excellence worldwide through the sharing of tools and information in order to help business achieve environmental excellence. GEMI currently has 40 members.

GEMI,
One Thomas Circle, NW, Tenth Floor, Washington, DC 20005, USA
Tel: +1 202-296-7449, Fax: +1 202-296-7442
E-mail: info@gemi.org
Internet: www.gemi.org

Gender Water Alliance (GWA)

The GWA is a network of organizations and individuals from around the world that aims to improve the participation of women in water issues. GWA offers a mix of information and knowledge sharing activities such as electronic conferencing, a web site, advocacy leaflets and video, annual reports, capacity building and pilot programs.

GWA Secretariat, Jennifer Francis, Executive Secretary, c/o IRC
P.O. Box 2869, 2601 CW Delft, The Netherlands
Tel: +31-15-219 2943, Fax: +31-15-219 0955
E-mail: francis@irc.nl
Internet: www.genderandwateralliance.org

Global Nature Fund (GNF) / Living Lakes

The Global Nature Fund is a non-profit, private, independent international foundation for the protection of environment and nature. Living Lakes, an international network of 19 lakes from five continents, is GNF's most important project. Living Lakes aims to promote sustainable water usage and access to quality water through best practice at local level. The Living Lakes Partnership will create and support a network in which local lake organizations can find critical kinds of assistance for

promoting sustainable development in lake areas. Living Lakes partners actively participate in a diverse program of mutual support to develop an environmentally sustainable social and economic structure.

Global Nature Fund,
Güttinger Str. 19, D-78315 Radolfzell, Germany.
Tel: +49 7732/99 95 - 80, Fax: +49 7732/99 95 - 88
E-mail: info@globalnature.org
Internet: www.globalnature.org / www.livinglakes.org

Global Water Partnership (GWP)

The Global Water Partnership is a global network organization, consisting of several regional, national and local networks. The Partnership is dedicated to the promotion of integrated water resource management. The goals of GWP are to establish partnerships and mobilize political will, to build strategic alliances for action, promote good practice in integrated water resource management and develop and implement regional actions.

GWP Secretariat,
Hantverkargatan 5, House 6, 2nd floor, SE-112 21 Stockholm, Sweden.
Tel: +46 (0)8 562 51 900, Fax: +46 (0)8 562 51 901
E-mail: gwp@gwpforum.org
Internet: www.gwpforum.org

Green Cross International

Green Cross works to prevent conflicts in water-stressed regions. It promotes informed and participatory decision-making, regional cooperation and the integrated management of land and water resources at the basin level. Green Cross aims to actively avoid and mitigate conflicts in water-stressed regions by encouraging the participatory integrated management of basins at the local, national and international levels.

Green Cross International,
160a, rte de Florissant, CH 1231, Geneva, Switzerland.
Tel: +41 22 789 1662, Fax: +41 22 789 1695
E-mail: secretariat@gci.ch
Internet: www.gci.ch

International Commission on Irrigation and Drainage (ICID)

ICID is a scientific, technical and voluntary international NGO. The Commission is dedicated to enhancing the worldwide supply of food and fiber for all people by improving water and land management and the productivity of irrigated and drained lands through appropriate management of water, environment and application of irrigation, drainage and flood management techniques.

ICID Head Office,

48 Nyaya Marg, Chanakyapuri, New Delhi 110021, India.

Tel: + 91-11-6116837, 4679532, 6115679, Fax: + 91-11-6115962

E-mail: icid@icid.org

Internet: www.icid.org

International Council for Local Environmental Initiatives (ICLEI)

ICLEI is an international environmental agency for local governments. ICLEI's mission is to build and serve a worldwide movement of local governments to achieve tangible improvements in global environmental and sustainable development conditions through cumulative local actions. One of the programs of ICLEI is called 'the Water Campaign'. The three main activity areas of the campaign lay the foundations for the systematic identification and evaluation of the water resource management challenges facing local governments at three levels; the municipal corporation, the urban area and the local watershed areas.

ICLEI World Secretariat,

City Hall, West Tower 16th Floor, 100 Queen Street West, Toronto, Ontario M5H 2N2, Canada.

Tel: +1 416-392-1462, Fax: +1 416-392-1478

E-mail: iclei@iclei.org

Internet: www.iclei.org

International Flood Network (IFNet)

The International Flood Network wants to facilitate international cooperation in flood management. Flooding is often a very local problem but one that can benefit from international assistance. IFNet aims to facilitate exchange of information, raise public awareness and establish floods high on the international agenda. IFNet is supported by the Global Water Partnership, the World Meteorological Organization and the World Water Council.

IFNet Secretariat,

Water in Rivers' Secretariat, 5-3-23 Kojimachi, Chiyoda-ku, Tokyo, 102-0083, Japan.

Tel: +81-3-3263-7986, Fax: +81-3-3230-4030

E-mail: waterinriver@mail.idi.or.jp

Internet: www.idi.or.jp/sision/

International Network of Basin Organizations (INBO)

INBO is an international network organization, focused on improving water resource management of river basins at local level. The network aims to develop lasting relationships between the organizations interested in INBO's approach, and stimulate exchanges of experiences and expertise among them. Another goal is to facilitate the implementation of tools suitable for institutional and financial management, programming, the organization of databanks, and to adapt models to these needs. Information and training programs are also promoted for local elected officials, for users' representatives and for the different stakeholders involved in water management as well as for the executives and staff of the member basin organizations.

INBO,

21, rue de Madrid, 75008, Paris, France.

Tel: +33 1 44 90 88 60, Fax: +33 1 40 08 01 45

E-mail: riob2@wanadoo.fr

Internet: www.inbo-news.org

The International Network on Participatory Irrigation Management (INPIM)

INPIM is a non-profit organization, whose mission is to facilitate participatory irrigation management through the exchange of people, ideas and training materials. At the moment, INPIM has country networks in Albania, Indonesia, India and Pakistan.

INPIM,

600 Pennsylvania Avenue SE, Suite 340, Washington, DC 20003, USA.

Tel: +1 202-546-1820, Fax: +1 202-318-0215

E-mail: coordination@inpim.org

Internet: www.inpim.org

International Rivers Network (IRN)

IRN supports local communities working to protect their rivers and watersheds. Their goal is to halt destructive river development projects and to encourage equitable and sustainable methods of meeting needs for water, energy and flood management. IRN works with environmental and human rights groups around the world in cooperative campaigns for community-based river development. In addition, IRN undertakes research and provides project critiques, analyses of alternatives and activist briefings. IRN also mobilizes international support from their network of activists and experts, assists in fundraising for campaigns at the local level and generates publicity through industry, alternative and mainstream media.

IRN,

1847 Berkeley Way, Berkeley, CA 94703, USA.

Tel: +1.510.848.1155, Fax: +1.510.848.1008

E-mail: info@irn.org

Internet: www.irn.org

The World Conservation Union (IUCN)

The World Conservation Union brings together states, government agencies and a diverse range of NGOs in a world partnership, with over 980 members from 140 countries. IUCN's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. One of the main themes is 'Water and wetlands'. This program consists of several projects all over the world. Involvement of local community groups is always an important part of the projects.

IUCN Headquarters,

Rue Mauverney 28, 1196 Gland, Switzerland.

Tel: +41 22-999-0000, Fax: +41 22 999-0002

E-mail: mail@hq.iucn.org

Internet: www.iucn.org

International Water Association (IWA)

IWA's goal is to help water professionals create innovative, pragmatic and sustainable solutions to challenging global water needs. IWA is a network organization, connecting the broad community of water professionals around the globe. Through membership in IWA, many different kinds of water professionals benefit from the synergistic gains that result from collaboration across the boundaries of specialties, professions and different parts of the world.

IWA,

Alliance House, 12 Caxton Street, London SW1H 0QS, UK.

Tel: +44 20 7654 5500, Fax: +44 20 7654 5555

E-mail: water@iwahq.org.uk

Internet: www.iwafoundation.org / www.iwahq.org.uk/

IWMI: Dialogue on Water, Food and Environment

The International Water Management Institute has set up a dialogue program on water, food and environment, together with several organizations active in these fields. The aim is to build bridges between agricultural and environmental communities on water resources issues, by improving the linkages between the sectoral approaches that dominate policy-making and implementation at national and local level. One of the immediate objectives is to promote the exchange of experience and the development and identification of best practices.

IWMI,

P.O. Box: 2075, Colombo, Sri Lanka.

Tel: +94 1 787404, 784080, Fax: +94 1 786854

E-mail: iwmi@cgiar.org

Internet: www.cgiar.org/iwmi

International Water Resources Association (IWRA)

IWRA promotes the sustainable management of water resources around the globe by facilitating the building and strengthening of partnerships. It networks people, information, and organizations that are concerned with the global sustainability of water resources. The driving force behind the association is the belief that sustainability requires interdisciplinary action and international cooperation. IWRA seeks to improve water resource outcomes by improving collective understanding of the physical, biological, chemical, institutional and socioeconomic aspects of water.

IWRA Headquarters,
4535 Faner Hall, Southern Illinois University Carbondale,
IL 62901-4516, USA.
Tel: +1 618.453.5138, Fax: +1 618.453.2671
E-mail: iwra@siu.edu
Internet: www.iwra.siu.edu

National Councils for Sustainable Development (NCSDs)

The 1992 Earth Summit recommended the active participation of citizens along with governments in implementing the Rio agreements. Since then, more than 70 countries have established some form of a multi-stakeholder participatory body, referred to here as National Councils for Sustainable Development (NCSDs), to promote and implement sustainable development at the national level. NCSD has developed an online 'Knowledge Network', to facilitate exchange of information.

