IWRM ToolBox Version 2 - Foreword

Dear Friends and Colleagues,

I am pleased to introduce to you Version 2 of the IWRM Toolbox, an instrument aimed at assisting with the development of practices inspired by the principles of Integrated Water Resource Management (IWRM). As Margaret Catley-Carlson, our Chair, stressed in the Preface to Version 1, introducing IWRM is hard work! On the surface IWRM seems easily understood and it is being embraced by everybody as it is a concept that is hard to disagree with – like many other complementary definitions used in the search for social justice and better living conditions for all, such as the fight against poverty and the promotion of gender equality.

However, once people – even with the greatest of enthusiasm – try to put IWRM into practice, they are faced with the apparently insurmountable difficulty of bringing together a very intricate socio-economic reality, the legacy of the past and its ingrained practices and beliefs, and the apparently non-reconcilable conflicting demands. Is the task impossible? No, but it does require the joint effort of all stakeholders to bring about – stakeholders who, in most cases, have generally acted in isolation of each other, or even consciously or unconsciously fighting against each other. This presents one of the main challenges for the GWP – rallying all stakeholders together and encouraging them to integrate their activities as advocated by IWRM.

Even if the perfect application of IWRM practices is unrealistic – as in any theoretical framework – its principles offer a very practical set of references to pursue sustainable development and management of water resources. Although the ToolBox aims to be a key reference instrument for the practical application of IWRM, it is neither a sacred text, where all truth can be found, nor a manual, from where an answer for any problem at hand can be lifted. Instead, all the information contained in the ToolBox can be useful in identifying and establishing feasible IWRM practices in a range of contexts, and it is a 'meeting point' for practitioners committed to establishing IWRM. Indeed, Version 2 already reflects the ideas and constructive criticisms provided by many of our friends and colleagues – contributions for which the whole GWP family, and myself personally, wish to express our gratitude. Also, considering the essential role of education and capacity building, it is very encouraging to see that in some universities and teaching institutions the ToolBox has already been adopted as a 'text-book' in IWRM-related courses. I trust all of you, and the whole IWRM community, will continue your active participation in making the ToolBox a 'living instrument' for the practical application of IWRM. This volume shows all the Tools and lists case studies, but the full interactive ToolBox is to be found on the web at www.gwpforum.org, and is supported by a CDrom version.

Finally, I would like to add my voice to the clear message going worldwide that calls for a clear transition from advocacy to action – a message reinforced in the recent World Summit for Sustainable Development in Johannesburg which called for all nations to have National Water Resources Management Plans in place by the year 2005. The GWP, from its patiently constructed and carefully defended neutral platform, aims to be a facilitator of this process. I believe that the IWRM ToolBox can be a very significant instrument in helping people to address this challenge.

Emilio Gabbrielli Executive
Secretary, GWP

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1 Why and how IWRM

This introductory section of the Global Water Partnership's ToolBox for Integrated Water Resources Management is intended for policy makers and decision takers who need to make informed choices about appropriate water governance and management reforms. Such policy makers will be well aware that their country, region, or locality is facing severe water problems and they will have recognised that these problems cannot be tackled effectively with current policies, governance structures and management practices. They will typically be faced with diverse, often conflicting, opinions from water practitioners and other specialist advisors about the types of reform, which are necessary. Many will also know of reform attempts made elsewhere which have yielded limited benefits or have had unintended and undesirable consequences.

Neither this section nor the full ToolBox is prescriptive; there is no set blueprint for reform which will yield good results in all countries. Policy makers will need to make judgements about which reform measures, management tools or institutional arrangements are most appropriate given the particular cultural, social, political, economic and environmental circumstances which provide the contextual setting for the reforms. The section has been designed to help policy makers ask the right questions, to test whether reform proposals are capable of addressing the specific water problems of a country or locality, to evaluate whether suggested measures are compatible with existing endowments of financial and human capital; and to assess whether specific management tools can effectively be utilised on their own or can only fulfil their objectives if accompanied by a more far ranging packages of changes.

Why IWRM?

If effective, long lasting solutions to water problems are to be found, a new water governance and management paradigm is required. Such a new paradigm is encapsulated in the IWRM concept, which has been defined by GWP as 'a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems' (Technical Advisory Committee 2000).

IWRM explicitly challenges conventional water development and management systems. It starts with the recognition that traditional top-down, supply led, technically based and sectoral approaches to water management are imposing unsustainably high economic, social and ecological costs on human societies and on the natural environment. If they persist, water scarcity and deteriorating water quality will become critical factors limiting future economic development, the expansion of food production and the provision of basic health and hygiene services to millions of disadvantaged people. Business as usual is neither environmentally sustainable, nor is it sustainable in financial and social terms. The traditional paradigm of publicly financed and managed, low cost or no cost recovery water services provision is beyond the financial capacity of most governments. Under investment and exacerbated conflicts over the allocation of water goods and services are inevitable with potentially disastrous economic and social consequences.

As a process of change, which seeks to shift water development and management systems from their currently unsustainable forms, IWRM has no fixed beginnings and will probably never end. The global economy and society are dynamic and the natural environment is also subject to change, IWRM systems will, therefore, need to be responsive to change and be capable of adapting to new economic, social and environmental conditions and to changing human values. IWRM is not an end in itself but a means of achieving three key strategic objectives:

- *Efficiency*, since, given scarcity of resources (natural, financial and human), it is important to attempt to maximise the economic and social welfare derived not only from the water resources base but also from investments in water services provision.

- *Equity* in the allocation of scarce water resources and services across different economic and social groups is vital to reduce conflict and promote socially sustainable development.
- *Environmental sustainability*, as ultimately all attempts at water management reform will fail if the water resources base and associated ecosystems continue to be regarded as infinitely robust and we continue to put at risk 'the water system that we depend on for our survival' (World Water Commission 2000)

IWRM Principles – The Governance Challenge

IWRM draws its inspiration from the Dublin Principles. It necessitates a more holistic approach to management, with attempts being made not only to consider the interdependencies within natural systems, but also the way that economic and social systems affect the demands placed on the resource base. It also requires a more participatory approach, emphasising the need for more stakeholder involvement in water development and management, including recognition of the vital role played by women as decision makers and water users. Finally, it necessitates consideration of water as an economic good, which cannot continue to be freely available for all competing users and uses. Demands will inevitably outstrip the capacity of the resource base to deliver services unless mechanisms exist to make users aware of the provision costs (including the environmental costs) involved.

IWRM, therefore represents a major challenge for policy makers. It requires a break with tradition, from the sectoral to integrated management, from top-down to stakeholder and demand responsive approaches, from supply fix to demand management, from command and control to more co-operative or distributive forms of governance, from closed expert driven management organisations to more open, transparent and communicative bodies. IWRM is ultimately about changing the nature of water governance, which is defined as 'the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society (GWP, January 2002)

Start Somewhere: Do nothing is not an option

It would be easy for a policy maker faced with the prospect of wholesale governance change to conclude that it is all too complex with too many difficult trade offs and choices to make. It may seem much easier and certainly politically safer to maintain current policies and practices and avoid confronting the vested interests who gain from the status quo. However, doing nothing is not an option; problems will simply get worse and more difficult to tackle.

It is important to keep in mind that the IWRM is a process of change; a process which can start from small beginnings. There is no such thing as a perfect IWRM system and the search for perfection can lead to action atrophy. Policy makers should think in terms of gradual, incremental change; identify opportunities for reform as circumstances alter and use all windows of opportunity to nudge the reform process forward. A crisis may, for example, provide such a window of opportunity but it will be vital to ensure that the response to a crisis challenges rather than reinforces the status quo. For instance, after a major flood event it is easy to give in to demands for more investment in protection infrastructure, but a policy maker thinking in IWRM terms will want to ask whether there are alternatives such as improved land zoning. Clearly during the process of change sectoral developments will continue, but it is imperative to keep questioning whether such developments are compatible with IWRM and rigorously challenge those that are clearly incompatible.

Principles for Effective Water Governance

- *Open and Transparent*: Institutions should work in an open and transparent manner
- *Inclusive and Communicative*: Improved participation – depending on all levels of government - is likely to create more confidence in the end result and in the institutions that deliver policies.
- Policies and action must be *Coherent and Integrative*:
- *Equitable and Ethical*: All men and women should have opportunities to improve or maintain their well-being. Equity between and among the various interest groups, stakeholders, and consumer-voters needs to carefully monitored throughout the process of policy development and implementation.

In terms of *Performance and Operation*, good governance requires that processes and operations are:

- *Accountable*: Roles in the legislative and executive processes need to be clear. Each institution must explain and take responsibility for what it does.
- *Efficient:* providing economic efficiency, and also concepts of political, social, and environmental efficiency
- *Responsive and Sustainable*: Policies must deliver what is needed on the basis of demand, clear objectives, an evaluation of future impact and, where available, of past experience

2 Understanding the Causes of the Water Problems

What problems do the reforms seek to address?

When embarking on a reform process and choosing new management tools, it is necessary for governments to be clear about what problems are to be resolved. Within the water sector it has been common to define these problems in physical or financial terms, eg:-

- Water scarcity (insufficient water to maintain food security)
- Over abstraction (mining of ground water, rivers failing to meet minimum flow requirements)
- Water quality deterioration (threats to ecosystems, human health and downstream supply sources)
- Increased threats from abnormal climatic events
- Lack of access to clean water and adequate sanitation
- Lack of hydrological and resource use data
- Lack of finance to invest in essential water services

Treating the causes not the symptoms

It is important for the policy maker to recognise that a perceived water problem may often be a physical manifestation or symptom of underlying deficiencies in the way that water management systems are operating. To uncover these deficiencies and the underlying problem causes a questioning approach will need to be taken. An example of the type of questions which may need to be asked is given in the box below, which looks at the lack of financial resources to invest in additional water infrastructure. Once such questions are answered the policy maker is in a much better position to judge which management tools can treat the disease rather than the symptoms.

Lack of Financial Resources to Invest in Additional Water Infrastructure

Is the need for new investment increased:
- by poor management of existing asset base (lack of maintenance, high leakage levels, illegal connections)?
- by actions of others (pollution of supply sources, dam sedimentation, increased occupation of flood plains, land use change)?
- because existing users are not using supplies efficiently (high levels of wastage, devoted to low value purposes)?

Has the service provider:
- increased the demand for investment by setting prices significantly below cost or even at zero? or
- failed to accumulate any investment surpluses by setting prices at levels, which do not even cover operating costs and essential maintenance? or
- inflated the need for new investment by assuming that everyone should have the same levels of service irrespective of ability and willingness to pay?
- Do current organisational arrangements increase total investment needs by failing to achieve economies of scale or scope (eg conjunctive use of ground and surface water, multi-purpose reservoirs)?
- Are there legal, constitutional or administrative barriers to private sector investment (international and national companies, NGO's, community groups and users through direct labour)?

For instance if poor management of existing water supply assets is one underlying cause, then appropriate tools might include performance audits and benchmarking, performance bonus incentives, distributional zonal metering, staff retraining or issuing managing contracts for the operation and maintenance of the service to bodies with more technical and managerial expertise.

Multiple causes

Understanding the causes is not a simple task, for multiple causation is commonplace. If we take the problem of *increased threats from flooding* it is likely that at least 9 different key underlying causes could be established:-

-Climate change, more extreme events
-Increased occupancy of flood plains
-Inadequate maintenance of existing flood defences
-Dam siltation
-Deforestation and upstream rural land use change
-Urbanisation of catchments
-Improved land drainage or flood defences upstream
-Ineffective land zoning or building regulations
-Lack of incentives for local/community vulnerability reduction measures

While multiple causes increase complexity, they also provide opportunities to start the reform process by tackling first those causes more amenable to change

3 Governance Failures

Many of the underlying causes can be traced to three types of governance failure, which are inherent in most countries:

- *Market failure* (eg. incomplete/non-existent property rights, uncorrected environmental and social externalities, incomplete information, information asymmetries, monopoly)
- *Institutional system failure* (eg. lack of worker commitment, no public respect/compliance culture, incomplete regulatory systems, failure to regulate monopolies, no legitimacy for regulators or service providers)
- *Government failure* (eg. water agencies acting to further internal, not public interests, capture vested interests, capacity constraints, bureaucracy, lack or accountability)

These failures are currently being addressed through the Dialogue on Effective Water Governance, but the Tools contained in the IWRM ToolBox are highly relevant for dealing with the major governance problems, as the following section illustrates.

Some of the failures occur outside the water domain. For example, over abstraction of ground water may be exacerbated by failures within the energy markets which highly subsidise pumping costs, and demand for irrigation water could be increased by policies which subsidise food or agricultural exports. By understanding the underlying external causes of the water problems, water professionals and policy makers are better placed to engage in dialogue with other branches of government to seek less cost solutions.