NCSD Program Earth Council,
Apartado 319-6100, San Jose, Costa Rica.
Tel: +506 205 1600, Fax: +506 249 3500
E-mail: info@ncsdnetwork.org
Internet: www.ncsdnetwork.org

National Resource Defense Council (NRDC)

NRDC is an American organization that uses law, science and the support of more than 500,000 members nationwide to protect the planet's wildlife and wild places and to ensure a safe and healthy environment for all living things.

NRDC Headquarters,
40 West 20th Street, New York, NY 10011, USA.
Tel: +1 212 727-2700, Fax: +1 212 727-1773
E-mail: nrdcinof@nrdc.org
Internet: www.nrdc.org

Third World Network of Scientific Organizations (TWNSO)

TWNSO is a non-governmental alliance of 154 scientific organizations in the South, including ministers of science, technology and higher education, science academies and research councils. TWNSO's primary goals are to help build political and scientific leadership in the South for science-based economic development and to promote sustainable development through South-South and South-North partnerships in science and technology.

TWNSO,
Strada Costiera 11, I-34014, Trieste, Italy.
Tel: +39 040 2240683, Fax: +39 040 2240-689
E-mail: info@twnsso.org
Internet: www.twnsso.org

UNEP Dams and Development Project (DDP)

The United Nations Environment Program (UNEP) Dams and Development Project (DDP) is a diverse and independent network dedicated to progress the process initiated by the World Commission on Dams (WCD). The goal of the DDP is to promote an open dialogue on improving decision-making, planning and management of dams and their alternatives at local, national and global levels. It advocates consensus over conflict. It supports flexible, locally appropriate approaches, not blueprint uniformity. DDP can help with the following:

- providing information on the WCD process and outputs;
- assisting in translating materials into your language;
- providing support to bring various parties together in discussion;
- providing information on how others deal with their situation and examples of good practice;
- creating access to an expert, a network or contacts for taking local processes forward.

UNEP Dams and Development Project,
P.O. Box 16002, Vlaeberg 8018, Cape Town, South Africa.
Tel: +27 21 426 4000, Fax: +27 21 426 0036
E-mail: info@unep-dams.org
Internet: www.unep-dams.org

World Business Council for Sustainable Development (WBCSD)

WBCSD is a coalition of 160 international companies united by a shared commitment to sustainable development consisting of three pillars: economic growth, ecological balance and social progress. The members are drawn from more than 30 countries and 20 major industrial sectors. WBCSD's mission is to provide business leadership as a catalyst for change toward sustainable development, and to promote the role of eco-efficiency, innovation and corporate social responsibility.

WBCSD,
4 Chemin de Conches, 1231 Conches-Geneva, Switzerland.
Tel: +41 22 839 3100, Fax: +41 22 839 3131
E-mail: info@wbcsd.org
Internet: www.wbcsd.ch

Water Supply and Sanitation Collaborative Council (WSSCC)

The Council helps sector professionals to share their concerns, knowledge and experience with one another. It provides opportunities for problem solving, access to combined expertise, continuous dialogue on key issues and publications which set out guidelines, procedures and codes of conduct developed by experts working together over several years.

WSSCC,
International Environment House, Chemin des Anémones 9, 1219 Châtelaine,
Geneva, Switzerland.
Tel : +41 22 917 8657, Fax : +41 22 917 8084
E-mail: wsscc@who.int
Internet: www.wsscc.org

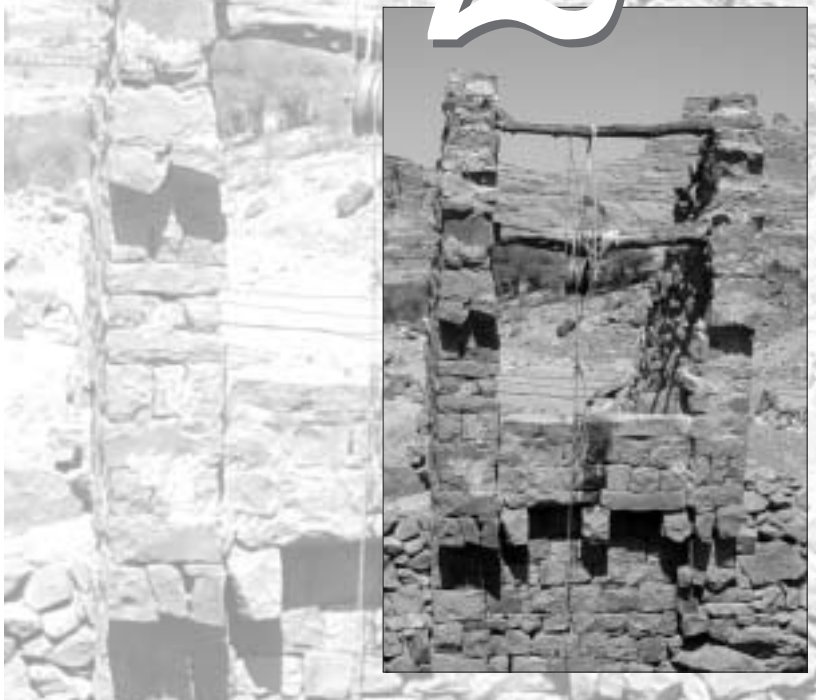
World Water Council (WWC)

The World Water Council is an international water policy think tank dedicated to strengthening the movement for improved management of the world's water resources. The mission of WWC is to promote awareness and build political commitment on critical water issues at all levels. To fulfill its missions and objectives, WWC has created the World Water Fora, major water events organized every three years in close collaboration with the authorities of the hosting country. A large list of members can be found on the WWC website.

WWC Headquarters,
Les Docks de la Joliette, Atrium 10.3, 10 Place de la Joliette,
13002 Marseille, France.
Tel: +33 491 99 41 00, Fax: +33 491 99 41 01
E-mail: wwc@worldwatercouncil.org
Internet: www.worldwatercouncil.org

INFORMATION SERVICES ON IWRM

2



BC Hydro: Water Use Plans

BC Hydro, one of the largest electric utilities in Canada, is a Crown corporation owned by the province of British Columbia. The BC Hydro website contains up-to-date information on their 'Water Use Planning' program, including links to individual projects and a 'quick facts' section. The provincial guidelines on water use planning and further information on the first national water use planning committees are also available online.

Internet: www.bchydro.com / www.bcafc.org/FNWUPC/

Both ENDS

Both ENDS supports the work of environmental organizations, primarily in the South and the Central and Eastern European (CEE) countries. Both ENDS works with NGOs, community-based organizations and issue-related coalitions or networks. The organization supports inspiring, people-oriented examples of sustainable development, rooted in local peoples' knowledge and managed from the bottom-up. Both ENDS produces funding guides, research and lobby documents, supports campaigns and helps build coalitions. A service desk offers information packs on environmental topics, helps fund-seeking organizations to locate donors, and assists in identifying the right expertise or partner. Water Management is one of the three main themes.

Both ENDS,

Damrak 28 –30, 1012 LJ, Amsterdam, The Netherlands.

Tel: +31 20 6230823, Fax: +31 20 6208049

E-mail: info@bothends.org

Internet: www.bothends.org

Centre for Science and Environment (CSE)

CSE is an Indian environmental NGO concerned with sustainable natural resource management. CSE educates people about the importance of sustainable development, especially for the daily survival of the country's poor and its rural women. CSE has a special interest in water management. CSE hosts a website on rainwater harvesting and has set up the National Water Harvesters' Network in India.

CSE,
41, Tughlakabad Institutional Area, New Delhi-110062, India.
Tel: +91-11-6081110, 6081124, 6081125, 6083394, 6086399, Fax: +91-11-6085879
E-mail: webadmin@cseindia.org
Internet: www.cseindia.org / www.rainwaterharvesting.org

Eddie

Eddie is a free, personalized, interactive news, information and communications service for water, waste and environmental professionals around the world. With comprehensive independent coverage, powerful search facilities, e-mail alerts and discussion forums, Eddie provides exchange of specialized online information.
Internet: www.edie.net

EnviroTools

EnviroTools is an online guide for citizens, community assistance leaders, outreach assistance providers and citizen leaders that aims to involve communities in the clean-up of polluted sites. EnviroTools contains presentation visuals, fact sheets, web links, a glossary and an annotated bibliography of other outreach resources; all designed to help people cut through the confusion and jargon of site clean-up projects.
E-mail: webmaster@envirotools.org
Internet: www.envirotools.org

Food and Agriculture Organization (FAO) of the United Nations

FAO's goal is to raise levels of nutrition and standards of living, to improve agricultural productivity and to better the condition of rural populations. A specific priority of the Organization is encouraging sustainable agriculture and rural development, a long-term strategy for increasing food production and food security while conserving and managing natural resources. The aim is to meet the needs of both present and future generations by promoting development that does not degrade the environment and is technically appropriate, economically viable and socially acceptable.
FAO Land and Water Division,
Viale delle Terme di Caracalla, 00100 Rome, Italy.
Tel: +39 6 5705 1, Fax: +39 6 5705 3152
E-mail: FAO-HQ@fao.org
Internet: www.fao.org

Global International Water Assessment (GIWA)

The Global International Water Assessment (GIWA) focuses on 66 transboundary water areas worldwide. GIWA's main executing agency is Kalmar University in Sweden, where a core team is located. The program objective is to produce a systematic assessment of the environmental conditions and problems in international waters. Ultimately, the aim is to provide sound scientific advice to decision-makers and managers concerned with these issues.