Learning from Failures

When analysing the underlying governance failures, policy makers need to pay special attention to those institutional system and government failures which have bedevilled previous reform attempts. In the past new laws or institutional arrangements have often been introduced based on their theoretical advantages (eg. market instruments) or their performance in other (typically developed) countries, without full analysis of the conditions necessary for successful implementation. For example, private sector participation can fail to deliver the desired benefits if the country concerned lacks regulatory capacity, lacks expertise and negotiating capacity, and neglects the creation of clear dispute arbitration mechanisms. Major reforms, if they are to be successful rarely involve a single change, in the Private Sector Participation (PSP) case new regulatory arrangements, regulatory capacity building, public information to ensure realistic expectations and the 'removal' of public sector problems, such as over-manning, may all be required. Learning from the past reform failures can be vital in judging what reform instruments can feasibly be employed.

Barriers to Change

In every country there are some legal, administrative, or constitutional 'failures' and some inappropriate policies (from a water perspective) which are currently 'unchangeable'. For example, in many countries it would be politically unacceptable for private companies to own and/or manage what are regarded as public services. The question then becomes what mechanisms are available to allow the advantages of private involvement (technical expertise, alternative sources of finance) to be achieved within a publicly controlled system.

Likewise, in countries which have recently decentralised their water services to local municipalities it could be politically impossible to reverse this even though major problems have resulted (diseconomies of scale and scope, external costs, eg. pollution passed to neighbouring areas, lack of human or financial capacity). The question then is are there tools which give municipalities incentives to enhance performance, develop cooperative investment opportunities and pool expertise and which reduce their ability to pass costs onto adjoining or downstream municipalities. Similarly, in some countries there may be ethical or religious objections to the use of particular policy tools; the challenge is then to work to find alternative ways of achieving the policy objective and tackling the problem cause.

4 How the IWRM Toolbox helps

Altogether close to 50 different tools are presented in the ToolBox, and the areas covered are set out overleaf. The characteristics of each tool are described in the ToolBox to allow the user to select a suitable mix and sequence of tools that would work in a given country, context and situation. The problems faced by water managers are many and diverse, as are the political, social and economic conditions, so no blueprint for the application of IWRM can be given. So the ToolBox provides a range of tools, which users can select and modify according to their needs. Some tools are preconditions for others, e.g. laws may need to be amended before private water rights can be acquired or traded. Other tools are complementary, e.g. demand management is strengthened by a simultaneous cost recovery policy. Integrated water resource management, by its nature, establishes and stresses the interrelationship of actions, so the tools in the ToolBox are not designed to be used randomly or in isolation. Thus, for instance, water resources policies must take account of other sector policies, in particular land use.

Structurally, the ToolBox is organised in a hierachial manner with each tool embedded in the wider perspective of IWRM. The structure is illustrated in a cascade below.

A conflict over water resources may be the issue that a user wants to address. Entering Part C in the ToolBox under management instruments, the user will find a chapter on conflict resolution (C5) with a variety of tools. The user may choose to focus on consensus building (C5.3) as the primary goal and study the options listed under the consensus building tool. Going through this, the user may settle on interest-based negotiation as an appropriate approach. The tool is linked to complementary tools, and the user is directed to C 4.4 (communication with stakeholders), C1 (demand and resource assessment) and A3.5 (investment appraisal).

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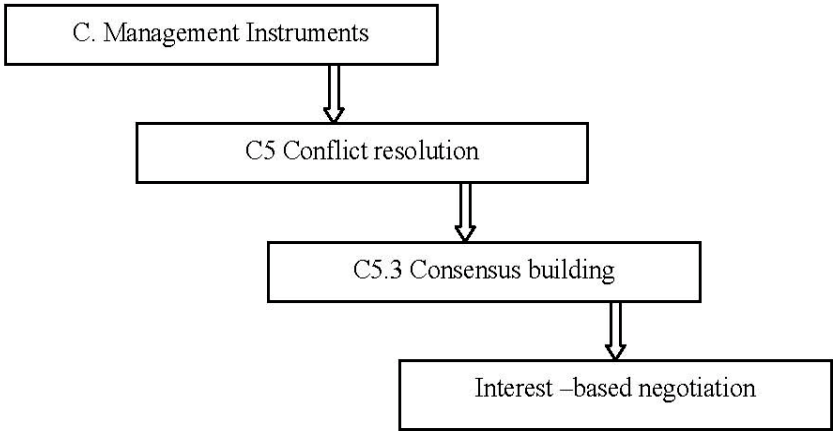

The tools are illustrated by real case experience. The cases give examples of how a tool has worked in a given combination and context. Cases are at varying levels of detail and include references to sources of further information.

The following box shows how the Tools are relevant to key governance problems and failures.

Governance failures IWRM TOOLS ADDRESSING GOVERNANCE FAILURES	
Governance problems	**IWRM Tools from ToolBox**
Failure to correct market distortions Inappropriate price regulation Perverse subsidies to resource users and polluters Inappropriate tax incentives and credits The existence of upstream downstream externalities and conflicts (environmental, economic and social) Over-regulation or under-regulation Conflicting regulatory regimes No independence and impartiality of the organisms of regulation Provision of water services as natural monopolies Imprecise reflection of consumer preferences Short-sightedness Voter ignorance and imperfect information Special interest effects, including political weaknesses and vested interests The inability of the government to control and regulate the sustainable use of water The non-payment of services linked to water Bureaucratic obstacles or inertia Lack of an overall responsible authority Little entrepreneurial incentives for internal efficiency The lack of effective knowledge of the resource, the demands imposed on the it and the current uses that are made of it Ignorance and uncertainty about water markets, droughts, floods, etc, leading to inability to set prices correctly Ill defined property rights, unclear ownership Absence of or inappropriate legislation Unclear ownership of property rights	Policies (A1) Economic instruments (C7) Financing and incentive structures (A3) Conflict resolution (C5) Regulatory instruments (C6) Institutional capacity building (C2) Information management systems (C8) Water campaigns and awareness raising (C4) Institutional roles (B1) Social change instruments (C4) Efficiency in water use (C3) Water resource assessment (C1) Plans for IWRM (C2) Legislation and water rights (A2)

5 Choosing the appropriate tools

Choice Constraints

It is recognised that policy makers rarely have unfettered freedom to choose amongst the range of notionally available tools. In some cases referred to above there are ‘immovable’ political or ethical constraints on choice, in others international trade agreements may restrict tool range. In still other cases countries may

feel forced to take or eschew a particular 'reform' path by international economic conditions. For example, highly indebted countries may have to embrace Private Sector Participation (PSP) because the public sector cannot increase its borrowing and export dependent countries may continue to subsidise irrigated agriculture to help maintain their markets against the highly subsidised agricultural sectors in Europe and North America. In this latter case the water management future in developing countries will be critically dependent on recognition by the developed countries of the ramifications of their internal policy decisions on the global economy. The table below shows the range of tools available in the ToolBox.
As the ToolBox demonstrates there are numerous tools available to improve water governance; tools which differ greatly in their characteristics and the consequences of their use.

Variations in how Management Tools work

- Degree to which demand reduction, or other management objectives are met (ie. response in practice)
- Degree to which each management technique is effective, taken alone
- Time-span required for implementation
- Scope for implementation discretion, control avoidance and non-reinforcement
- Administrative costs, administrative competence required and complexity of system
- Cost structures (total expenditure – time path – factor input combinations)
- Who bears the costs from a management change ?
- Who bears the administrative burden and costs?
- Who benefits from the change?

It is, however rare for one tool alone to be able to address the identified problems. Given that multiple problem causes are commonplace, it follows that several reforms, using several tools, may be necessary. In addition, for a tool to be effective and acceptable it may often be necessary to embark on several changes at the same time.

Multiple changes are typically required in four situations:

- *The tool itself has preconditions* (eg. Pollution/abstraction charging or standard setting require the establishment of some form of monitoring/measurement agency)
- *The tool needs to be accompanied by other measures to make it effective* (eg. The introduction of irrigation charges to improve efficiency in use may need to be accompanied by an advisory service to give farmers information about conservation measures and the markets for higher valued crops)
- *The tool creates losers who may need to be compensated to buy acceptance of the reform* (eg. attempts to improve the efficiency of service providers may require payments to redundant labour)
- *The tool may generate unintended and undesirable consequences* (eg. private sector concessions may lead to monopoly power abuses without an adequate system of economic regulation or increased water charges may lead to civil unrest if not accompanied by measures to protect the poor).

It is now increasingly recognised that mixed management systems, using an array of different tools are likely to be most effective; employing, for instance, a mixture of direct controls, market instruments, information and education, assisted community participation or incentives for self-help.

A THE ENABLING ENVIRONMENT

A1 Policies – setting goals for water use, protection and conservation.
A group of tools in the ToolBox deal with water policies and their development. Policy development gives an opportunity for setting national objectives for managing water resources and water service delivery within a framework of overall development objectives.

A2 Legislative framework – the rules to follow to achieve policies and goals.
The ToolBox includes tools for use in the development of water law. Water law covers the ownership of water, the permits to use (or pollute) it, the transferability of those permits, and customary entitlements and underpin regulatory norms for e.g. conservation, protection, and priorities.

A3 Financing and incentive structures – allocating financial resources to meet water needs.
The financing needs of the water sector are huge, water projects tend to be indivisible and capital-intensive, and many countries have major backlogs in developing water infrastructure. The ToolBox has a group of financing and incentive tools.

B INSTITUTIONAL ROLES

B1 Creating an organisational framework – forms and functions.
Starting from the concept of reform of institutions for better water governance, the ToolBox can help the practitioner create the needed organisations and institutions- from trans-boundary organisations and agreements, basin organisations, regulatory bodies, to local authorities, civil society organisations and partnerships.

B2 Institutional capacity building – developing human resources.
The ToolBox includes tools for upgrading the skills and understanding of public decision- makers, water managers and professionals, for regulatory bodies and capacity building for empowerment of civil society groups.

C MANAGEMENT INSTRUMENTS

C1 Water resources assessment – understanding resources and needs.
A set of tools are assembled to assist water resources assessment. Assessment starts with the collection of hydrological, physiographic, demographic and socio-economic data, and setting up systems for routine data assembly and reporting.

C2 Plans for IWRM – combining development options, resource use and human interaction.
Tools are available for river and lake basin planning entailing the comprehensive assembly and modelling of data from all relevant domains. The planning should recognise the need for parallel action plans for development of the management structures.

C3 Demand management – using water more efficiently.
Demand management involves a set of tools for balancing supply and demand focusing on the better use of existing water withdrawals or reducing excessive use rather than developing new supplies.

C4 Social change instruments – encouraging a water-oriented civil society.
Information is a powerful tool for changing behviour in the water world, through school curricula, university water courses and professional and mid-career training.Transparency and product-labelling are other key aspects.

C5 Conflict resolution – managing disputes, ensuring sharing of water.
Conflict management has a separate compartment in the ToolBox since conflict is endemic in the management of water in many countries and several resolution models are described

C6 Regulatory instruments – allocation and water use limits.
A set of tools on regulation is includedcovering water quality, service provision, land use and water resource protection. Regulations are key for implementing plans and policies and can fruitfully be combined with economic instruments.

C7 Economic instruments – using value and prices for efficiency and equity.
The ToolBox holds a set of economic tools involving the use of prices and other market-based measures to provide incentives to consumers and to all water users to use water carefully, efficiently and avoid pollution

C8 Information management and exchange– improving knowledge for better water management.
Data sharing methods and technologies increase stakeholder access to information stored in public domain data banks and effectively complement more traditional methods of public information

Combining tools to fit local contexts

Policy makers should be wary of advisors with simple 'one size fits all' solutions to problems based on theories or the assumed success of a measure in another country. To judge the likely outcomes from a reform proposal, what matters are country specific conditions and the way that water users and other stakeholders will respond in practice. Even something as seemingly straightforward as improving training for service providers may have little effect if the workforce is unmotivated and there are no incentives to reduce corrupt practices (eg. taking kickbacks to ignore illegal abstractions, connections, waste dischargers or land use changes).

In judging the suitability of particular tools, four factors need to be taken into account:-

- *Political capacity* (are there influential champions for the reform, can the reform produce results within a politically relevant time-scale, can opposing ministries be brought on board or isolated ?)
- *Professional capacity* (are there the professional skills needed to draft legislation, provide regulation or adjudication, provide conflict resolution etc ?).
- *Implementation capacity* (have the agencies likely to be charged with implementation the technical, financial and human resources necessary to fulfil the task ?).
- *Compliance capacity* (many of the tools are designed to change water using behaviour; do users have the knowledge and ability to respond ?)