GIWA,
SE- 391 82 Kalmar, Sweden.
Tel: +46 480 44 73 53 , Fax: +46 480 44 73 55.
E-mail: info@giwa.net
Internet: www.giwa.net / www.gefweb.org



GWP: IWRM ToolBox

The Global Water Partnership (GWP) has developed a web-based ToolBox on Integrated Water Resources Management (IWRM). It is a reference site that provides water management professionals with examples of good and bad practices and lessons learned from real life experiences of implementing IWRM. Information is organized into four main parts: policy guidance; operational tools; case studies and references; and organizations and websites. The intended users of the ToolBox are water resource management professionals such as water resource planners, policy makers, river basin managers and political advisors, as well as the general public.
Internet: www.gwpforum.org

International Lake Environment Committee (ILEC)

ILEC is an international NGO, which was founded with the aim of promoting environmentally sound management of natural and man-made lakes and their environments. ILEC has collected environmental and socio-economic data from important lakes and reservoirs around the world. Data from more than 500 lakes from 73 countries can be viewed at their Internet site.
ILEC,
1091 Oroshimo-cho, Kusatsu-shi, Shiga 525-0001, Japan.
Tel: +81-77-568-4567, Fax: +81-77-568-4568
E-mail: info@ilec.or.jp
Internet: www.ilec.or.jp

The International Office for Water (IOW)

This international water organization supplies information in several languages, but concentrates mainly on the French-speaking parts of the world and is focused on capacity building and information dissemination. It also provides information about water management practices in France.

IOW,
Place Sophie Laffite, 06902 Sophia-Antipolis Cedex, France.
Tel: +33.4 92.94.58.00, Fax: +33.4.93.65.44.02
E-mail: aquacoope@oieau.fr
Internet: www.oieau.fr.

The International Program on Chemical Safety

The International Program on Chemical Safety has made thousands of chemical safety documents available free of charge on their website. This includes all Environmental Health Criteria (EHC) Monographs, many of which relate to chemicals that play an important role in water quality.

Internet: www.inchem.org/

International Water Management Institute (IWMI)

IWMI is a nonprofit scientific research organization focusing on the sustainable use of water and land resources in agriculture and on the water needs of developing countries. IWMI has developed several tools, such as water accounting for integrated water management and irrigation performance indicators, to help water and food security planners improve their understanding of water resources. These tools provide data, methods and practices useful to various types of water planners.

IWMI,
P.O. Box: 2075, Colombo, Sri Lanka
Tel: +94 -1 787404, 784080, Fax: +94 -1 786854
E-mail: iwmi@cgiar.org
Internet: www.cgiar.org/iwmi

International Water and Sanitation Center (IRC)

IRC facilitates the sharing, promotion and use of knowledge so that governments, professionals and organizations can better support poor men, women and children in developing countries to obtain water and sanitation services. Using its website,

documentation and publications, IRC advocates change and aims to improve the information and knowledge base of the sector. IRC runs a special online information service, called 'Source'. Especially interesting, regarding the topic of this book, is the information on 'community water supply management', which can be found on the IRC website along with several case studies.

IRC,
P.O. Box 2869, 2601 CW Delft, The Netherlands.
Tel: + 31 15 219 29 39, Fax: +31 15 219 09 55
E-mail: general@irc.nl Internet: www.irc.nl / www.source.nl

Latin American Network Information Center (LANIC)

The LANIC website hosts useful environmental links for the Latin American region.

E-mail: info@lanic.utexas.edu
Internet: www.lanic.utexas.edu/la/region/environment/

MekongInfo

MekongInfo is an interactive system for sharing information and knowledge about participatory natural resource management (NRM) in the Lower Mekong Basin. In addition to over 2,700 documents (full-text and abstract) in the library, MekongInfo provides a contacts database of individuals, projects and organisations, news and announcements of events, relevant web links, a gallery of useful resource materials and a forum for online discussions. MekongInfo is an initiative of the Mekong River Commission.

Mekong River Commission,
PO box 1112, 364 Preah Monivong Boulevard, Penh, Cambodia
Tel: 855-23 720 979, Fax: 855-23 720 972
E-mail: mrcs@mrcmekong.org
Internet: www.mrcmekong.org / www.mekonginfo.org

Mersey Basin Campaign

The Mersey Basin Campaign is an example of best practice in promoting sustainable development of a river. The campaign has won the Brisbane River Prize for its achievements.

Mersey Basin Campaign,
28th Floor, Sunley Tower, Piccadilly Plaza, Manchester UK M1 4BT, UK.
Tel: +44 161 242 8200, Fax: +44 161 242 8201
E-mail: communications@merseybasin.org.uk

Mitigation banking

More information on the mitigation banking concept can be found on the website.
Internet: www.mitigationbanks.com

Ramsar Toolkit: Handbooks for the wise use of wetlands

The Ramsar Handbooks for the wise use of wetlands comprise a set of nine handbooks containing guidelines, supporting background documents, photographs, case studies and cross-references. The full texts of most case studies are available online at the Ramsar Convention website. Guidelines and case studies on river basin management can be found in Handbook 4: Integrating wetland conservation and wise use into River Basin Management. For action at local level, Handbook 5 is very interesting.

Ramsar Convention Bureau,
Rue Mauverney 28, CH-1196, Gland, Switzerland.
Tel: +41 22 999 0170, Fax: +41 22 999 0169
E-mail: ramsar@ramsar.org
Internet: www.ramsar.org / www.ramsar.org/wurc_handbook_index.htm

Savewater.com

A treasure-trove of information on water saving at home, in the garden and in business can be found on this Australian Internet site, which also contains information on water saving and water quality improving products.
Internet: www.savewater.com.au

Southern African Water Information Network (SAWINET)

SAWINET is an Information Network on Integrated Water Resources Management. It is an Associated Program under the umbrella of the Global Water Partnership and is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ). SAWINET is meant to support one of the German policy priorities, the prevention of future conflicts over water.

SAWINET,
Tel: +49 6196-79-1369
E-mail: sawinet@gwpsatac.org.zw
Internet: www.gtz.de/gwpgtz/index.html / www.globwinet.org

Spate irrigation

The community spate irrigation project aims to spread information and facilitate knowledge exchange on spate irrigation. Community Spate Irrigation is a project funded through the UK's Department for International Development (DFID) Knowledge and Research Program. It will develop guidelines and provide capacity building and practical support to organizations that develop spate systems. The guidelines and support will concern the improvement of livelihoods in spate systems, appropriate engineering improvements, working with local organizations, spate water rights, spate irrigation agronomy and ecology
E-mail: P.Lawrence@hrwallingford.co.uk / info@metameta.nl
Internet: www.spate-irrigation.org

Transboundary Freshwater Dispute Database

Oregon State University is coordinating an effort with nine other universities across five continents to direct the expertise, educational and technical potential of academia towards conflicts and environmental degradation in the world's shared river basins. Population growth has put pressure on transboundary water resources, so increasing the need for effective treaties. The online Transboundary Freshwater Dispute Database provides information on water treaties and maps of international watersheds worldwide. It facilitates the search for solutions in transboundary water management.

Transboundary Freshwater Dispute Database, Dr. Aaron Wolf,
104 Wilkinson Hall, Department of Geosciences, Oregon State University,
Corvallis, OR 97331-5506, USA.
Tel: +1 541-737-2722, Fax: +1 541-737-1200
E-mail: wolfa@geo.orst.edu
Internet: www.transboundarywaters.orst.edu

UNDP Small Grants Program Database

The Small Grants Program (SGP) provides financial and technical support to projects in developing countries. With more than 3000 projects in 63 countries, SGP provides a wide range of knowledge and experience. This is recognized by UNDP by making project descriptions accessible on the SGP website.

UNDP-SGP,

304 East 45th Street, FF-1038, New York 10017, USA.

Tel: +1 212-906-6191, Fax: +1 212-909-6568

E-mail: sarah.Timpson@undp.org

Internet: www.undp.org/sgp

United Nations Best Practices online database

On the UN's best practices website, hundreds of short project descriptions from projects all over the world can be found, including several water projects.

Internet: www.bestpractices.org

US Environmental Protection Agency (EPA) / INFOTERRA

EPA is the US governmental organization concerned with environmental protection. The EPA has a huge Internet site, with a lot of useful information on law, legislation, grants, education, guides, and advice on how to deal with water wisely. Citizens, local government, NGOs and companies can benefit from this information service. INFOTERRA is an international environmental referral and research network made up of about 170 countries coordinated by the United Nations Environment Program (UNEP). The US National Focal Point for INFOTERRA is located at the EPA. INFOTERRA/USA responds to requests from the international community for environmental information through document delivery, database searching, bibliographic products, purchasing information and referrals to experts.

E-mail: library-infoterra@epa.gov.

Internet: www.epa.gov

Water saving tips

One hundred water saving tips are listed on the internet site of the Cholla water treatment plant.

Internet: www.chollawtp.com

The Water Page / The African Water Page

On this website a huge amount of information and links regarding water themes can be found. The Water Page is an independent initiative dedicated to the promotion of sustainable water resources management and use. Particular emphasis is placed on the development, utilization and protection of water in Africa and other developing regions.

Water Web Management Ltd,

1 Dome Hill, Caterham, Surrey CR3 6EE, UK.

E-mail: info@thewaterpage.com

Internet: www.thewaterpage.com

The Water, Engineering and Development Centre (WEDC)

WEDC is concerned with education, training, research and consultancy relating to the planning, provision and management of infrastructure for development in low- and middle-income countries. WEDC aims to improve health and well-being of people living in both rural areas and urban communities through the integration of technological, environmental, social, economic and management inputs for effective and sustainable development.

WEDC,

Loughborough University, Leicestershire LE11 3TU, UK.

Tel: + 44 (0) 1509 222885, Fax: + 44 (0) 1509 211079

E-mail: WEDC@lboro.ac.uk Internet:

http://info.lut.ac.uk/departments/cv/wedc/index.html

World Bank

The World Bank offers loans, advice and an array of customized resources to more than 100 developing countries and countries in transition. Water is one of the main topics. Some of the ideas in this book are taken from the World Bank publication 'Greening Industry', which can be read online.

Internet: www.worldbank.org/water /

www.worldbank.org/nipr/greening/index.htm

WCA-infoNET

The WCA infoNET is an Internet-based integrated information platform, which merges information resources and expertise allowing direct access to publications, documents, data, computer programs and discussion groups.