If any of the capacities are lacking, reforms may either have to address these deficiencies first or other less demanding tools could be chosen. For example, newly industrialising countries may suffer greatly from water pollution, but lack the financial and human resources and the legal or institutional infrastructure to implement pollution control regulations. An alternative employed in Indonesia was the Program for Pollution Control, Evaluation and Rating (PROPER). This was based on information disclosure (see Box below) and according to a World Bank assessment it 'increased compliance by over 50% in two years' and 'initial results suggest that public disclosure can play a powerful role in developing countries where conventional regulation is weak'

PROPER programme in Indonesia

This pilot programme started in 1995; it involved information on emissions, production, pollution control and monitoring efforts by 187 important dischargers of waste. Each was placed in one of six performance categories:

- Gold (world class)
- Green (good – above basic compliance)
- Blue (compliance with rules)
- Red (non compliance but some efforts)
- Black (no effort)

Poor performers were given the opportunity to improve before publicly being named and shamed.

(Shamon David and Wheeler David, Controlling Industrial Pollution in the Developing World, Environmental Quality Management 69,70, 1988)

Using tools in IWRM compatible ways

All the tools within the ToolBox can be used to further the change from unsustainable to sustainable water management systems. However policy makers need to be aware that some tools could be implemented in non-IWRM compatible ways. For example, as noted earlier, decentralisation of responsibilities to municipalities or community groups could result in external costs being passed on (eg. through untreated wastes) to people in other jurisdictions. Likewise, tradable permits increase water use efficiency but have third party effects; they could exacerbate scarcity if bought by consumptive users or increase pollution if, for instance, the permits go to more intensive farmers employing more fertilisers and pesticides. Even the development of river basin organisations, which are often seen as an important IWRM tool, could produce non IWRM compatible outcomes, for example, if they become 'captured' by a powerful interest group or even a profession.

Making a start!

However, although it is logical to think that creation of policies and institutional frameworks should precede the use of specific management instruments, in reality the IWRM process may be started before all the policies, laws and organisations are in place. Institutional change, requiring new legislation, is typically a time consuming activity. It is often better to *start somewhere*, working as far as it is possible with existing arrangements, rather than waiting for the more wide-ranging reform measures to be enacted.

A THE ENABLING ENVIRONMENT

A1 POLICIES – Setting goals for water use, protection and conservation

As pressure on water resources increases, governments need to consider water as a resource in its own right and manage it accordingly. Policies are the framework within which water resources are managed, and thus a framework within which to develop an IWRM approach. To be integrated, water resources policy must mesh with overall national economic policy and related national sectoral policies. IWRM also means that water issues within every economic and social sector must be taken into account.

Since the multiple users of water are competing, and the pressure on resources is increasing because of growing pollution, it is crucial to have the participation of as many different stakeholders and authorities as possible in the management of water resources. Environmental concerns – the ways in which water policies may have an impact on other environmental media and vice versa – must be recognised. At the same time, economic and social policies need to take account of possible water resource implications. Developments outside the water sector – for example national energy and food policies – should be evaluated for possible impacts on the water resource. Water is a core developmental issue; its development and management therefore affects almost every activity within the wider economy and society, including migration, land use and settlement growth and changes in industrial activity.

Policy formulation is a core government role. Through its policies, government can delimit the direct and indirect activities of all stakeholder groups, including itself. Government can be a direct provider, or regulate and support other providers. Appropriate policies can encourage participatory, demand-driven and sustainable development. Policies that encourage integrated water resources management include reference to the nation's wider social and economic objectives that make up the development goals of the society. Policies lead to the development of laws and rules and regulation designed to achieve the overall policy goals (A2).

Appropriate policies can deal with the many inter-related and complex issues involved in IWRM, including:

· Assessing the relative environmental, economic and social values of water;
· Recognising the role of men and women as users and managers of water resources;
· Taking into account sustainability and environmental issues in the planning, design, construction, operation and management of major water projects;
· Assessment of the social impact of water resource developments;
· Restoring and protecting the quality of surface and groundwater;
· Introducing procedures to designate, evaluate and conserve surface waters;
· Introducing flexible drought and flood management strategies;
· Mandating the provision of easily accessible, accurate and up-to-date data on water resources and needs;
· Linking water policies with other ecosystem, economic and social policies;
· Estimation of the costs of policies and identifying the means for financing them.

A1.1 Preparation of a national water resources policy

§ **Characteristics**

A National Water Resources Policy sets goals and objectives for the management of water resources at the national scale and includes policies for regions, catchments, shared or transboundary water resources, and inter-basin transfers, all within an IWRM framework. It addresses both the quantity and quality aspects of both surface and groundwater resources and also deals with delivery of water services.

A national policy may include matters of jurisdiction and delegation and items like: the extent to which water management is decentralised or consolidated, the use of economic incentives, capacity building to meet institutional challenges, and monitoring and control to reduce ecosystem degradation. Policies entail measures which require investments, and their costs and benefits should be considered before their adoption.

The IWRM approach moves away from single sector water planning to multi-objective and integrated planning of land and water resources, recognising the wider social, economic and development goals and entailing cross-sectoral co-ordination. It is a dynamic approach. The IWRM approach is often set within a catchment (watershed) framework (B1.3). Therefore, the process of policy making for IWRM requires extensive consultation as well as raising the awareness of the importance of integration among policy makers, stakeholders, and the general public. The sustainability of resources and policies should be a central goal.

Policy reform may be gradual in recognising changing political and resource priorities, or may be able to respond to major shifts in external circumstances, which enable comprehensive redevelopment of water resources policies.

§ **Lessons**

Policies are more useful if they are designed proactively, not just as a short-term response to a crisis (although a crisis may provide an opportunity for policy change). By failing to anticipate change, and taking a narrow sectoral view, water resources policy development has frequently ignored both macroeconomic and development needs.

Some key points for effective integrated policy making are:

- Ensure policies clarify the roles of government and other stakeholders in achieving overall goals and especially define the role of government as regulator, as organiser of the participatory process and, as a last resort, adjudicator in cases of conflict;
- Identify and set priorities for key water resources issues to ensure a focused policy;
- Recognise that considering water as a social and economic good means designing policies to allocate resources to where they offer the greatest value to society, starting with the fulfilment of basic needs; ;
- Engage stakeholders in policy dialogue, recognising potential conflicts and the need for tools for conflict resolution (C5);
- Make explicit in the policy the links between land use and other economic activities
- Recognise the importance of subsidiarity, so that water resource allocation decisions are taken at the lowest appropriate level (B1.3, C2);
- Take into account trade-offs between short-term costs and long-term gains (C2.8);
- Make functional arrangements and cost allocation explicit.

Key organisations

GLOBWINET is an Information Network on IWRM focusing on transboundary river basin organisations, water legislation, and national water administration. GLOBWINET is a GWP associated programme. The first regional node of GLOBWINET is SAWINET in Southern Africa. www.globwinet.org

Selected references and websites

The World Bank, *Water Resources Management*, ISBN 0-8213-2636-8, 1993. This study examines new World Bank policies that deal with scarce water resources in developing countries. It provides a framework to help governments design effective water management programmes. www.worldbank.org Contacts: Headquarters - General Enquiries fax: (202) 477-6391. A comprehensive list of World Bank advisory services: feedback@worldbank.org

FAO, *Reforming water resources policy: a guide to methods, processes and Practices*, FAO Irrigation and Drainage Paper 52, Rome, ISBN 92-5-103506-7, 1995. The report aims to indicate the size and complexity of the water sector, to spell out the ramifications throughout the economy of water management, introduce some of the methods and processes involved in a water policy review, and illustrate how different countries have gone about such a review.

EC, *Towards Sustainable Water Resources Management, A Strategic Approach*, 1999. The Guidelines set out a strategic approach for the planning and management of water-related activity, from national policy-making through the implementation of programmes and projects and subsequent operation of services. europa.eu.int/comm/development/publicat/water/en/frontpage_en.htm Details of contacts can be obtained from: europa.eu.int/comm/contact/index_en.htm

Political change in South Africa enabled a fundamental shift in water policy following a comprehensive consultative process. Department of Water Affairs and Forestry. www-dwaf.pwv.gov.za/. See also Department of Water Affairs and Forestry, *National water resource strategy*, which sets out a people centred approach of water; "Some, For All, For Ever". www.dwaf.gov.za/Documents/Policies/NWRS/Default.htm

The National Water Quality Management Strategy (Australia) was developed between the States of Australia and through workshops of water professionals to develop an agreed strategy for State implementation. www.affa.gov.au/nwqms

ADB, *Towards Effective Water Policy in the Asian and Pacific Region*, Proceedings of the Regional Consultation Workshop, ADB, Manila, 1996. These proceedings are the outcome of the Regional Consultation Workshop held at the Asian Development Bank (ADB) in Manila, 10-14 May 1996. They concentrate on the water sector and directing the ADB's role in the water sector.

Towards water security: A Framework for Action prepared for 2nd World Water Forum, GWP 2000.

A1.2 Policies with relation to water resources

§ **Characteristics**

Governments, at both the national and local level, develop policies, plans and programmes of action which directly or indirectly affect water resources management. These include policies and plans for land use (particularly at the local level), environmental protection and conservation, economic development (in such areas as energy, agricultural, industrial developments), and trade. In most countries, water is dealt with by many ministries, for example, agriculture, transport and navigation, power, industry and environment, but there may be little co-ordination between them, and their focus is likely to be more on development type issues, as suggested above, than on water resource management.

It is therefore important to recognise the direct impact of non-water policies on water use and management. Tools for co-ordinating policies and ensuring that water implications are taken into account (and that other sectoral interests are recognised in water policies) include the establishment of institutional structures (see B1), such as:

-Inter-ministerial co-ordinating bodies (e.g. the Office of the President);
-Apex bodies for water resources;
-Catchment co-ordination bodies;
-Local co-ordinating teams.

To succeed, cross-sectoral mechanisms for co-ordination need to be driven by strong political champions, committed senior bureaucrats and internal financial and administrative support. The mechanisms should be set up at the level at which the policy is formulated.

Cross-sectoral understanding and commitment is difficult to achieve, but many tools can be used to support the process, including assessment of water resources and needs (C1), and planning processes where recognition of other sectoral needs and priorities are made explicit (C2). The legal framework itself can set out procedures for working with other economic and social activities.

§ **Lessons**

Developing processes to introduce an integrated approach with non-water sectors can be complicated and costly, exacerbated by politics and widely differing vested interests. Although generalisations are difficult, experience suggests the following should be considered:

- The participation of different stakeholders often clarifies the issues, but an overall agreement among all parties may be difficult to achieve. Government then has a role as a policy maker, but with full knowledge of stakeholders' positions and the implications for water management;
- Tools such as GIS and shared vision modelling (C5.2) can provide an effective interface between regional land use change (e.g. deforestation of tropical forests, urban expansion into rural areas), watershed management, and development proposals and support;
- Effective cross-sectoral relations are particularly hard to achieve where strong vertical lines of command between local, provincial and state, and national government restrict lateral interchange and cause bureaucratic rigidities. Innovative participatory and awareness raising tools can be of use here;
- Some problems are simply intractable – where there are clear winners and losers it severely limits the scope for painless co-ordination, giving rise to a need for conflict resolution (C5);
- Where decisions are based on good cost and benefit data, trade-off decisions are more transparent.

Key organisations

The WWC (World Water Council) www.worldwatercouncil.org, wwc@worldwatercouncil.org Contact: World Water Council, Les Docks de la joliette, 13002 Marseille, FRANCE. Tel: +33 (4) 91 9 41 00, Fax: +33 (4) 91 99 41 01

The FAO (Food and Agriculture Organisation of the United Nations)
www.fao.org/
FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy. Tel: +39 06 5705 1, Fax: +39 06 5705 3152

ESCAP (Economic and Social Commission for Asia and the Pacific)
unescap.org/
ESCAP The United Nations Building, Rajadamnern Nok Avenue, Bangkok 10200, Thailand. Tel: (66-2) 288-1234 Fax: (66-2) 288-1000

The ECLAC (Economic Commission for Latin America and the Caribbean) - the Spanish acronym is CEPAL www.eclac.org/ ECLAC Headquarters Casilla de Correo 179-D, Santiago, Chile Tel: (56-2) 210-2000-2085051 Fax: (56-2) 2080252

UNECA (United Nations Economic Commission for Africa) www.uneca.org ECA Headquarters, P.O. Box 3001, Addis Ababa, Ethiopia. Tel: 251-1-51-72-00 , Fax: 251-1-51-44-16

Selected references and websites

Draft Guidelines for Managing Externalities (Australia)
A set of guidelines to assist jurisdictions in the efficient management of environmental externalities associated with Australia's water resources. www.ea.gov.au/water/

National Action Plan for Salinity and Water Quality (National Action Plan). The Plan represents the first targeted national strategy to address salinity and water quality problems, two of the most significant issues confronting Australia's rural industries, regional communities and environment. www.affa.gov.au/

Water Support Unit, *Achieving Water Security*, Ministry of Foreign Affairs, The Netherlands, April 2001.
The Netherlands Ministry of Foreign Affairs focuses on support for the development of coherent strategies and policies and for building institutional capacities to achieve integrated water resources management. www.minbuza.nl/OriginalDocuments/c_55314.pdf

DFID, *Addressing the water crisis, Department for International Developments* UK, March 2001.
This sets out DFID's strategies for water and the links to poverty elimination and the international development targets.
www.dfid.gov.uk

A2 LEGISLATIVE FRAMEWORK – WATER POLICY TRANSLATED INTO LAW

Water is a fugitive and scarce resource with multiple uses, which can lead to conflicts of use, negative externalities and upstream-downstream conflicts. It is also renewable and its sustainable use requires integrated management. Water legislation can create a framework for such integrated management and determines the way that economic factors relate to water resources, providing the context for private, public, community and individual water activities. Water law exists to:

- Clarify the entitlement and responsibilities of users and water providers:
- Clarify the role of the state vis-à-vis other stakeholders;
- Formalise the process of transfer of water allocations;
- Provide legal status for various water user groups;
- Ensure sustainability of the resource.