Internet: www.wca-infonet.org

World Meteorological Organization (WMO)

WMO facilitates cooperation within water basins shared between countries. The Hydrology and Water Resources Program concentrates on promoting world-wide cooperation in the evaluation of water resources and the development of hydrological networks and services. WMO also runs an Education and Training Program.

WMO Information and Public Affairs Office,
7 bis, avenue de la Paix, CH 1211 Geneva 2, Switzerland.
Tel: +41 22 730 8315, Fax: +41 22 733 2829 / 730 8027
E-mail: ipa@gateway.wmo.ch
Internet: www.wmo.ch

World Water Actions Database

The World Water Council has developed an online database with short descriptions of world-wide actions in water management. Most of the cases give reference sources for further information. More than 1200 actions are listed and the number is still growing.

Internet: www.worldwatercouncil.org

World Water Assessment Program

The United Nations has started a program to improve water management world-wide. The program contains several themes: governing water wisely; meeting basic needs; securing the food supply; protecting ecosystems; sharing water; managing risks; valuing water; improving the knowledge base; water and energy; water and industry; and water and cities. There have been several case studies to study the progress in achieving a better water management at a local level.

Internet: www.unesco.org/water/wwap/case_studies/indexs.shtml

WWF: Managing water wisely

The World Wide Fund for Nature (WWF) has started a program called 'Living Waters', which aims to influence private sector practices and government policies to ensure freshwater resources for all, protect and manage critically important freshwater wetlands worldwide and safeguard river basins crucial to people and wildlife. In August 2002, WWF presented the report: 'Managing water wisely; Promoting sustainable development through integrated river basin management' in which seven guiding principles for translating integrated river basin management theory into effective field action are mentioned. These are presented in the report, which can be downloaded from the Internet. WWF has also prepared 11 case studies of river basin management in different regions of the world. The Internet site also contains a list of addresses of WWF offices.

Internet: www.wwf.org.uk/researcher/programmethemes/freshwater
www.panda.org/livingwaters/pubs/.

**INFORMATION SERVICES
ON WATER-RELATED
TECHNOLOGY**

3



Anamed: use of water hyacinth

A practical handbook illustrating uses for water hyacinth across the world.

Anamed, Dr. Hans Martin,
Hirt - Schafweide 77, D- 71364 Winnenden, Germany.
Tel: +49 7195 910225, Fax: +49 7195 65367
E-mail: anamed@t-online.de
Internet: www.anamed.org

City of Santa Monica:

Information on how to set up a water saving plan at city level.

The city of Santa Monica has set up a comprehensive water saving plan for the city. The Urban Water Management Plan can be downloaded from the city's Internet site. Environmental Programs Division,
City of Santa Monica, 200 Santa Monica Pier, Ste. C, Santa Monica, CA 90401, USA.
Tel: +1 310 / 458-8229, Fax: +1 310 / 393-1279
Internet: www.santa-monica.org /
<http://epwm.santa-monica.org/epwm/>

Cleaner Production

On the internet site cleanerproduction.com organizations can find practical information on how to be more environmentally friendly. There is also a good links page. Internet: www.cleanerproduction.com

CWWA: Substance removal technologies database

The Canadian Water and Wastewater Association (CWWA) offers a 'substance removal technologies database', which can be used to identify water and wastewater treatment technologies capable of removing specific substances, or to search for information on a specific technology. The database also allows users to enter information on a technology.

CWWA,
2nd Floor, Unit 20; 5330 Canotek Road; Ottawa, ON; K1J 9C3, Canada.
Tel: +1 613 747-0524, Fax: +1 613 747-0523
E-mail: admin@cwwa.ca
Internet: www.ccwa.ca

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)

In order to effectively and purposefully promote strategies oriented to the material-flow recycling process in the field of wastewater management and sanitation, the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), has started to conduct the supraregional sector project 'Ecosan'. The site gives background information on the subject as well as access to their newsletter, events and publications.

E-mail: Christine.Werner@gtz.de

Internet: www.gtz.de/ecosan/english/index.html

Eco-solutions

Eco-solutions provides information on designing, promoting and demonstrating ecological sanitation solutions in the Indian sub-continent.

Internet: www.eco-solutions.org

Global Water Information Network (GLOBWINET)

GLOBWINET is an Associated Program of the Global Water Partnership (GWP), implemented by the German Agency for Technical Cooperation (GTZ) with German government funding. Their website provides information on transboundary river basin organizations, national and international water law and legislation, national water administrations and country-level water resources information. GLOBWINET incorporates two regional networks: the Southern African Water Information Network (SAWINET) and the German Water Information Network (GEWINET).

Internet: www.globwinet.org

International Ecological Engineering Society (IEES)

IEES is a group of about 150 professionals from more than 20 countries, mostly scientists and engineers, interested in promotion and development of Ecological Engineering. IEES is a non-profit organization which seeks to promote contacts between scientists and eco-engineers from different countries and coordinate their activities and exchange information in the field of ecological engineering among scientific and educational organizations, private enterprises, non-governmental organizations and governmental bodies.

IEES, c/o Dr.Johannes Heeb

Bahnhofstr. 2, CH-6110 Wolhusen, Switzerland.

Tel: +41 41-490 40 81

E-mail: info@iees.ch

Internet: www.iees.ch

Innovation Relay Center Paris: Technical water quality solutions

The website of the Innovation Relay Center, Paris, provides a list of technical solutions and companies.

Internet: www.brist.ccip.fr/IRC-Paris-

IdF/pollutec/docs/PollutecLst2001.pdf

International Development Research Centre (IDRC)

The International Development Research Centre (IDRC) support water-related research. In earlier days, this focused mainly on developing water supply technologies, such as improved water pumps and rooftop water collection systems. Now, the focus lies on water treatment and quality control, water demand management and the devolution of water management to lower levels of government, local organizations and communities. The development of simple water testing kits, which can be used by local people to examine the quality of water, is one example.

IDRC,

P.O. Box 8500, Ottawa, ON K1G 3H9, Canada.

Tel: +1 613 236 6163

Internet: www.idrc.ca / www.idrc.ca/nayudamma/waterkit_73e.html

International Program for Technology and Research in Irrigation and Drainage (IPTRID)

IPTRID is an internationally funded program aimed at promoting technology and research in irrigation and drainage in and by developing countries. The Program is hosted and managed by the Food and Agriculture Organization of the United Nations.

E-mail: iptrid@fao.org

Internet: www.fao.org/iptrid

The International Water Association (IWA) Water KnowHow

IWA is a global network of water professionals. 'IWA Water KnowHow' is a technical service, provided by IWA, giving free advice to people who are active in the water sector in a low-income country, when the question can be answered within one hour. If your question requires more work, IWA Water KnowHow will refer you to other sources of help. A volunteer with particular knowledge of your subject will answer your question.

E-mail: help@waterknowhow.info

Internet: www.iwafoundation.org / www.iwahq.org.uk/

IWMI: Re-use of Wastewater for Agriculture

This page provides results from the International Water Management Institute (IWMI) series of studies on wastewater re-use for irrigation and fertilizers for the poor in developing countries.

Internet: www.cgiar.org/iwmi/health/wastew/index.htm

maESTro (UNEP)

maESTro is a free searchable directory on Environmentally Sound Technologies (ESTs) by the United Nations Environment Program (UNEP) International Environmental Technology Centre. maESTro delivers environmental technology databases such as indigenous technology, wastewater treatment, pollution, solid waste, freshwater augmentation etc.

United Nations Environment Programme International Environmental Technology Centre,

2-110 Ryokuchi Koen, Tsurumi-ku, Osaka 538-0036, Japan.

Tel: 81-6-6915-4581, Fax: 81-6-6915-0304

E-mail: maestro@unep.or.jp

Internet: www.unep.or.jp/maestro2/

Medair: Household sand filtration

Medair, a Swiss NGO active in relief and development work, has recently added to their website technical information on how to construct and produce household sand filtration.

Internet:

www.medair.org/MEDAIR%20Sand%20Filtration%20Pages/default.htm

NEMI Online clearinghouse for environmental monitoring

This was set up by the US Geological Survey to help users select of appropriate methods. Scientists and managers monitoring water quality can compare data collection methods and share monitoring data on the National Environmental Methods Index (NEMI). The NEMI database contains chemical, microbiological and radiochemical method summaries of laboratory and field protocols for regulatory and non-regulatory water quality analyses.

Internet: www.nemi.gov

Pesticide alternatives

The Northwest Coalition for Alternatives to Pesticides is an American organization that works to protect people and the environment by advancing healthy solutions to pest problems. The coalition spreads information about pesticide hazards and alternatives, promotes reduction and alternatives and fights for transparency concerning use and ingredients of pesticide products.

Northwest Coalition for Alternatives to Pesticides,

P.O. Box 1393, Eugene OR 97440-1393, USA.

Tel: +1 541-344-5044, Fax: +1 541-344-6923

E-mail: info@pesticide.org

Internet: www.pesticide.org

Potters for Peace

Over the past several years, Potters for Peace has been developing a low tech, low-cost, colloidal silver-enhanced ceramic water filter – the Filtron. Field experience and clinical test results have shown this filter to effectively eliminate over 99% of most water-borne disease agents. The Filtron has been cited by the United Nations' Appropriate Technology Handbook. The ultimate objective of the Filtron project is to provide employment for local potters while meeting an urgent demand for safe water in rural and marginal communities, particularly in the Third World.

Potters for Peace,

2216 Race Street, Denver CO, 80205 USA..

E-mail: barb@potpaz.org

Internet: www.potpaz.org

Practica Foundation

The aim of the Practica Foundation is to reduce poverty by improving technology and facilitating research, development and commercial application of technology in the field of water and energy in developing countries.

Practica Foundation,

Schoorweg 22, 3356 BK, Papendrecht, The Netherlands.

Tel: +31 78 6410222

E-mail: info@practicafoundation.nl

Internet: www.practicafoundation.nl

Roundabout playpump

Using the energy of playing children to pump water is the idea behind the roundabout playpump.

Roundabout Playpumps,

24 Homestead Road, Rivonia, 2128, South Africa.

E-mail: mark@roundabout.co.za

SANDEC

SANDEC is the Department of Water and Sanitation in Developing Countries at the Swiss Federal Institute for Environmental Science and Technology (EAWAG). Its activities focus on problems of sustainable development in economically less developed countries. Its mandate is to assist in developing appropriate and sustainable water and sanitation concepts and technologies adapted to the different physical and socio-economic conditions prevailing in developing countries.

SANDEC,

P.O. Box 611, Duebendorf, Switzerland.

Tel: +41-1-823 52 86 / 823 50 18, Fax: +41-1-823 53 99

E-mail: catarina.dallatorre@eawag.ch

Internet: www.sandec.ch/

SOS-arsenic.net

SOS-arsenic.net is a website dealing with arsenic poisoning in Bangladesh. Text is available in English, French, German and Spanish.

E-mail: jamal@SOS-arsenic.net

Internet: www.sos-arsenic.net

Sulabh International: Cost effective and appropriate sanitation systems

The Sulabh International Social Service Organization implements cost effective sanitation systems. It converts dry/bucket privies to sanitary toilets, supplies toilets to houses where no latrines existed, provides well-designed and maintained community facilities, trains and rehabilitates scavengers to find other jobs and generates bio-gas from public toilets for energy generation. Sulabh works in India but the program is being replicated in South Africa, Sri Lanka, Nepal, Bhutan, Tanzania and Kenya.

Sulabh Bhawan,

Mahavir Enclave, Palam Dabri Marg, New Delhi, India.

Tel: +91-11-5032631 / 5032617 / 5032654, Fax: +91-11-5034014, / 91-11-5036122

E-mail: sulabh@ndb.vsnl.net.in

Internet: www.sulabhinternational.org

UNDP Technical Cooperation among Developing Countries (TCDC)

The United Nations Development Program has a special unit for Technical Cooperation in Developing Countries (TCDC). It fosters communication and promotes wider and more effective cooperation among developing countries, in order to create, acquire and pool knowledge and experience for their mutual benefit. It serves as a vital force for initiating, designing, organizing and promoting cooperation.

TCDC,

1 UN Plaza, FF 12th Floor, New York, NY 10017, USA.

Tel: +1 212 906 5727, Fax: +1 212 906 6429

E-mail: francisco.simplicio@undp.org

Internet: www.undp.org/tcdc/

United Nations Educational, Scientific and Cultural Organization (UNESCO)

The main objective of UNESCO is to contribute to peace and security in the world. This is promoted through collaboration among nations involving education, science, culture and communication in order to further universal respect for justice, for the rule of law and for human rights and fundamental freedoms, without distinction of race, sex, language or religion.

UNESCO,

7, place de Fontenoy, 75352, PARIS, 07 SP, France.

Tel: +33 1 45 68 10 00, Fax: +33 1 45 67 16 90

Internet: www.unesco.org

Vetiver grass

Use of vetiver grass is a good example of a biological instrument to clean up water and to fight erosion. Read more about the use of vetiver grass on:

www.vetiver.org

Water recycling: Technical information on natural water recycling systems

This Internet site gives information on recycling water following the cleaning principles of wetlands. It gives practical information on the design of wetland water recycling systems and provides several examples of applications of such systems.

E-mail: info@waterrecycling.com

Internet: www.waterrecycling.com

Waterportfolio

Water Portfolio presents collaborative, shared cost research projects within the water, wastewater and environment industry. More than hundred project descriptions can be read on this site.

E-mail: info@waterportfolio.com

Internet: www.waterportfolio.com

Waterscape International Group

Waterscape International Group is a team of individuals with an interest in surface water and groundwater management, salinity and agriculture, public health and the environment, citizen environmental monitoring and education and technology training for environmental protection. Special attention is given to Geographic Information System (GIS) applications. The group is composed of members from California, Washington DC and Lithuania and seeks research and project partnerships in the United States, Eastern Europe and the Newly Independent States of Central Asia.

E-mail: info@waterscape.org

Internet: www.waterscape.org

Waterwiser

The waterwiser website is a useful source of links to further information on wise water use.

Internet: www.waterwiser.com

World Health Organization (WHO)

WHO's objective is the attainment by all peoples of the highest possible level of health. Health is defined in WHO's Constitution as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The WHO Secretariat is staffed by health professionals, other experts and support staff working at headquarters in Geneva and in the six regional offices.

WHO,

Avenue Appia 20, 1211 Geneva 27, Switzerland.

Tel: + 41 22 791 21 11, Fax: + 41 22 791 3111

E-mail: info@who.int

Internet: www.who.int



Photo libraries

Many organizations mentioned in this list of references can supply illustrations, photos, presentations, CD-ROMs, videos etc. Here are some online photo libraries that offer photos for free or at a low cost:

- Food and Agriculture Organization (FAO):
www.fao.org
- United Nations Educational, Scientific and Cultural Organization (UNESCO):
<http://upo.unesco.org/photobank.asp>
- WELL Image catalogue:
www.lboro.ac.uk/well/resources/image_catalogue.htm
- World Bank:
<http://worldbank.emotion.com/>

ELDIS

ELDIS is a gateway to information on development issues, providing free access to a wide range of online resources. One of their online services is a table in which you can check the pricing structure for 19 reference and CD-ROM picture libraries.

ELDIS Program,

Institute of Development Studies, University of Sussex, Brighton BN1 9RE, UK.

Tel: +44 1273 877330, Fax: +44 1273 621202

E-mail: eldis@ids.ac.uk

Internet: www.eldis.org/tales/picturingit.htm

Water media network

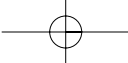
The World Bank Institute, together with the governments of the Netherlands and Japan, are implementing a program to inform and educate journalists on how to cover the subject in more depth, share information, and experience the difference that water can make to the economy of individual regions. A Water Media Network Online has also been set up, providing information, workshop materials, contact lists and links to key water organizations and research institutes.

Water Media Network,

c/o Tracey Osborne, 1818 H Street,
Washington, DC 20433, USA.

E-mail: tosborne@worldbank.org

Internet: www.worldbank.org/wmn



Water words online dictionaries

On the internet, several water word dictionaries can be found, for example:

- Nevada government:
www.state.nv.us/cnr/ndwp/dict-1/ww-index.htm
- Water Softeners:
www.watersofteners.com/Waterdictionary_mainpage.html
- North American Lake Management Society:
www.nalms.org/glossary/glossary.htm
- Cholla Water treatment Plant:
www.chollawtp.com/
- U.S. Geological Survey, Cartography and Publishing Program:
http://sr6capp.er.usgs.gov/GIP/h2o_gloss/

World comics

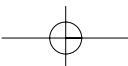
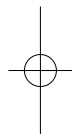
World Comics is a Finnish organization that promotes the use of comics in education, development, cross-cultural communication and anti-corruption.

World Comics, Leif Packalén,
Vanamontie 4 E 156, 01350, Vantaa, Finland.

Tel: +358-9-8736751

E-mail: leif.packalen@worldcomics.fi

Internet: www.worldcomics.fi





**SERVICES IN PROMOTING
TRANSPARENCY**

Aarhus Convention

The United Nations Economic Commission for Europe (UNECE) provides more information on the Aarhus convention.

Internet: www.unece.org

Agenda 21 Statement

The full text of the statement on local participation 'Agenda 21' can be downloaded from the United Nations website.

Internet: www.un.org/esa/sustdev/agenda21text.htm

African/Australian Institute of Corporate Citizenship

The African Institute of Corporate Citizenship and Australian Institute of Corporate Citizenship are linked organizations, working in corporate social responsibility and sustainable development across all sectors but with a significant focus on mining. The AICC mining team works internationally with core teams based in South Africa and Australia. The teams specialize in supporting mining companies, local communities, international development agencies and government in finding and managing sustainable development beyond the life of the mine.

AICC Africa

9 St. Davids Place
Parktown, Johannesburg
South Africa

Tel: +27 11 643 6604

Fax: +27 11 643 6918

E-mail: info@aiccafrica.com

Internet: www.corporatecitizenship-africa.com

AICC Australia

Level 10, 423 Bourke Street
Melbourne
Australia

Tel: + 61 8 827 41941

Fax: + 61 8 827 41160

E-mail: info@aiccglobal.com

Internet: www.aiccglobal.com

Compliance Advisor Ombudsman (CAO)

The compliance advisor ombudsman is an organization that addresses complaints by people affected by projects, and works to enhance the social and environmental outcomes of projects. Therefore, CAO executes so-called 'compliance audits'. A compliance audit is a systematic, documented verification process of objectively obtaining and evaluating evidence to determine whether environmental and social

activities, conditions, management systems or related information conform with the audit criteria.

Compliance Advisor Ombudsman,
2121 Pennsylvania Avenue, NW, Washington, DC 20433, USA.
Tel: 202-458-1973, Fax: 202-522-7400
E-mail: cao-compliance@ifc.org
Internet: www.cao-ombudsman.org

Digital governance

The website www.digitalgovernance.org explores some of the innovative models putting electronic forms of governance into practice. The website provides descriptions of these models and various programs based on these models, along with relevant electronic governance case studies, articles and publications and upcoming events. Updates can be received by sending a blank email.

E-mail: digitalgovernance-subscribe@yahoogroups.com
Internet: www.digitalgovernance.org

Citizen participation in local watershed management

The US Environmental Protection Agency (EPA) stimulates citizens to become active in the conservation of local watersheds. EPA uses the Internet for this purpose. The 'Earth Day' site is an example where you can find 'Fifteen things you can do to make a difference in your watershed' Another example is the site 'Adopt Your Watershed', a database of active watershed groups in the US and information on how to start a watershed group.