Thus, water legislation provides a structure for both conservation and development goals. At its best, it can spur efficient investment in water development and conservation. At its worst, it can deter both investment and conservation, and promote monopolies.

Security and flexibility of rights are two main structural features of legislation in general and of water law in particular. Water legislation addresses, among other things, the ownership of water resources, the legal nature and stability of water rights, the effective and beneficial use of water, the transferability of water rights, and the need to acknowledge and respect existing uses and customary entitlements when changing water legislation. Water law also seeks to prevent the transfer of negative externalities, restrict monopolies, and reduce transaction costs. In addition, water law sets out the duties and functions of water/environmental management agencies and water service providers.

Many countries have signed and ratified international conventions and treaties that guide and influence laws affecting water so national laws must also be seen in this context.

Water law can achieve its goals through regulatory norms, which can address many issues including:

· Water conservation;
· Protection of water supplies;
· Establishment of preferences and priorities;
· Protection of water quality;
· Technology and efficiency requirements;
· Creation of management areas;
· Basin management principles;
· Monitoring;
· Information requirements;
· Administrative rights of entry and inspection;
· Creation and enforcement of public rights;
· Emergency measures;
· Registration and recording of uses and supplies.

A2.1 Water Rights

§ **Characteristics**

A water right is the right to use water – not to own it. Good water law recognises and acknowledges existing uses and rights, including customary uses and aboriginal entitlements. At the same time, good water law is flexible enough to permit reform in response to technological change and socio-economic need.

In most countries, water (or at least its most important sources) belongs in the public domain, reflecting the notion of water as a public good. Where water use rights are granted to private individuals or corporations, they may be protected under the provisions of national, state, or provincial constitutions. Water rights may be closely linked to land rights, and entitlements may also be held on the grounds of gender or other social attribute, with implications for the transfer of rights and enforcement of water legislation.

Under most water laws, a right may be held or maintained only when there is effective use. This often reflects the scarcity and value of the water resource and is linked to concerns about the risk of vesting an absolute monopoly on a single individual. Law may specify that use is beneficial as well. The tenets of effective and beneficial use are:

-Water must not be obtained for speculation or be wasted;
-The end use must be a socially acceptable use;
-Water is not to be misused;
-The use must be reasonable as compared with other uses.

Water law will often rank uses for allocation of water at times of scarcity or in case of competing applications, e.g. water for basic human needs and/or ecosystem protection. Legally established water rights allow the development and conservation of water resources, provide collateral or assets for obtaining credit, and recognise existing social and economic relationships. In rural areas, legislation may allow responsibility for the operation, maintenance and management of irrigation systems to be transferred to farmers.

As water becomes scarcer, the transfer of water rights becomes important. Water law increasingly accepts transfers, under prescribed conditions. A water rights registry helps to ensure the stability of water rights and the transfer of title, but adequate transitional mechanisms should also be developed to avoid socio-economic instability.

The allocation of water rights *per se* may or may not strengthen IWRM. Reform may be needed if water rights are assigned inequitably, or do not reflect the value of water (C7.5), or the management role of specific social groups or gender.

§ **Lessons**

Key factors for good water law include:

- Transparency in water allocation and rights to reduce potential social unrest;
- Adequate information and availability of data on the surface and groundwater resource (C1.1);
- A mechanism that ensures that allocation of water between competing demands is compatible with sustainable use;
- Explicitly setting out conditionalities before water rights are granted or recognised, to prevent laborious political wrangling if changes are needed;
- Although many legal systems allow perpetual rights, time-bound concessions might be preferred for the same reason.

Key organisations

The ECLAC (Economic Commission for Latin America and the Caribbean) - the Spanish acronym is CEPAL www.eclac.org/ ECLAC Headquarters Casilla de Correo 179-D, Santiago, Chile Tel: (56-2) 210-2000-2085051 Fax: (56-2) 2080252

Selected references and websites

Caponera, D., *Principles of water law and administration: National and International*, A. A. Balkemea, Rotterdam/Brookfield, ISBN 9054101083, 1992.
Provides a tool for dealing with the legal and institutional aspects of water resources management, both at national and international levels, indicating problems that may arise and guidelines for possible alternative solutions.

IFPRI, *Negotiating Water Rights*, Eds. Bruns, B. R., Meinzen-Dick, R. S., Vistaar, New Delhi, ISBN 8170368782, 2000.
This book presents a broad view of water rights and includes case studies, demonstrating the wide variety of water rights, conflicts and outcomes.

United Nations Economic and Social Council, *Permanent Sovereignty Over Minerals and Water Resources*, Report of the Secretary General to the Committee on Natural Resources.

Solanes, Miguel and Gonzalez-Villareal, Fernando, *The Dublin principles for water as reflected in a comparative assessment of institutional and legal arrangements for Integrated Water Resources Management*, TAC background paper No 3, Global Water Partnership, Sweden, 1999.
This document discusses the contents of water legislation and institutional arrangements. Subjects include water ownership, water rights, water markets, water charging, customary entitlement and restriction of monopolies.
www.gwpforum.org/servlet/PSP?iNodeID=215&itemId=27 orHomepage www.gwpforum.org/ > Library – Publications > Technical Papers (TEC
Background Papers) > TEC Background Paper no.3

The Law on Water Resources of Vietnam Based upon the Government's policy, practical water resources conservation and management needs, and existing conditions in Vietnam, the Law on Water Resources has been passed; this takes into account experiences and lessons of water laws in other countries.
www.adbta2871.vnn.vn/ project-ta-2871/en/frame.htm

A2.2 Legislation for water quality

§ **Characteristics**

Measures to protect the quality of water resources should be encoded in legislation, and may be preventive or corrective.

Preventive measures include effluent and discharge regulations, technical standards and requirements for treating polluted effluents, economic instruments as well as quality standards for receiving waters, set according to expected or existing water uses and services. Legislation sets out the principles upon which pollution control is based. These and other measures to control non-point pollution can be integrated into programmes tailored for specific sites and regions (see C6 and C7). *Corrective* measures include cease and desist orders, compensation for damage and economic losses, and abatement and remediation requirements. The polluter pays principle allocates responsibility for damage costs.

Emergency actions and citizen suits can also be tools to enforce water quality, and under some legal systems can be used even by those who do not have a direct interest or legal right.

Other legal instruments for quality protection include liability**,** both strict and fault based, reversals in the burden of the proof, joint and several liability for pollution caused by more than one actor, fines, and other penalties such as imprisonment. Personal liability for employees and officers of corporations causing pollution can operate as a useful deterrent. In some systems, fines and other financial penalties are tailored to offset any financial advantages accruing to polluters. Water quality legislation is enforced through inspection, monitoring, record keeping, reporting and related powers.

The special problems posed by groundwater are addressed through various measures, including: water quality testing; land use and catchment protection programmes; control of diffuse pollution, leachates, pesticides and fertilisers; requiring a "no-concerns" certificate before issuing groundwater permits; control of point-source pollution and of hazardous and mining waste; regulation of underground storage tanks and of injection activities, and well head protection. The transfer of waste products between the different environmental media such as air, water and soil is recognised in some countries, and legislation can be introduced to ensure that waste disposal follows the least damaging environmental path.

To be effective, water quality law needs a supporting system of indicators and institutional capacity for the measurement, interpretation and application of environmental quality objectives or water standards.

§ **Lessons**

Water quality legislation protects water in resource management and planning (see C2) and is as important as water rights law for the establishment of IWRM. Specific lessons learned include:

- Enforcement of water quality legislation is more complex than controls on discharges alone;
- The complexity of the issues requires good collaboration between dischargers and enforcement agencies;
- Self-regulation by dischargers may be useful, but monitoring and random sampling by the regulatory agency is often the only feasible procedure to ensure quality;
- In setting water quality goals and standards it is important to ensure that they are technically achievable and that there is an institutional capacity to monitor and apply standards;
- Water quality laws must be included when overall water law is being revised (see A2.3);
- Over-ambitious or over-rigorous standards may be excessively costly to apply and may reduce the credibility of the legislation, thus undermining compliance.

Key organisations

The ECLAC (Economic Commission for Latin America and the Caribbean) - the Spanish acronym is CEPAL www.eclac.org/ ECLAC Headquarters Casilla de Correo 179-D, Santiago, Chile Tel: (56-2) 210-2000-2085051 Fax: (56-2) 2080252

FAO, *Reforming water resources policy: a guide to methods, processes and Practices*, FAO Irrigation and Drainage Paper 52, Rome, ISBN 92-5-103506-7, 1995. The report aims to indicate the size and complexity of the water sector, to spell out the ramifications throughout the economy of water management, introduce some of the methods and processes involved in a water policy review, and illustrate how different countries have gone about such a review.

Selected references and websites

The European Water Framework Directive sets out the course for improving water quality in Europe in addition to getting people involved. It comprises comprehensive legislation on ambient water quality and management within river basin units. europa.eu.int/water/water-framework/index_en.html

The Law on Water Resources of Vietnam Based upon the Government's policy, practical water resources conservation and management needs, and existing conditions in Vietnam, the Law on Water Resources has been passed; this takes into account experiences and lessons of water laws in other countries. www.adbta2871.vnn.vn/ project-ta-2871/en/frame.htm

A2.3 Reform of existing legislation

§ **Characteristics**

The role of water laws is to implement and enforce policy, and provide effective administrative and regulatory mechanisms at appropriate levels. Thus, water laws are a powerful tool to support IWRM. Creation of modern, IWRM-supporting water legislation should follow on from the development of integrated and coherent water policies (A1).

Legislation may be reformed to include the core elements of IWRM, that is, the value of water in use (water as a social and economic good), the role of women in water management and the sustainability of the resource. The legal framework may emphasise principles in support of such IWRM elements, such as: polluter pays principle, the river basin approach, public participation, reform of financing, ecological protection and equitable access to water resources.

Other legal reform topics which help create a strong IWRM framework include:

- *The enabling institutional framework*, including the legal roles and responsibilities of institutions and their inter-relationship;
- *Mechanisms* for stakeholders to participate in water resources management;
- *Conflict resolution mechanisms*;
- *Water services* and associated rights and responsibilities, covering, for example: provision of water for basic human needs, and standards of service (quality of water provided, assurance of supply, efficiency levels, etc);
- *Tariff and water pricing* systems, including principles of fairness, affordability and protection of the poorest;
- *Customer protection mechanisms*, such as timely and appropriate access to information, participation and involvement in water management;
- *Equitable allocation* of water rights;
- Clear mechanisms *for the transfer of water* rights to minimise conflicts and risk of social unrest;
- *Regulatory functions*.

§ **Lessons**

Experience teaches the following lessons:

- New legislation should be socially acceptable and administratively feasible;
- Water law is closely linked to land use in many countries. The close links between land use and water availability and quality should be reflected in water law. Note, however, that a strict link between land and water rights can pose problems for water markets (see C7.3);
- Water law needs to tread a careful line between completeness and flexibility. It needs to be flexible enough to reflect changing circumstances, yet explicit and complete enough to ensure full discussion of the basic principles and policies and their implications. If not sufficiently firm and clear, framework legislation may allow for arbitrary decision-making by implementers;
- National water laws must take into account any International Conventions accepted by that country;
- Legislative change creates stress for existing uses and water rights. In law reform, existing rights and uses and the entitlements of rural and indigenous populations should be protected and transitional provisions made. (Tools for conflict resolution and consensus building can support law reform, see C5).