Internet: www.epa.gov/ow/citizen/thingstodo.html

Global Reporting initiative (GRI)

GRI provides information on why and how organizations should write an Environmental Year Plan.

GRI,
P.O. Box 10039, 1001 EA, Amsterdam, The Netherlands.
Tel: +31 20 531 00 00, Fax: +31 20 531 00 31
E-mail: info@globalreporting.org
Internet: www.globalreporting.org

Global Compact

The Global Compact initiative is a network that brings companies together with United Nations agencies, labor, non-governmental organizations and other civil-society actors to foster action and partnerships in the pursuit of good corporate citizenship. The Global Compact is based on nine principles in the areas of human rights, labor and the environment and asks companies to integrate these principles into their core business operations. To be considered a participant in the Global Compact, a company is required to provide, once a year, a concrete example of how it is internalizing one or more of the nine principles into management practices and policies.

The UN Global Compact Office,
Room DC1-1170, New York, N.Y. 10017, USA.
E-mail: globalcompact@un.org
Internet: www.unglobalcompact.org.

Mineral Policy Center

The Mineral Policy Center is a non-profit environmental organization dedicated to protecting communities and the environment by preventing the environmental impacts associated with irresponsible mining and mineral development and by cleaning up pollution caused by past mining.

Mineral Policy Center,
1612 K Street NW, Suite 808, Washington, DC 20006 PH 202.887.1872, USA.
E-mail: webmaster@mineralpolicy.org (for technical questions)
Internet: www.mineralpolicy.org

OneWorld

OneWorld is an online media gateway that informs a global audience about human rights and sustainable development and brings together a global community working for sustainable development through interactive online partnerships of organizations and individuals sharing their vision.

OneWorld,
Floor 17, 89 Albert Embankment, London SE1 7TP, UK.
Tel: +44 20 7735 2100, Fax: +44 20 7840 0798
E-mail: justice@oneworld.net
Internet: www.oneworld.net

Riverkeeper

Riverkeeper started with the Hudson Riverkeeper in the 1960s. Since then the Hudson River changed slowly from an open sewer into a clean river. Nowadays, Riverkeeper is spread all over the country. Riverkeeper organizations are led by a full-time privately funded non-governmental ombudsperson. The activities of Riverkeeper are patrolling the river, collecting evidence and filing lawsuits against polluters. At the moment there are over 70 Riverkeeper programs across the country.

Riverkeeper,

P.O. Box 130, Garrison, NY 10524, USA.

E-mail: info@riverkeeper.org

Internet: www.riverkeeper.org

Third party certification provider: NSF international

NSF International (formerly the National Sanitation Foundation) is a global third-party certification provider. NSF International provides standards and third-party conformity assessment services to government, consumers and manufacturers of products and systems related to environmental safety and public health. NSF International focuses on the essential elements of public health; water, food, environment and air.

NSF International,

P.O. Box 130140, 789 N. Dixboro Road, Ann Arbor, MI 48113-0140, USA.

Tel: +1 734-769-8010, Fax: +1 734-769-0109

E-mail: info@nsf.org

Internet: www.nsf.org

Trace

Trace is an independent, non-partisan organization that undertakes preliminary vetting of agents, consultants and subcontractors. It has developed a 'Standard for Doing Business with Intermediaries Internationally'. The standard helps companies identify overseas business intermediaries (sales agents, consultants, suppliers, distributors, resellers, subcontractors, franchisees and joint venture partners) that share their commitment to transparent, ethical business practices.

Trace,

1100 New Hampshire Ave. NW, Washington, DC 20037, USA.

E-mail: info@TRACEinternational.org

Internet: www.TRACEinternational.org

Public Affairs Council

The Council is an association for public affairs professionals. It provides information, training and other resources to its members to support effective participation in government, community and public relations activities at all levels. More than 600 member corporations, associations and consulting firms work together to enhance the value and professionalism of the public affairs practice, and to provide thoughtful leadership as corporate citizens.

Public Affairs Council,

2033 K Street, NW, Suite 700, Washington, DC 20006, 202.872.1790 USA.

E-mail: dpinkham@pac.org (international contacts)

Internet: www.pac.org

Transparency International (TI)

Transparency International raises awareness about the damaging effects of corruption, advocates policy reform, works towards the implementation of multilateral conventions and subsequently monitors compliance by governments, corporations and banks. Their website contains comprehensive information and a toolkit featuring different ideas, methods and best practices.

TI,

Otto-Suhr-Allee 97/99, 10585 Berlin, Germany.

Tel.: +49-30-343 8200, Fax: +49-30-3470 3912

E-mail: ti@transparency.org

Internet: www.transparency.org



CAPACITY BUILDING SERVICES

Africa Water Task Force (AWTF) and African Water Facility (AWF)

AWTF is a non-profit NGO with representatives selected from regional and sub-regional organizations and/or stakeholders working on water issues in Africa. The Task Force is accountable for the African Water Stakeholders' Conference which is convened every two years. The African Water Facility (AWF) is not to be confused with the African Water Forum, which has the same acronym. It is a product of the AWTF. It is designed to generate pooled funds from donors and other interested parties. AWF is active at the sectoral level and calls for both sides – countries and donors – to enter into a deal to solve the continent's water supply and sanitation problems. AWF wants to provide financial support in order to promote innovative actions by both countries and donors, to assist in creating an enabling environment, to build governance and management capacity within implementing institutions and to support innovation to enable subsidies to be more effective.

Secretariat African Water Taskforce / African Water Facility,
African Development Bank, BP V316, Abidjan 01, Ivory Coast.

E-mail:

Chairman AWTF: Professor A. Wright: amwright2@msn.com,

Secretary AWTF: Dr. Daniel Adom: dan-watrecom@ighmail.com,

Contact AWF: Dr. Shehu Yahaya: S.yahaya@AFDB.org

Internet: www.waterdome.net

Ashoka

Ashoka screens and selects highly motivated people and makes them 'Ashoka Fellows'. Ashoka Fellows are leading social entrepreneurs who have innovative solutions and the potential to change patterns across society. They are selected because they demonstrate the following attributes: a big new idea, creativity, entrepreneurial quality, social impact of the idea and ethical fiber. The projects are concerned with themes like health, education, human rights and environment. There are several water projects initiated by fellows.

Ashoka Headquarters,

1700 North Moore Street, Suite 2000, Arlington, VA 22209, USA.

Tel: +1 703-527-8300, Fax: +1 703-527-8383

Email: info@ashoka.org

Internet site: www.ashoka.org

Cap-net

Cap-net is a global capacity building network in integrated water resource management (IWRM), providing support for regional and national networks of IWRM training and strengthening the water curricula of educational institutions. It works with partners to impart training for trainers' courses, and to organize seminars to promote local awareness, competence and better understanding of IWRM. Cap-net has helped to establish and strengthen regional IWRM networks.

Cap-net Secretariat,

P.O. Box 3015, 2601 DA Delft, The Netherlands.

Tel: +31 15 2151808, Fax: +31 15 2139598

e-mail: info@cap-net.org

Internet: www.cap-net.org

International Foundation for Science (IFS)

IFS contributes to strengthening the capacity of developing countries to conduct relevant and high quality research on the sustainable management of biological resources. This involves the study of physical, chemical and biological processes, as well as relevant social and economic aspects that are important in the conservation, production and renewable utilization of the natural resource base. Promising young scientists from developing countries can apply for financial support.

IFS,

Grev Turegatan 19, SE-114 38 Stockholm, Sweden.

Tel: +46 8 545 818 00, Fax: +46 8 545 818 01

E-mail: info@ifs.se

Internet: www.ifs.se

ISO 14000 and Environmental Management

ISO 14000 is a systematic approach in monitoring environmental management. Online information and implementation cases can be found here.

Internet: www.trst.com/iso5.htm

IW:LEARN

IW:LEARN's mission is to build an Internet-based 'global knowledge community' to protect, restore and sustain the world's aquifers, great lakes and river basins, coastal zones, seas and oceans. Sponsored by the Global Environment Facility (GEF) and its

United Nations and World Bank partners, IW:LEARN specifically builds capacity among transboundary water resource projects worldwide.

IW:LEARN,

4211 N. Fairfax Drive, Arlington, VA 22203, USA.

Tel: +1 703.522.2190, Fax: +1 703.522.2191

Email: info@iwlearn.org

Internet: www.iwlearn.org

The Regional Environmental Center (REC) for Central and Eastern Europe

REC is a non-advocacy, not-for-profit organization with a mission to assist in solving environmental problems in Central and Eastern Europe. The Center fulfills its mission through encouraging cooperation among NGOs, governments and businesses, supporting the free exchange of information and promoting public participation in environmental decision-making.

REC Head Office,

2000 Szentendre, Ady Endre út 9-11, Hungary.

Tel: +36 26 504-000, Fax: +36 26 311-294

E-mail: info@rec.org

Internet: www.rec.org

Third World Academy of Sciences (TWAS)

The principal aim of TWAS is to promote scientific capacity and excellence for sustainable development in the South. The Academy has more than 600 Fellows (from the South) and Associate Fellows (from the North). Since 1986, TWAS has supported scientific research in 100 countries in the South through a variety of programs. 'Safe Drinking Water: The need, the problem, solutions and an action plan' is the title of the latest report produced by TWAS.

TWAS Secretariat, Sandra Ravalico,

c/o ICTP, Strada Costiera 11 -34014 Trieste, Italy.

Tel: +39 040 2240-327, Fax: +39 040 224559

E-mail: info@twas.org

Internet: www.twas.org

Tools of Change

The Tools of Change website contains several detailed cases about water management at local level.