Key organisations

ESCAP (Economic and Social Commission for Asia and the Pacific) unescap.org/
ESCAP The United Nations Building, Rajadamnern Nok Avenue, Bangkok 10200, Thailand.

Tel: (66-2) 288-1234 Fax: (66-2) 288-1000

ECLAC (Economic Commission for Latin America and the Caribbean).
www.eclac.org/default.asp?idioma=IN
ECLAC Headquarters Casilla de Correo 179-D, Santiago, Chile Tel: (56-2) 210-2000-2085051
Fax: (56-2) 2080252

UNECA (United Nations Economic Commission for Africa) www.uneca.org ECA Headquarters, P.O. Box 3001, Addis Ababa, Ethiopia. Tel: 251-1-51-72-00 , Fax: 251-1-51-44-16

GLOBWINET is an Information Network on IWRM focusing on transboundary river basin organisations, water legislation, and national water administration. GLOBWINET is a GWP associated programme. The first regional node of GLOBWINET is SAWINET in Southern Africa. www.globwinet.org

Selected references and websites

Environment Canada*:* This website contains information on water policy and legislation and the management of water, including the Federal Water Policy. Links to relevant publications and policies. Contact: National Water Issues Branch, Ecosystems and Environmental Resources Directorate. Fax: (819) 994-0237 www.ec.gc.ca/

The Water Page. This website incorporates the former African Water Page and gives comprehensive information and links related to water law and policies. www.thewaterpage.com/

GWP-Central America, Report of the Central America Legal Workshop, Antigua, Guatemala, 2000.
This report describes the status of water legislation in Central American countries, and gives a short analysis of how to improve this legislation. www.gwpforum.org or tempis@sol.racsa.co.cr

South Africa Water Law. Sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources. These guiding principles recognise the basic human needs of present and future generations, the need to protect water resources, the need to share some water resources with other countries, the need to promote social and economic development through the use of water and the need to establish suitable institutions in order to achieve the purpose of the Act. Contact: Dept of Water Affairs & Forestry, Fax: +27 12 326 2715, Web site: www-dwaf.pwv.gov.za/Home>Legislation>National Water Act 1998

The Law on Water Resources of Vietnam Based upon the Government's policy, practical water resources conservation and management needs, and existing conditions in Vietnam, the Law on Water Resources has been passed; this takes into account experiences and lessons of water laws in other countries. www.adbta2871.vnn.vn/ project-ta-2871/en/frame.htm

European Water Law. The European Water Framework Directive is an operational tool, which sets objectives well into the next century. The Directive is a good example, of a policy developed in an open consultation process involving all interested parties in response to widespread consensus that the current water policy was fragmented, in terms of both objectives and of means. It was agreed that a single piece of framework legislation was needed. Contact: European Commission, 200 rue de la loi/Westraat 200, B-1049 Brussels, Belgium. Web site:
www.europa.eu.int/water/water-framework/index_en.html

A3 FINANCING AND INCENTIVE STRUCTURES – Financial resources to meet water needs

Allocating financial resources to meet water needs is a major challenge. At the 2nd World Water Forum (The Hague 2000) it was suggested that, in order for developing countries to meet the needs for ecosystem protection, water supply, sanitation and wastewater treatment, and agricultural production, annual investment in the water sector would have to double from about $US90bn per year to about $180bn in the years up to 2020.

Funds to meet this challenge may be sought from government, communities and individuals, commercial banks, the private water sector and the donor community. None of these sources can fill the gap alone, and a combination of these is surely needed. Financial resources are needed for:

-Overall resource management, conservation and protection of water resources; -Service delivery (e.g. potable water, irrigation and wastewater treatment); -Investments to balance out supply and demand in terms of both space and time; -Public goods such as the protection of people against extreme events (floods, droughts).

The availability of funds for water depends on overall development priorities and policies (see A1) and legal and institutional frameworks (A2 and B1). The introduction of IWRM does not change these realities, but tries to adapt policies in these areas to the realities of water resources, and to adapt water policies to the development strategy. Part of the financing of the nation's development strategy thus involves direct funding of the water sector.

All the costs of investing in and operating water services have to be recovered eventually. The only ultimate sources of revenue are charges and fees levied on users themselves, plus the various kinds of subsidies available from national taxation, international grants, and voluntary contributions made through NGOs. All loans have to be repaid, and all equity rewarded, from one or other of these sources. Having said this, the choice of financial *facilities* is important. "Financial engineering" can make the difference to a project's sustainability and affordability.

All governments need a water funding strategy that estimates overall investment requirements, and identifies funding sources (A3.1). Financing needs in the water sector are often huge, since projects tend to be indivisible and capital-intensive; furthermore, many countries have major backlogs in the provision of services. The important contributions of international and bilateral donors are declining, and are highly limited in relation to need. Private finance through loans is available, but the risks involved in lending to certain groups, such as municipalities or farmers' associations may be too high to attract private finance, or make it too costly. Better coordination between public and private finance can be effective in mobilising better financial resources.

Sustainable financing is linked to improved cost recovery, often entailing tariff increases. These can be made more acceptable if better service results and their impact on poorer users is cushioned (A3.4). Note the distinction between the value of water as an economic good and the financial issues covered by charging and paying for water. The value of water in alternative uses is important for the rational allocation of water as a scarce resource and should inform policy.

Finance can be raised either from internal sources (A3.2) or loans and equity (A3.3).

The typical characteristics of water investments influence the choice of finance. It usually involves a heavy initial outlay (particularly for new centralised systems and advanced treatment), its physical assets have a long life, and once the investment is made it produces a steady, though usually modest, cash flow for the indefinite future. Almost all revenues are in local currency and there is a high local cost content of investment (civil works), maintenance and operation. Financial rates of return on new projects and concessions are usually modest, and closely regulated. Investment is beset principally by foreign exchange, regulatory and revenue risks.

The "water sector" is very diverse, and a different spectrum of financial sources is appropriate for each of its different parts. Not all options cost money directly; the water sector can benefit from improvements to water management resulting from investments in other sectors (e.g. power, industrial pollution abatement) and some projects ("win-win") have other benefits to offset their costs.

A3.1 Investment policies

§ **Characteristics**

Through economic policies and public investment, governments may advertently or inadvertently have a significant effect on the water sector. IWRM encourages policy makers to be aware of all these

potential effects and to include in the development of *investment policies* the role and potential impact of every level of investor: public (state, municipal), private sector, communities and individuals. Governments have a responsibility for investment policies that affect the water sector at three levels:

- *Macroeconomic policies*: Monetary, fiscal and trade policies all affect the pace and type of development of the economy in general and the water sector specifically. Thus, devaluation may lead to a boom in the export of irrigated crops; tax incentives might result in the growth of water-intensive industries, and trade liberalisation may cause changes in the balance of products leading to changes in water use;
- *Public investment*: investment in many sectors may affect the demand for water, including investment in housing, new town and industry development, transport, power and energy, agriculture and tourism;
- *Public and private investment in the water sector itself:* the water sector is capital-intensive with potentially very large financial needs for irrigation, water supply, wastewater treatment, and flood and environmental protection.

A national water investment strategy based on IWRM will be demand-led, and identify sources of funding for an affordable, realistic programme covering all aspects of water resource management, including conservation and wastewater treatment.

§ **Lessons**

Pre-conditions for good investment policies include:

- Medium-term (3-5 year) macroeconomic projections;
- A central unit that co-ordinates and reviews all policies (e.g. Prime Minister's Office or Central Planning Board. See A1);
- A public investment programme, broken down by economic sector;
- A project appraisal capability (see C2.8);
- Data and information on water needs and the intensity of water use in different sectors (see C1);
- Institutions have the capacity to implement the scope and volume of the programme effectively.

A workable investment strategy for the water sector includes:

- Estimates of investment requirements;
- Allocation of responsibilities for fundraising (e.g. among central or municipal government, communities, autonomous agencies, private companies);
- Identification of sources of grants and concessional loans (e.g. bilateral and multi-lateral donors such as the World Bank);
- Definition of the role of the private sector, and financial targets for concessions, joint ventures, etc;
- Assessment of the scope for alternative approaches, such as demand management (C3) or economic instruments (see C7) to reduce capital needs;
- Assessment of the scope for investment at the community/household level;
- Charging schemes for water and wastewater discharges (see economic instruments, C7);
- Clear assessment of the roles of public and private sectors and associated regulatory instruments.

Fund-raising can be delegated by central government to other stakeholders. This depends on factors such as whether the Treasury can raise finance on better terms than private investors, whether municipalities have the capacity to raise their own funds without central government guarantee, and the extent to which private firms will bring their own equity or loan funds to a project.

Key organisations

The Asian Development Bank is a multilateral development finance institution dedicated to reducing poverty in Asia and the Pacific. ADB's water policy stresses the need for integrated cross-sectoral approaches to water management and development. www.adb.org/Documents/Policies/Water/default.asp Headquarters, P.O. Box 789, 0980 Manila, Philippines. Tel: (632) 632-4444, Fax: (632) 6362444

The World Bank helps developing countries fight poverty and establish economic growth that is stable, sustainable, and equitable. It works in more than 100 developing economies with the primary focus of helping the poorest people and the poorest countries. www.worldbank.org/ Headquarters - General Enquiries, The World Bank, 1818 H Street, N.W., Washington, DC 20433 U.S.A. tel: (202) 477-1234, fax: (202) 477-6391

The African Development Bank is the premier financial development institution of Africa, dedicated to combating poverty and improving the lives of people of the continent and engaged in the task of mobilising resources towards the economic and social progress of its Regional Member Countries.
www.afdb.org
ADB Headquarters, Rue Joseph Anoma, 01 BP 1387 Abidjan 01, Côte d'Ivoire.
Tel: (225) 20.20.44.44, Fax: (225) 20.20.49.59

The Inter-American Development Bank was established to help accelerate economic and social development in Latin America and the Caribbean. Current lending priorities include poverty reduction and social equity, modernisation and integration, and the environment. www.iadb.org IDB Headquarters, 1300 New York Avenue, NW, Washington, DC 20577, United States of America. Tel: (202) 623-1000

ECOWAS (Economic Community of West African States) designates the achievement of a common market and a single currency as economic objectives, while in the political sphere it envisages the establishment of a West African parliament, an economic and social council and an ECOWAS court of justice to replace the existing Tribunal and enforce Community decisions. mbendi.co.za/cb17.htm ECOWAS, Private Bag 12745, Lagos, Nigeria. Tel: +234 (0)1 63-6841, Fax: +234 (0)1 636822

Panel on financing water infrastructure GWP, together with the World Water Council and the organisers of the Third World Water Forum, have established a panel of high level financiers to explore new and innovative financing mechanisms to address the deficit in water management funding. To serve the poor with more cost-effective options, they will be looking at greater community involvement and harnessing the energies of the private sector. www.gwpforum.org/

Selected references and websites

Thobani, Mateen, *Private Infrastructure, Public Risk*, Finance and Development,1999. Publication discusses the risks involved in private contracts for public utility services and infrastructure, as well as the key role of government

A3.2 Financing options I: Grants and internal sources

§ **Characteristics**

This tool deals with grants and sources which are "internal" to the water sector (A3.3 deals with loans and equity sources). Allowing for the diversity of the water sector in different countries, and variations in financial sources available, a rational financing strategy is as follows:

- Minimise financial costs by the choice of appropriate standards (e.g. deferring the introduction of central sewerage in every case) and technology (avoiding "gold-plated" options);
- Encouraging water users to take on some of the costs of local schemes ("sweat equity" in urban upgrading or rural communal schemes) supported by small loan schemes for materials and installations;
- Getting commercial enterprises to undertake their own investment in water conservation and pre-treatment of effluent by a mixture of legal penalties and tariff incentives. In irrigated agriculture there is already a high degree of self-financing, especially on smaller schemes;
- Use revenues from the sale of water and related services (C7.1) to cover recurrent operating and maintenance costs plus a contribution to the cost of investment in expanding and modernising the system. It is important to cover O&M (operation and maintenance) costs from normal revenue, otherwise operations will proceed on a hand to mouth basis and maintenance will be neglected. In the long term, capital investment in water services should also be funded from internal revenues plus borrowing (which is repaid from revenues) but this ideal state may need to be approached gradually, especially in irrigation;
- Tap all potential sources of grants, but take steps to reduce long-term dependence on them (because they are unlikely to be permanent)
- Subsidies from central and local governments, particularly for investment (most governments are reducing recurrent subsidies for water). Funding "public goods" (e.g. watershed conservation, hydrological research) is also an appropriate function of governments;
- Grants from international aid agencies (bilateral donors, UN agencies, EU ISPA, etc). Appropriate for technical assistance, capacity building, setting up regulatory systems, etc.;
- Grants from local and international NGOs raised from voluntary donations, sometimes matched by official aid agencies, which can encourage lending from local banks;
- Grants (including soft loans) from the proceeds of pollution and other environmental taxes, which are recycled within the sector for such purposes as water conservation, pre-treatment of effluent, etc.

§ **Lessons**

- An active tariff policy, generating an adequate and inflation-proof cash flow, is the best foundation for the sector's long-term financial health, and will be needed as the basis for attracting loans and equity.
- Cost recovery through taxation is difficult in poor countries with weak governments and a weak fiscal position.
- In recent years international aid for water has been declining, partly in response to bad experiences, a thin flow of good projects and the poor governance of this sector (see B1.1). In the current climate, with growing international interest and commitments, the prospect for aid is brighter, but much will depend on reforms and capacity building efforts.

Key organisations

The Asian Development Bank is a multilateral development finance institution dedicated to reducing poverty in Asia and the Pacific. ADB's water policy stresses the need for integrated cross-sectoral

approaches to water management and development. www.adb.org/Documents/Policies/Water/default.asp Headquarters, P.O. Box 789, 0980 Manila, Philippines. Tel: (632) 632-4444, Fax: (632) 6362444

The World Bank helps developing countries fight poverty and establish economic growth that is stable, sustainable, and equitable. It works in more than 100 developing economies with the primary focus of helping the poorest people and the poorest countries. www.worldbank.org/ Headquarters - General Enquiries, The World Bank, 1818 H Street, N.W., Washington, DC 20433 U.S.A. tel: (202) 477-1234, fax: (202) 477-6391

The African Development Bank is the premier financial development institution of Africa, dedicated to combating poverty and improving the lives of people of the continent and engaged in the task of mobilising resources towards the economic and social progress of its Regional Member Countries.
www.afdb.org
ADB Headquarters, Rue Joseph Anoma, 01 BP 1387 Abidjan 01, Côte d'Ivoire.
Tel: (225) 20.20.44.44, Fax: (225) 20.20.49.59

The Inter-American Development Bank was established to help accelerate economic and social development in Latin America and the Caribbean. Current lending priorities include poverty reduction and social equity, modernisation and integration, and the environment. www.iadb.org IDB Headquarters, 1300 New York Avenue, NW, Washington, DC 20577, United States of America. Tel: (202) 623-1000

ECOWAS (Economic Community of West African States) designates the achievement of a common market and a single currency as economic objectives, while in the political sphere it envisages the establishment of a West African parliament, an economic and social council and an ECOWAS court of justice to replace the existing Tribunal and enforce Community decisions. mbendi.co.za/cb17.htm ECOWAS, Private Bag 12745, Lagos, Nigeria. Tel: +234 (0)1 63-6841, Fax: +234 (0)1 636822

Panel on financing water infrastructure GWP, together with the World Water Council and the organisers of the Third World Water Forum, have established a panel of high level financiers to explore new and innovative financing mechanisms to address the deficit in water management funding. To serve the poor with more cost-effective options, they will be looking at greater community involvement and harnessing the energies of the private sector. www.gwpforum.org/

Selected references and websites

Report of the Panel on Financing Water Infrastructure (The Camdessus Panel), March 2003 at the Kyoto Conference. www.gwpforum.org

A3.3 Financing options II: Loans and equity

Grants and internal sources (A3.2) can be supplemented by borrowing and the injection of equity capital. In the long run, both these types of finance have to be repaid or reimbursed from the cash flow from water sales, so should not be regarded as additional sources.

Some of the larger and middle-income developing countries have large and well-developed local capital markets that can provide the required amounts of loan capital for water. In other cases, foreign borrowing is subject to macroeconomic constraints on the size of public debt, reinforced by IMF pressure, which severely limit the amount of foreign borrowing by poor and highly-indebted countries. The offer of public guarantees, e.g. for foreign exchange risk, represents a contingent liability which effectively raises public debt (though these liabilities are not always reflected in budgets).

Loans should be tailored to the cash flow profile of the investment, and match the offshore/local content of the project. The main sources are:

- Long-term loans from multilateral agencies (World Bank, regional development banks, European Investment Bank, etc)
- Guarantee facilities from the above agencies and governments which improve the terms and conditions on which local loans can be raised;
- Export credit, usually officially guaranteed by the exporting country, subject to the OECD Consensus rules;
- Loans on commercial terms from local banks (normally for no more than five years) and international banks (sometimes longer-term if 'enhanced' by guarantees of various kinds);
- Bonds raised locally or overseas, by central and less often municipal governments, requiring public.

Equity capital can also be raised by private companies, joint ventures, or utilities with a corporate structure. Equity sources include:

- Private international companies, e.g. in concessions, asset transfers, joint operating ventures, etc.;
- Purchase of shares by specialised water and environmental investment funds, usually requiring a rate of return;
- Local institutions, e.g. commercial & development banks, pension funds; -International and bilateral investment agencies, e.g. International Finance Corporation (IFC), Commonwealth Development Corporation (CDC), European Bank for Reconstruction and Development (EBRD).

§ **Lessons**

- Since water revenues arise in local currencies, it is prudent to raise money locally where possible, to avoid a foreign exchange risk.
- There has been little international commercial bank finance for the water sector; project finance for water has been meagre, partly due to high fixed costs relative to the size of the deal.
- Many of the recent high-profile private international water projects have been problematic, due in particular to foreign exchange risks. These risks are underlined by recent international financial troubles.
- Equity investment is a high-cost source of finance. It is flexible in the short term and a buffer for loans, but shareholders demand market rates of return.
- The development of local capital markets are crucial to water finance in the long term. -Political and regulatory risks are problems in addition to exchange risk. Counter-guarantees between multilateral agencies, central governments and municipalities can help to address this.

Key organisations

The Asian Development Bank is a multilateral development finance institution dedicated to reducing poverty in Asia and the Pacific. ADB's water policy stresses the need for integrated cross-sectoral approaches to water management and development. www.adb.org/Documents/Policies/Water/default.asp

Headquarters, P.O. Box 789, 0980 Manila, Philippines. Tel: (632) 632-4444, Fax: (632) 6362444

The World Bank helps developing countries fight poverty and establish economic growth that is stable, sustainable, and equitable. It works in more than 100 developing economies with the primary focus of helping the poorest people and the poorest countries. www.worldbank.org/ Headquarters - General Enquiries, The World Bank, 1818 H Street, N.W., Washington, DC 20433 U.S.A. tel: (202) 477-1234, fax: (202) 477-6391

The African Development Bank is the premier financial development institution of Africa, dedicated to combating poverty and improving the lives of people of the continent and engaged in the task of mobilising resources towards the economic and social progress of its Regional Member Countries.
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The Inter-American Development Bank was established to help accelerate economic and social development in Latin America and the Caribbean. Current lending priorities include poverty reduction and social equity, modernisation and integration, and the environment. www.iadb.org IDB Headquarters, 1300 New York Avenue, NW, Washington, DC 20577, United States of America. Tel: (202) 623-1000

ECOWAS (Economic Community of West African States) designates the achievement of a common market and a single currency as economic objectives, while in the political sphere it envisages the establishment of a West African parliament, an economic and social council and an ECOWAS court of justice to replace the existing Tribunal and enforce Community decisions. mbendi.co.za/cb17.htm ECOWAS, Private Bag 12745, Lagos, Nigeria. Tel: +234 (0)1 63-6841, Fax: +234 (0)1 636822

Panel on financing water infrastructure GWP, together with the World Water Council and the organisers of the Third World Water Forum, have established a panel of high level financiers to explore new and innovative financing mechanisms to address the deficit in water management funding. To serve the poor with more cost-effective options, they will be looking at greater community involvement and harnessing the energies of the private sector. www.gwpforum.org/

Selected references and websites

IFC, *"Project finance in developing countries: lessons of experience"*. 1999 Standard & Poor's, *"Project and Infrastructure Finance Review"* annually, and periodic reports on water sector (available on internet site). David Owen, "European Water Company Profiles", Financial Times Energy. Regularly updated. (www.standardandpoors.com)

David *Owen "Masons Water Yearbook"* (For privatisation news).

B INSTITUTIONAL ROLES

B1 CREATING AN ORGANISATIONAL FRAMEWORK – Forms and functions

Many different types of institution can be involved in integrating water resources management, ranging from very large, trans-boundary or international entities to local and regional governments, much smaller civil society groups and community organisations (as listed in B1.2 to

B1.11 below). The composition in any given country will depend on the nation's experience and needs. Today water organisations are experiencing both institutional and structural change, reflecting national desires for greater efficiency and improved performance. B1.1 deals with the reform of institutions for better governance.

But at the same time, many organisations whose primary function is not water management are responsible for sectors where the impact on water resources can be enormous – agriculture, industry, trade and energy are examples. Similarly water resources organisations will have to consider non-water issues, such as environment or gender.

Institutional structures vary from country to country, but whatever the specific structure it is essential to have mechanisms for dialogue and co-ordination to ensure some measure of integration. A balance has to be met between providing a fully integrated approach where specific issues may get lost due to lack of expertise or interest, and a sectoral approach where different policies are followed without any co-ordination.

The roles, responsibilities and functions of water organisations vary. They may include:

- Policy formulation;
- Education and promotion;
- Networking and information exchange;
- Regulation, control and enforcement;
- Surveillance and monitoring;
- Allocation and supply of water;
- Flood control and risk mitigation;
- Water treatment and reuse;
- Conservation and protection;
- Pollution control and water quality management;
- Adjudication in the case of conflict.

The structure of institutions is a matter of *water governance*, which deals with the design and implementation of public policies for sustainable water investments and management that elicit the support of society as a whole. Governance activities include legal frameworks, policies, institutions, and management tools and, as such, is an overarching concept that influences many of the tools in the ToolBox. Without appropriate policies institutions cannot function – without appropriate institutions policies will not work – and without a working set of policies and institutions, management tools are irrelevant. Without good governance civil society will not support the policies and will have a difficult time achieving sustainable and equitable water use. Good governance requires, above all, transparency of the institutions and participation by the citizens.

Governments and civil society have increased their scrutiny of water groups, having been driven by accountability concerns, and demanding performance assessments. These reviews have looked at such aspects of the organisations' performance as jurisdiction, enforcement powers, fiscal adequacy, staffing adequacy, administrative discretion, flexibility, visibility, accountability and structural compatibility. All organisations should also aim to practise what they preach. Knowledge sharing, conflict resolution and equity are not just issues to be addressed between organisations, but should be part of the ethos of each organisation.

B1.1 Reforming institutions for better governance

Water governance refers to the political, administrative, economic and social systems that exist to manage water resources and services and is essential in order to manage water resources sustainably and provide access to water services for domestic or productive purposes.

Governance models must fit the prevailing social, economic and cultural particularities of a country, but certain basic principles or attributes are essential. The approach taken to water governance should be transparent, inclusive, coherent and equitable. Similarly, the governance system should be accountable, efficient and responsive. Better governance requires the participation of government, civil society and the private sector, as all are instrumental in different ways in the successful implementation of institutional reforms.

In reforming institutions for better governance, an assessment of existing institutional systems should be carried out first – to understand who does what for whom, and to whom they are accountable. An *institutional assessment* should identify, for example, conflicting laws, duplication or lack of clarity of mandates for different organisations and jurisdiction of different tiers of authority – local, sub-regional, national and, increasingly, international. Determining what to reform and the sequence that reforms should take is critical to the success of the reform process. A comparative analysis of reforms that have been undertaken, either within a country or with other similar countries, can help clarify needs.

Change can be painful and is often resisted as it makes people feel insecure even if they understand the need. Often good laws or revised procedures can fail as they are not understood or accepted by officials or citizens. Institutional reform needs to be done with a participatory and consultative approach, involving the formal and informal sectors, to develop understanding and ownership of the change process (see tools such as Conflict Resolution, C5, or B2, Building institutional capacity).

A key element is access to information (see C4.3). Frequently, information is only available to a select group of experts or officials leading to "information asymmetry". Concrete actions are needed to redress this imbalance.

§ **Lessons**

- Reforms should be carried out in a coherent and integrative way and suit the broader social and political policies of the country.
- Not all necessary reforms can be undertaken at the same time – it is important to decide on priorities and a sequence of actions to suit those priorities.
- Avoid unrealistic reforms that are not politically or socially acceptable.
- Raising awareness, sharing information and meaningful participatory debate are key elements of any reform process.
- Reform is a dynamic, iterative process and the only certainty is change itself.
- Vested interests and special interest groups should be included in debates but decision-makers should avoid being 'captured' by special interest groups.
- In any reform, regulation of service providers, both public and private, is a key element and regulators must be independent and strong.
- Reforms should avoid confusing the roles of resource management (government responsibility) and service provision (public or privately operated utilities).
- Governance for water must take account of all sectors which are dependent on water or are key providers of water and must not concentrate solely on drinking water supply.