Internet: www.toolsofchange.com

UNDP Water and Sanitation Program (WSP)

The United Nations Development Program Water and Sanitation Program (WSP) is an international partnership concerned with water and sanitation services for the poor. Its mission is to alleviate poverty by helping the poor gain sustained access to improved water and sanitation services. Over the past two decades, the WSP has helped clients in more than 30 countries. The initiative has improved access to water and sanitation services for millions of poor people in rural and urban communities by assisting local partners to overcome obstacles and to identify innovative solutions to problems of service provision.

The World Bank Group Water Supply and Sanitation Division,
H Street, N.W, Washington, D.C. 20433, USA.

Tel: +1 202 473-9785, Fax: +1 202 522-3313 / 522-3228

E-mail: info@wsp.org

Internet: www.wsp.org

Unilever

Unilever facilitates major social investment projects, nature conservation projects and water projects. Regarding the water theme, Unilever has supported the following activities: Sustainable Water and Integrated Catchment Management (SWIM), Living Lakes and a volunteer program for employees.

Unilever,

Unilever House, London, EC4P 4BQ, UK.

Tel: +44 20 7 822-5252, Fax: +44 20 7 822-5951

Internet: www.unilever.com.

WaterAid

WaterAid is a charity dedicated to helping people escape the stranglehold of poverty and disease caused by living without safe water and sanitation. WaterAid works in partnership with local organizations in 15 countries in Africa and Asia to help poor communities establish sustainable water supplies and latrines close to home.

WaterAid,

Prince Consort House, 27-29 Albert Embankment, London, SE1 7UB, UK.

Tel: +44 20 7793 4500, Fax: +44 20 7793 4545

E-mail: wateraid@wateraid.org.uk

Internet: www.wateraid.org.uk

AWARDS AND PRIZES

7



Asian Development Bank Water Prize

The Asian Development Bank (ADB) Water Prize is presented to a project agency in an ADB-financed water project in recognition of sound practice in support of ADB's Water Policy 'Water for All'.

ADB Headquarters,
P.O. Box 789, 0980 Manila, Philippines.
Tel: +632 632 4444, Fax: +632 636 2444
Internet: www.adb.org/Water/default.asp

The Business Award by ICC and UNEP

The Millennium Business Award for Environmental Achievement was presented for the first time in May 2000 by the International Chamber of Commerce (ICC) in collaboration with the United Nations Environment Program (UNEP). The spirit of the Awards is the revelation and recognition of leading innovative approaches to advance sustainable development. The Awards highlight concrete actions taken by business organizations in partnership with other stakeholders for sustainable development. The prize is given every two years during May.

International Chamber of Commerce,
38 Cours Albert 1er, 75008 Paris, France.
Tel: +33 1 49 53 28 28, Fax: +33 1 49 53 28 59
E-mail: Claire.kilvert@iccwbo.org
Internet: www.iccwbo.org

Dubai International Award

The Dubai International Award rewards best practices in improving the living environment. Governments, local authorities and civil society, including the private sector, that have made outstanding contributions to improving the quality of life in urban and rural communities are invited to send in their projects. The award has a two-year cycle.

Dubai Municipality,
P.O.Box 67, Dubai, United Arab Emirates.
Tel: 971 4 2215555, Fax: 971 4 2246666
E-Mail: info@dm.gov.ae
Internet: <http://dubai-award.dm.gov.ae>

ICID awards

The International Commission on Irrigation and Drainage (ICID) rewards research, projects and individuals with several awards:

- *Innovative Water Management Award*
- *Technology Award*
- *Dr. Hassan M. Ismail Memorial International Award*: awarded to a young professional for the best paper on the development of irrigation, drainage and flood control in Africa.
- *WaterSave Award*: an award for promoting research that leads to substantial savings in water applications or uses, besides demonstrated savings in a project or allied areas (best technology) and an award for promoting development of new policies/approaches for water saving leading to cost effective and efficient use of water (best management)

ICID Head Office,

48 Nyaya Marg, Chanakyapuri, New Delhi 110021, India.

Tel: 91-11-6116837, 4679532, 6115679, Fax: 91-11-6115962

E-mail: icid@icid.org

Internet: www.icid.org

King Hassan II World Water Prize

The King Hassan II World Water Prize is an international award jointly established by the Government of Morocco and the World Water Council, in memory of his Majesty King Hassan II of Morocco. The award was created in March 2000. The prize is awarded to an institution, organization, individual or group of individuals in honor of outstanding achievements in any aspects of water resources such as scientific, economic, technical, environmental, social, institutional, cultural or political.

WWC,

Stephanie Porro, Prize Coordinator, Secretariat of the King Hassan II Prize,

10 place de la Joliette, Les Docks de la Joliette, Atrium 10.3 13001 Marseille, France.

Tel: +33 4 91 99 41 00, Fax: +33 4 91 99 41 01

E-mail: Hassan2-waterprize@worldwatercouncil.org

Internet: www.worldwatercouncil.org/water_prize.shtml

International Riverprize

The Riverprize supports outstanding achievements in river management anywhere

in the world with a financial donation. It is open to an individual, organization, agency or group of organizations that can demonstrate outstanding achievement in river management. The prize is awarded every year.

Riverprize Panel,

Brisbane Pty Ltd., PO Box 25, Stanley St Plaza, South Bank Queensland 4101, Australia.

Tel: +61 7 3846 7444, Fax: +61 7 3846 7660

E-mail: symposium@riverfestival.com.au

Internet: www.riverfestival.com.au

Stockholm Water Prize

The Stockholm Water Prize is an international environmental award presented by the Stockholm Water Foundation annually in honor of outstanding achievements in science, engineering, technology, education or public policy related to protection of the world's water resources. The prize is awarded to an institution, organization, individual or company that has contributed substantially to water preservation and enhancement through applied research or direct action. In addition to this award, the Foundation also present the Stockholm Industry Water Award and the Stockholm Junior Water Prize.

Stockholm International Water Institute,

Hantverkargatan 5, 11221 Stockholm, Sweden

Tel: +46 852-213-960, Fax: +46 852-213-961

E-mail: siwi@siwi.org

Internet: www.siwi.org.

Vern Haverstick Groundwater Hero Award

This American award recognizes an individual for groundwater service and is given every year in November. The goal of the award is to spread the word about groundwater, inspire groundwater leadership in others and pull unrecognized 'groundwater heroes' into the spotlight.

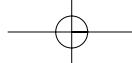
The Groundwater Foundation Awards Nomination,

P.O. Box 22558, Lincoln, NE 68542-2558, USA.

Tel: +1 402-434-2740, Fax: +1 402-434-2742

E-mail: info@groundwater.org

Internet: www.groundwater.org/awards/vern_haverstick.htm

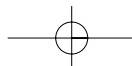


Annex 2:

Text and illustration sources



Searching for water sources:
Drilling a well in North Bengal, India



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- Peter Rogers and Alan Hall, 2002. Effective Water Governance. TEC Paper 7, Stockholm: Global Water Partnership.
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- Ashoka: www.ashoka.org
- Global Water Partnership: www.gwpforum.org
- State Office for Water Management Hof: www.bayern.de/wwa-ho/ttw
- United Nations: www.bestpractices.org
- Self Employed Women's Association: www.sewa.org
- Nicole Bernex, Pontificia Universidad Catolice del Peru
- Rockland Government: www.co.rockland.ny.us
- World Water Council (World Water Action Database): www.worldwatercouncil.org
- International Council for Local Environmental Initiatives: www.iclei.org
- Pinga Oya project: Lalith Dassenaike, Kusum Athukorale
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- Minnehaha Creek Watershed District: www.minnehahacreek.org
- Living Lakes: www.livinglakes.org/milicz/storks.htm
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- Roundabout Outdoor, South Africa

Photos and illustrations:

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- Arcadis Euroconsult / CDHI 18

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- Consultative Group on International Agricultural Research: www.cgiar.org
- International Water Management Institute: www.cgiar.org/iwmi/
- Natural Resources Defense Council: www.nrdc.org/water/conservation/
- Practica Foundation: www.practicafoundation.org
- Atria: www.atria.net
- City of Moose Jaw: www.citymoosejaw.com/departments/engineers/municipal/wastewater.shtml
- Morarka Foundation: www.morarkango.com/vermicompost.html
- Water Management Project Benelux: www.watermanagement.be
- International Development Research Center: www.idrc.ca
- Water Harvesting Gansu: www.unep.or.jp/ietc/Publications/Urban/UrbanEnv-2/9.asp
- City of Tucson: <http://www.ci.tucson.az.us/> / www.iclei.org
- City of Santa Monica: <http://www.santa-monica.org/cm/> / www.iclei.org
- Zaragoza: www.habitat.aq.upm.es/bpes/onu98/bp439.en.html
- City of Kamloops: <http://www.city.kamloops.bc.ca/water/>
- Minimizing leakage Romania, Bulgaria: www.ecolinks.org/ / www.ashoka.net/ / www.rec.org/
- Vienna: www.bestpractices.org
- Tokyo: www.env.go.jp/earth/g8_2000/forum/g8bp/detail/japan/japan12.html
- Den Bosch, Netherlands: Toolbox GWP