Key organisations

Transparency International, monitors corruption and general governance issues. See also 'Corruption Fighters Toolkit' – civil society experiences and emerging strategies, 2001.
www.transparency.org

Parliamentarians for Global Action, organisation promoting good global governance. See "Sustainable

Development and Population Programme", www.pgaction.org/prog.asp

Selected references and websites

Rogers. P. A., Hall. A. W., *Effective Water Governance* – Background Paper No 7, GWP 2002

UNDP – Democratic Governance. www.undp.org/governance

OECD – Themes include corporate governance and corruption. Publication on Principles of Corporate Governance (May 1999)
www.OECD.org

B1.2 Transboundary organisations for water resource management

§ **Characteristics**

Transboundary organisations provide a framework for managing water resources across international boundaries, where there are issues about the management of common (cross-jurisdiction) property resources.

Such organisations vary in type and function according to the political context, the water resources challenges and the cultural features of the area. They are often based on voluntary agreements between sovereign states, but may include international and intra-national water authorities and commissions. Traditionally, international organisations have been set up to address a given problem, for example, navigation or flooding. However, their remit can be and has often been expanded to tackle wider water problems in the basin. While ministers in each country often wish to retain ultimate responsibility for decisions, it can be helpful to establish some kind of consultative body to broaden the range of stakeholder involvement.

The type of agreement underlying these organisations varies greatly around the world, from ad hoc arrangements, memoranda of understanding, to formal international treaties and agreements. It is clear that the effective functioning of transboundary organisations requires a secure funding base, the political will of governments, and the commitment of the partners who create them. An IWRM approach requires that human resources and institutional capacity in transboundary structures are able to address social issues, as well as environmental and economic development imperatives.

To develop the essential confidence to enable transboundary water resource management and collaboration, parties need to build and accept common data sets and knowledge about the water resource issues (see C1 and C8), and share visions (see C5) about the future of the resource.

§ **Lessons**

- Once established, transboundary organisations and water agreements are remarkably robust – contrary to popular belief, they often act as a moderating factor within a conflict situation (Kader Asmal, 2000).
- Establishing the conditions for agreement can be time-consuming and costly in terms of money and resources (e.g. brokers and negotiators to build confidence). Donor support can be helpful here.
- The use of a respected external party or organisation to act as honest broker is useful (multilateral agencies such as the UNDP and World Bank have both fulfilled these roles).
- National water policy needs to support inter-agency co-ordination for the transboundary organisation and may need to be modified to align with the other parties in the agreement.
- Citizen, media and NGO pressure frequently galvanises action, e.g. to reduce environmental problems from water overuse (see also B1.9, role of civil society).
- Once established, transboundary water management needs to move beyond visions, and develop specific regulatory mechanisms, data and information sharing protocols and financing mechanisms to put transboundary water management firmly on the ground. Experience shows that technical secretariats are essential in this respect.

Key organisations

The International Commission for the Protection of the Rhine.
International Commission for the Protection of the Rhine, Postfach 200253, D-56002 Koblenz.
Phone: +49-261-12495, Fax: +49-261-36572. sekretariat@iksr.de or www.iksr.org

The Mekong River Commission (MRC)
The MRC was established in 1995 to promote co-operation between member states in the fields of sustainable development and utilisation, conservation and management of the Mekong River

Basin. Mekong River Commission, P.O. Box 1112, Phnom Penh, Cambodia. Phone: +855 23 72- 0979, Fax: +855 23 72- 0972. www.mrcmekong.org/

SICA Water Consultative Group (Central America)
Regional Committees on Water Resource (CRRH) of SICA, crrhcr@racsa.co.cr

GLOBWINET is an Information Network on IWRM focusing on transboundary river basin organisations, water legislation, and national water administration. GLOBWINET is a GWP associated programme. The first regional node of GLOBWINET is SAWINET in Southern Africa. www.globwinet.org

International Law Commission (ILC)
Established by the General Assembly in 1947 to promote the progressive development of international law and its codification. www.un.org/law/ilc/index.htm
Contact: Fax. +1 (212) 963-1963, E-mail: cod@un.org

The Nile Basin Initiative
The NBI is a regional partnership within which countries of the Nile Basin have united in common pursuit of the sustainable development and management of Nile waters.
www.nilebasin.org/
Contact: Fax: +256 (41) 320 971 E-mail: nbisec@afsat.com

Selected references and websites

Transboundary Water Management as an International Public Good. Study looks at financial mechanisms for transboundary water management – case studies of the Mekong, Incomati, Jordan River Basins Ministry of Foreign Affairs, Sweden, 2001

DSE, *Global water politics: Co-operation for transboundary water management*, 1st Petersberg Round Table, International Dialogue Forum, Petersberg/Bonn, 3-5 March 1998, German Foundation for International Development, 1998. Available on-line at: www.dse.de/ef/petersb.htm

Salman M. A., *International Watercourses: Enhancing Cooperation and Managing Conflict*, World Bank, Washington D.C., ISBN 0-8213-4298-3, 1998. (see also C5.1).

Convention on Co-operation for the Protection and Sustainable Use of the Danube River (Danube River Protection Convention) Vienna International Centre, Room D 0443, P.O. Box 500, A-Vienna, Austria Phone: +43 1 26060 5738 Fax: +43 1 26060 5895 E-mail: icpdr@unvienna.org Homepage: www.icpdr.org

The *Transboundary Freshwater Dispute Database* provides:
1. A searchable database of summaries and full text of 150 water-related treaties. The summaries are catalogued by basin, countries involved, date signed, treaty topic, allocations measure, conflict resolution mechanisms, and non-water linkages
2. A similar database of 39 interstate compacts within the United States
3. Negotiating notes and other primary and secondary sources for 14 case studies of the processes of international water conflict resolution
4. Descriptions of indigenous/traditional methods for the resolution of water disputes News files and bibliographic entries of acute water conflicts. www.terra.geo.orst.edu/users/tfdd

B1.3 National apex bodies

§ **Characteristics**

Apex bodies consist of a range of entities such as high level steering groups within national governments, inter-agency task forces (for specific purposes, e.g. water pollution control), and international consortia for the management of water resources. The aim of such bodies is to provide structures for co-ordination between different organisations involved in water resource management. In some cases water policy and management is centred in a specific body of

government but in many situations responsibility for water is shared between a number of bodies (e.g. ministries for irrigation, environment and public works) that may not be able to operate easily together. Here an apex body may provide a useful co-ordinating function.

The functions of these bodies vary considerably. As many governments endorse and seek to use IWRM, the intended outcomes include:

- Improved co-ordination of government functions through integrated plans of action (see A1.2);
- Structural change within government agencies to facilitate better co-ordination;
- Creation of new departments or commissions and authorities for natural resources management, aligned to river basins and/or ecological zones (see B1.4);

The role of an apex body depends on the economic, social and encompassing political issues, even more than on the technical IWRM issues.

§ **Lessons**

- Successful experience to date in establishing robust and respected apex bodies is limited.
- Establishment of a successful apex or co-ordinating body can be a slow process, since it takes time for a new body to achieve legitimacy.
- The effectiveness of an apex body is linked to the specific political and historical context.
- For an apex body to function effectively, all the stakeholders who are involved in the functions under its jurisdiction need to develop commitment to it and ensure it has appropriate powers. Conflict management (C5) and awareness raising techniques (C4) are important here.

Key organisations

GLOBWINET is an Information Network on IWRM focusing on transboundary river basin organisations, water legislation, and national water administration. GLOBWINET is a GWP associated programme. The first regional node of GLOBWINET is SAWINET in Southern Africa. www.globwinet.org

Selected references and websites

The High Level Steering Group on Water (HLSGW) The HLSGW comprises representatives of the agriculture and environment agencies of the Commonwealth and Australian State Governments in the contact of the Council of Australian Governments COAG Water Reform Framework. Current projects also focus on identifying costing and charges for externalities; establishing a consistent national approach to water trading; institutional approaches to water resource management; water for the environment, and opportunities for improved management of groundwater. www.affa.gov.au/ Home > Natural Resource Management > Water Management > National water reform policy > The High Level Steering Group on Water

The National Water Agency of Brazil is the executor of the water recourses policy and administer the permit system under control of the federal government. As a prerogative of the federal government, the Office of Water Resources will remain responsible for elaborating the country's water policy. The National Water Agency was proposed in order to introduce more flexibility into the system. The idea is to create an entity with sufficient stability and technical capability to implement the Water Resources Management Systems – a task that will take many years of continued efforts before maturing. National Water Agency (Agencia Nacional de Aguas – ANA), Brazil, Setor Policial – Área 5 – Quadra 3 – Bloco B, 70610-200, Brasília – DF, Brazil. www.ana.gov.br

The Regional Committee on Water Resources in Central America – CRRH promotes the development and conservation of water resources and their sustainable use in order to reach an integral development for the Central America countries and the quality of life of their citizens. CRRH focuses on meteorology (climate), hydrology and water resources management. Regional Committee on Water Resources (CRRH), Central, 21-2300 San Jose, Costa Rica, Tel: +506 231 5791, Fax: +506 296 0047, crrhcr@racsa.co.cr

B1.4 River basin organistions

§ **Characteristics**

River basin organisations (RBOs) are specialised organisations set up by political authorities, or in response to stakeholder demands. RBOs deal with the water resource management issues in a river basin, a lake basin, or across an important aquifer. The focus here is on the basin organisations that are domestic and do not transcend state boundaries. River basin organisations provide a

mechanism for ensuring that land use and needs are reflected in water management – and vice versa. Experience has varied dramatically in the ability of these organisations to achieve IWRM. Their functions vary from water allocation, resource management and planning, to educating basin communities and developing natural resources management strategies and programmes of remediation of degraded lands and waterways. They may also play a role in consensus building, facilitation and conflict management (C5).

Recent innovation has focused on an integrated river basin management approach (IRBM), a subset of IWRM, and catchment management rather than single sector approaches. (See also C2.2, Basin management plans.)

The form and role of a river basin organisation is closely linked to its historical and social context. Key characteristics of sustainable river basin management are:

- Basin-wide planning to balance all user needs for water resources and to provide protection from water-related hazards;
- Wide public and stakeholder participation in decision making and local empowerment (B2.1);
- Effective demand management (C3);
- Agreement on commitments within the basin, and mechanisms for monitoring those agreements;

- Adequate human and financial resources.

Varying opinions exist about the most effective scale of application. The success of a river basin organisation may depend on aspects such as the level of human and institutional capacity of the civil society, the degree to which water resources are developed, and climatic variability (arid versus temperate river basins, for example). The policy and legislative framework will govern the purpose and effectiveness of the RBO.

§ **Lessons**

Experience shows that all RBOs evolve with time and see their composition and duties adapted from time to time reflecting the real needs of the moment. Successful river basin organisations are supported by:

- An ability to establish trusted technical competencies;
- A focus on serious recurrent problems such as flooding or drought or supply shortages, and the provision of solutions acceptable to all stakeholders;
- A broad stakeholder involvement, catering for grassroots participation at a basin-wide level (e.g. through water forums);
- An ability to generate some form of sustaining revenue;
- The capacity to collect fees, and attract grants and/or loans;
- Clear jurisdictional boundaries and appropriate powers.

Key organisations

RBA Centre (Centre for Research on River Basin Administration, Analysis and Management)
The RBA Centre is the research centre of the Delft University of Technology in the field of integrated river basin management. RBA centre, Delft university of Technology, Stevinweg 1, 2628 CN Delft, The Netherlands, tel. +31 15 2784773, fax: +31 15 2787799,
rba.centre@citg.tudelft.nl
www.ct.tudelft.nl/rba/index.html

The GWP Associated Programme on Developing and Strengthening of River Basin Organisations supports organisational initiatives for IWRM at basin level (led by International Network of Basin Organisation INBO). stp-riob@oieau.fr or www.oieau.fr/riob/

Bank-Netherlands Water Partnership Programme (BNWPP).
www.worldbank.org (see C2.8)

International Office of Water France The International Office of Water is a non-profit making Association. Its objective is to establish a network of public and private partners involved in water resources management and protection. www.oieau.fr Contact: Fax: 01 40 08 01 45 E-mail: dg@oieau.fr

ECLAC's (United Nations Economic Commission for Latin America and the Caribbean) network for co-operation in IWRM identifies procedures for creating and maintaining river basin organisations. www.eclac.org (see A2.2 for contact address

Selected references and websites

Natural Resources Law Centre, *The Watershed Source Book*, Natural Resources Law Centre, University of Colorado, Boulder, 1996.