- World Water Actions Database: www.worldwatercouncil.org (Hamburg, fiscal incentives)
- Soccer stadium South Korea: www.CSEindia.org
- US Green Building Council, Leadership in Energy and Environmental Design (LEED): www.usgbc.org/LEED/LEED_main.asp
- Hutchinson Technology Incorporated: www.htch.com/
- TNO, Netherlands: www.mep.tno.nl
- Galatex, Bulgaria: www.galatex.bg/ www.ecolinks.org/
- Ecolinks: De Miclén, Slovakia, Potato Chip Plant, Kazakhstan
- Motorola: www.motorola.com
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- APWELL, Euroconsult (PHM program Andhra Pradesh, India) 20
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- John Ratsey (photo bucket drip) 21
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- International Development Research Center: www.idrc.ca
- Maryland Department of Natural Resources: www.dnr.state.md.us/bay/protect/field.html
- International Water and Sanitation Center (IRC): www.irc.nl/themes/communication/cases/index.html
- Sulabh International Social Service Organisation: www.sulabhinternational.org
- Laguna Lake Development Authority: www.llda.gov.ph
- Western Lake Superior Sanitary District: www.wlssd.duluth.mn.us/
- City of Seattle: www.ci.seattle.wa.us/oem/pesticides/PesticideStrategy.htm / www2.cityofseattle.net/urbansustainability/
- Integrated Pest Management Resource Center: www.IPMRC.com
- National Wildlife Federation: www.nwf.org/watersheds/nonpoint.html
- Delaware Department of Natural Resources and Environmental Control: <http://www.dnrec.state.de.us/del-auto.htm>
- Oil Recycling: www.downeyca.org/residential_recycle.php / www.cuyahogawd.org/hhw/motor_oil.shtml
- United Nations: www.bestpractices.org
- Ecological Engineering Group: www.ecological-engineering.com
- Global Environmental Management Initiative: www.gemi.org/water/casestudies.htm
- Potters for Peace: www.potpaz.org
- Changemakers.net: www.changemakers.net/journal/98october/ghosh.cfm
- Constructed wetlands: www.waterrecycling.com / www.lboro.ac.uk/departments/cv/wedc/conferences/28/28th%20pre-prints/Maciaszek.pdf
- Living Machines Inc.: www.livingmachines.com
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- Laguna Lake Development Authority (satellite photo) 34
- University of Kuopio, Finland: www.uku.fi (Ichneumonid wasp) 34
- Cuyahoga County Solid Waste District (oil recycling pamphlet) 35
- UNEP Kenya (water hyacinth Nairobi dam) 35
- Wim Giesen (water hyacinth) 36
- Potters for Peace (ceramic filter) 37
- Indiana Architecture (biofilter Ethel M) 38

CHAPTER 5: CLEAN-UP PROGRAMS

Information sources:

- United Nations Development Fund: www.unep.org/roa/nairobi_river/
- Clean Asia: www.cleanasia.com
- River festival Queensland, Australia: www.riverfestival.com.au
- Ashoka: www.ashoka.org
- Cuyahoga River, Ohio: www.sbaonline.sba.gov
- United Nations Romania
- Santa Barbara County Water Agency
- Walton League: www.iwla.org/sos
- Stockholm Water Prize: www.siwi.org
- www.malloryswamp.org
- United Nations: www.bestpractices.org
- Fox river: www.greenbaypressgazette.com
- Living Lakes: www.livinglakes.org
- Organization for the Assabet River: www.assabriver.org/about.html
- River Torres, Costa Rica: www.oneworld.org
- Fu and Nan Rivers, China: www.iclei.org
- Minnesota Clean Water Partnership: www.pca.state.mn.us/water/cwpartner.html

- Samsung: www.Samsung.com
- Lake Peipsi Center for Transboundary cooperation:
www.ctc.ee/index.php?lang_id=2
- Mitigation banking: www.mitigationbanks.com
- Vetiver Grass: www.vetiver.org
- Global Environment & Technology Foundation / Ecolinks: www.getf.org
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- www.Solutions-site.org (otter) 40
- Prefecture Shiga: www.pref.shiga.jp (lake biwa) 41
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- Organization for the Assabet river (cleanup day) 46
- Bureau of land management Oregon (Rogue cleanup day) 46
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CHAPTER 6: PROMOTING TRANSPARENCY

Information sources:

- Environmental Defense Fund: www.scorecard.org
- Pesticide Action Network: www.psticideinfo.org
- Yalova municipality, Turkey: www.yalova-bld.gov.tr

- Aarhus Convention: www.mem.dk/aarhus-conference/issues/public-participation/ppartikler.htm
- Essential Action: www.essentialaction.org/ / www.pirg.org/marypirg/enviro/pest/ipm_rtk.htm
- Worldcomics: www.worldcomics.fi
- Independent monitoring Moldova: www.bestpractices.com
- Global Reporting Initiative: www.globalreporting.org
- Ftse4good: www.ftse4good.com
- Mineral Policy Center: www.mineralpolicy.org
- Transparency International: www.transparency.org
- US National Biosolids Partnership: www.biosolids.org
- Ashoka: www.ashoka.org/ / www.changemakers.net
- Institute of Development Studies: www.ids.ac.uk/ids
- IWRM ToolBox, GWP: Porto Alegre, Brazil
- IUCN: www.iucn.org/themes/wetlands/journalistnetwork.html
- Hudson River Keeper Organization: www.riverkeeper.org
- GWP Slovakia
- WaterVoice UK: www.ofwat.gov.uk/aptrix/ofwat/publish.nsf/Content/navigation-watervoice-homepage
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- Well image library: (man calling) 51
- www.ifes.md/moldova (River Prut) 52
- FTSE: www.ftse4good.com 52
- Toolkit TI: www.transparency.org 53
- Ministry of Water Res. & Irr., Govern. Egypt (complaint form) 54
- Klub Gaja 54

CHAPTER 7: WATER MANAGEMENT WITHIN ORGANIZATIONS

Information sources:

- ITT Flygt: www.flygt.com
- Essential action
- Sony: www.sony.net/SonyInfo/Environment/
- Minnesota Office of Environmental Assistance
- Norsk Hydro: www.hydro.com/en
- DuBo Centrum: www.dubo-centrum.nl
- SC Johnson: [www.scjohnson.com./](http://www.scjohnson.com/) / <http://policyworks.gov/org/main/mp/gsa/ics2.html#9>
- www.rainwaterharvesting.org
- Samsung: www.Samsung.com
- US Environmental Protection Agency: www.epa.gov
- Stockholm water prize: www.siw.org
- World Business Council on Sustainable Development: www.wbcsd.org
- General Motors: www.GM.com
- Compaq / Hewlett-Packard: www.hp.com/ / www.compaq.com
- CEFIC: www.cefic.org
- Ecolinks
- www.washright.com
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- Unilever: www.unilever.com

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- Flygt: www.flygt.com 58
- Sony: www.sony.net/SonyInfo/Environment 58
- www.vhall.nl/VanHallInstituut/VirtueleRondleiding/Index.HTM 59
- www.rainwaterharvesting.org (waterharvesting India) 59
- www.djh.dk/euroviews02/romania/fabrik.jpg (SIDEX) 62
- www.washright.com 62
- ISO: www.iso.ch 62

CHAPTER 8: FACILITATING LOCAL INITIATIVES

Information sources:

- Lalith Dassenaik, Kusum Athukorale, Pinga Oya project
- Minnesota Pollution Control Agency: www.pca.state.mn.us
- Ashoka / www.changemakers.net: Yadfon, Thailand
- Groundwater Foundation: www.groundwater.org/Guardian/ggindex.htm
- WaterAid: www.WaterAid.org
- ICLEI: www.iclei.org
- Japanese Government:
www.env.go.jp/earth/g8_2000/forum/g8bp/detail/japan/japan12.html
- Innovation Relay Center, Paris
- Water for Africa: www.water4people.org: examples Workshops Zambia, Seed funds Malawi.
- Ecolinks: example Sidex, Kazakhstan
- Michigan State University:
www.msue.msu.edu/learnnet/newprogram_061802.htm
- Rockland County Health Department: www.co.rockland.ny.us/health/default.htm
- American Rivers: www.americanrivers.org
- Ashoka / Personal website Prasad Rasal:
www.members.tripod.com/~mah_watershed/tech.html
- Integrated Resource Management Research Pty Ltd: www.catchment.com
- Canadian Water and Wastewater Association: www.cwwa.ca/water.htm
- Center for Science and Environment India WATERLINKS:
http://data.cseindia.org/register/FMPro?-db=cs_register.fp3&-lay=web&-format=new.htm&-view
- National Land and Water Resources Audit Australia: www.nlwra.gov.au
- Dragonfly Award: www.merseybasin.org.uk
- Scandinavian Leisure Group: www.slg.se/default_en.htm
- National Solidarity Fund Tunisia: www.26-26.org/english/whatis/
- www.toolsofchange.com: example city of Barrie, Canada
- Groundwater foundation: example insurance benefits Michigan, USA
- Cargill: www.cargill.com/commun/water.htm

Photos and illustrations:

- Msu water Conservation Mission (Chief Minister Andhra Pradesh) 64
- Groundwater Guardian: www.groundwater.org/ 64
- <http://mshand.geog.gla.ac.uk/DAR/people.jpg> (WaterAid, Tanzania) 65
- ICLEI: www.iclei.org 65
- www.nahbrc.org (low flow showerhead) 68

Cover photos:

- Arcadis Euroconsult (child drinking)
- Wim Giesen (others)

Chapter photos:

- Title page: Roundabout playpumps, South Africa
- Chapter 1 - 4, 7: Wim Giesen
- Chapter 5: Organization for the Assabet river: cleanup day
- Chapter 6: Jose Antonio Sicilia Paneque / GWP
- Chapter 8: International Institute for Sustainable Development
- Text and illustration Sources: F. van Steenbergen

Illustrations in the references:

- Main Picture: Francois Bouvé (also used as box background)
- Water networks: www.georgehart.com
- Information services on IWRM: F. van Steenbergen
- Information services on water related technology: <http://pix.opa.anl.gov>
- Media and communication support: www.undp.org.in
- Services in promoting transparency: <http://pix.opa.anl.gov>
- Capacity building services: <http://f64.nu/photo/watertower.jpg>
- Awards and prizes: Mekong River Commission

Illustrations inside back flap:

- Cape Cod Groundwater Guardian Team: www.capecodgroundwater.org