Manaaki Whenua Landcare Research (New Zealand) have developed a template of integrated catchment management protocols, based on a knowledge-driven approach: bridging the science-policy gap to create catchment management strategies and programmes at the regional scale in New Zealand. www.landcare.cri.nz/science/ soil_water/icm/

Mostert, E., van Beek, E., Bouman, N. W. M., Hey, E., Savenije, H. H. G., and Thissen, W. A. H., River basin management and planning, in: E. Mostert (eds.), *River Basin management; Proceedings of the International Workshop*, The Hague, 27-29 October 1999, IHP-V, Technical documents in Hydrology, UNESCO, Paris, 2000.
www.ct.tudelft.nl/rba/rba.htm > International Workshop on RBM > River Basin

Strategic Activities to Strengthen the Policies of Integrated River Basin and Coastal Marine Zone Management in Central America Forum of Vice Presidents of Central America
Yamileth Astorga – yastorga@sol.racsa.co.cr

The Murray Darling Basin Initiative, a partnership between governments and the community to implement integrated catchment management. www.mdbc.gov.au

B1.5 Regulatory bodies and enforcement agencies

§ **Characteristics**

Regulatory and enforcement bodies have an extremely important role in establishing and ensuring the effective application of tools for building IWRM. Their functions include the allocation of water rights, environmental management related to water use, water quality, land use planning and the financial management of water resources management by the state. Regulatory bodies also have a function in setting prices and performance standards for service providers (economic regulation). The actual function of regulatory and enforcement bodies

should be set out in a clear legal framework reflecting water policies. In some cases the same body undertakes regulation and enforcement; in other cases they are separate. Regulatory and enforcement agencies normally have a range of tools for enforcement – fines, taxes, penalties, withdrawal of permits and licences etc.

Regulatory bodies and enforcement agencies may be financed through central government funds, or by user fees (e.g. pollution charges) or fines for non-compliance. If the latter applies, the terms need to be very clear or there is a potential risk of conflict of interest.

The specific functions of regulatory bodies and enforcement agencies are determined by government policy on water resources management (A1). These bodies and agencies are usually in the government sector but may subcontract specific activities (e.g. monitoring and testing samples) to non-governmental organisations, including private companies. It is important that they can act without day-to-day political interference.

Effective capacity in regulation and enforcement (C6) is essential and this applies whether traditional regulatory instruments or innovative pricing and economic instruments are used (C7). However, capacity in regulatory and enforcement bodies varies widely from region to region and a focus on capacity building and support is essential. The legitimacy of the regulatory body is critical in ensuring compliance.

§ **Lessons**

Important priorities for enforcement and regulatory agencies include:

- Sufficient staff of adequate capability to enforce regulations (enforcement agencies) and make appropriate assessments about water management needs (regulatory bodies);
- Statutes which are practical, enforceable and are based on accurate knowledge of resource management and environmental impacts (see also A2.2);
- Staff who are knowledgeable about good management practices and have appropriate scientific knowledge in water resources management;
- A sense of ownership on the part of stakeholders so that they accept the monitoring, enforcement and regulation procedures; ownership can by built through use of awareness raising techniques (C4.2 and C4.3) and participatory management (B2.1);
- Adequate financial resources to support the staff and operations, and transparency in financial management, to minimise regulatory capture;
- Selecting meaningful indicators for technical, economic and social issues and appropriate benchmarks (see C1.5);
- A programme of legal education and awareness building – for the regulating parties and public at large – goes a long way towards putting legal instruments into practice and ensuring that the use of regulatory instruments is not limited to specialists.

Key organisations

The Office of Water Services (OFWAT), UK The aim of OFWAT is to regulate the water and sewerage companies in a fair and open way so that the companies can improve the quality of service and value for money they provide for their customers. www.open.gov.uk/ofwat/index.htm Fax: +44 (0)121 625 1400, E-mail: enquiries@ofwat.gtnet.gov.uk

Selected references and websites

World Bank, *Toolkits for Private Sector Participation in Water and Sanitation*, 1997. Contact: Fax: (202) 522-1500 E-mail: pic@worldbank.org www.worldbank.org/html/fpd/wstoolkits/ (See also A3.3 and C6.3).

Association of Waterboards, The Netherlands Umbrella Organisation for waterboards with responsibility for management of regional water systems. Association of Waterboards, The Netherlands, PO Box 80200, 2508 SE, Den Haag. www.urw.nl

Environment Agency of the UK. Regulatory body responsible for water quality and water resources, regulations of dischargers etc. www.environment-agency.gov.uk

B1.6 Service providers and IWRM

§ **Characteristics**

Service providers range from government departments and municipalities, public corporations and private sector companies to community-based organisations and farmers' groups. They are the providers of water to rural and urban communities for irrigation and water supply including drinking, industrial uses, etc. They may also provide sanitation, treatment, and pollution control services. In some cases, service providers may be natural resource management agencies which provide nature conservation or they may be agencies reducing people's vulnerability to natural hazards such as floods. Service providers may also be required to preserve hydrological balances

and ensure resource sustainability.

The legal framework for service providers is set out in water legislation, which covers issues such as responsibilities and requirements (see A2). Approaches to improve efficiency in service providers are indicated in B1.6, the specific characteristics of the role of the private sector in service delivery are reviewed in B1.7. Less formal service suppliers (water vendors, farmers with water from private wells) may lie outside the formal legislative framework but can be essential for meeting local needs.

National IWRM policies determine the roles and responsibilities of the various levels of service provision and the way in which they can be used to develop an integrated cross-sectoral approach. Such policies will be enforced through the appropriate regulatory bodies. Water users and providers should comply with agreed national and state standards of water use, conservation and health.

Organisations with water supply, sewerage, treatment and reuse functions are increasingly driven by the need to make efficiency gains: to do more with less water, to eliminate subsidies, incorporate externalities and minimise impacts, to recover costs of operation, maintenance and replacement of water and wastewater systems, and to transfer the cost of supply and treatment from the provider (usually government) to the consumer (citizens, private companies and other government organisations and users).

§ **Lessons**

The structure of service providers is linked to the social economic and political structures of the society, so generalisations are difficult. However, there are some broad lessons in terms of effectiveness and efficiency:

- Efficient water service providers are likely to be characterised by a desire to achieve high standards in water use and reuse, using a range of tools (C3 demand management), awareness techniques and technical innovation (C4);
- Efficient and equitable service delivery is more straightforward in a system of well-defined property rights and obligations for water for all uses (see A2.1);
- Benchmarking can help to enforce performance.

Technical tools for ensuring good service provision include:

- Systems of water pricing related to volume and timing, for all applications (C7);
- Periodic audits of the activities of the private and public sector regarding water resources management;
- Transparent use of economic instruments (C7);
- Management systems which secure best practice use and reuse of water resources while minimising off-site, groundwater, and downstream impacts on freshwater ecosystem services (C3);
- Technical innovations can include increased efficiency in storage, conveyance and distribution of water and techniques for waste minimisation (C3);
- Effective regulation and clear government policies (A1).

Key organisations

Public Private Partnerships for the Urban Environment (UNDP)
This programme helps bring together government, private business and civil society to pool their resources and skills to address the urban environmental challenges of the 21st century.
www.undp.org/pppue
Contact: Public-Private Partnerships for the Urban Environment (PPPUE),
Fax: +1 (212) 906-6973, Email: pppue@undp.org

The Water Utilities Partnership for Capacity Building in Africa (WUP-Africa) builds

partnerships between African water supply and sanitation utilities and other key institutions, and to share experiences. WUP Africa is a GWP Associated Programme.
www.wup.org or wup@africaonline.co.ci

The Water Utilities Partnership for Capacity Building in South Asia facilitates increased knowledge management in South Asia on reform and institutional development of urban water supply and sanitation. WUP South Asia is a GWP Associated Programme.
dpyakural@ecomail.com.np

Bank-Netherlands Water Partnership Programme (BNWPP) is an operational instrument to stimulates innovative approaches to water management in World Bank operations and the broader development community.

Bank Netherlands Water Partnership Programme (BNWPP), Room MC 5-850, 1818 H Street, N.W., Washington, D.C. 20433. Phone: 202-458-2613. Fax: 202-522-3306. lbijlsma@worldbank.org

GW-MATE offers advice on groundwater management and protection, role of governments, associated policy and institutional issues, and mobilising stakeholders. GW-MATE is a GWP Associated Programme.
gwp@sida.se, www.worldbank.org/gwmate

Selected references and websites

Merrey, D. J., *Institutional Design Principles for accountability in large irrigation systems*, IIMI Research Report No. 8, Colombo, Sri Lanka, International Irrigation Management Institute, 1996.
www.cgiar.org/iwmi/pubs/ > Research Reports > No. 8
Available in HTML or in pdf for downloading.

B1.7 Strengthening public sector water utilities

§ **Characteristics**

Most water services - including regulation and ecosystem protection, as well as water supply and sanitation and irrigation infrastructure - are provided by public utilities. Improved efficiency of operation in public sector service providers is an important means of improving the effectiveness of financial resources, and indeed, many public water service and irrigation agencies are inefficient and need reform. Reform can yield efficiency gains of the sort normally associated with the private sector (see B1.8).

There are several types of public utility, with varying levels of autonomy. This affects the way in which they can operate. In ascending order of autonomy the main types are:

- Government department (within ministry or separate ministry);
- Special water unit, reporting to a minister or mayor;
- Fully autonomous, 'commercial' water utility with financing capacity;
- Company wholly or majority-owned by the public sector.

Water supply and sanitation are provided by all of the above in different places. However, irrigation agencies are usually highly centralised, and reform here is often impeded by strong vested interests.
Because each public water organisation is different, it requires a unique and tailored package of solutions. A clear definition of the respective responsibilities of service providers and regulatory bodies is essential. There are some common elements for reform (improved efficiency) for service providers which include:

- A clear and effective regulatory framework (both financial and service delivery (C6.3));
- Greater autonomy from government and day-to-day interference;
- Commitment to effectively monitored performance targets (e.g. new connections, leakage reduction, reliability, bill collection rates, financial break-even, etc.);
- Tariff reform to improve cost recovery (C7.1);
- Motivation and training of staff, oriented to customer needs;
- Sub-contracting services to the private sector, where this is feasible and efficient;
- Restructuring the organisation to reflect new goals and orientation.

"Benchmarking" has been successfully used (e.g. by the Asian Development Bank and through the WUP) to set performance targets using comparative data drawn from other relevant systems, or in "yardstick competition" by regulators, to compare the performance of both private and public service delivery organisations relative to domestic or international equivalents.

§ **Lessons**

- Drastic reform is easier to contemplate when the water situation is desperate and public discontent with service levels is high.
- Consultation with water users is vital in order to ensure the provision of services that people really want and are willing to pay for. Note that users should be identified: women may be the main users of domestic water, but consultation often takes place only with (male) community leaders.
- Immediate and early improvements in the standard of service (e.g. water quality, reliability, pressure) will help offset the unpopularity of tariff increases or layoffs.
- Correcting inefficiencies (e.g. high levels of leakage, unpaid bills) can reduce the need for unpopular tariff increases (C3).
- Government needs to ensure that the poor are served and users are protected from excessive costs.

Key organisations

The BPD Water and Sanitation Cluster is an informal network of partners who seek to demonstrate that strategic partnerships involving business, government and civil society can achieve more at the local level to improve access to safe water and effective sanitation for the urban poor than any of the groups acting individually. www.bpd-waterandsanitation.org/

The Water and Sanitation Program (WSP) strengthens sector policies, improves sector investments, and generates and communicates sector knowledge by supporting governments, private sector, non-governmental organisations and communities. WSP is a GWP Associated Programme. www.wsp.org/ or info@wsp.org

Public Services International Research Unit, Univ. of Greenwich This research institution focuses on the effectiveness and role of public sector institutions in service provision in water resources. www.id21.org/society/s2cdh2g1.html psiru@psiru.org

The Water Utilities Partnership for Capacity Building in South Asia facilitates increased knowledge management in South Asia on reform and institutional development of urban water supply and sanitation. WUP South Asia is a GWP Associated Programme. dpyakural@ecomail.com.np

Selected references and websites

Private Business, Public Owners. Government Shareholding in Water Enterprises was edited by Maarten Blokland, Okke Braadbaart and Klaas Schwartz and published with the support of the Dutch Ministry of Housing, Spatial Planning and the Environment in April 1999. The book explores 'the Public Water PLC model' (Public Limited Company) that can improve the effectiveness and efficiency of water and sanitation services. www.wsscc.org/test/activities/imo/index.html Ministerie van VROM, Postbus 2727, 3430 GC Nieuwegein, The Netherlands. Fax +31 70 339 1568

B1.8 Role of the private sector

The private water sector plays an important role in financing water resource management through investment in service delivery in water supply and sanitation, and irrigation (typically when the source for irrigation water is groundwater). Commercial banks and other financial institutions (such as the World Bank) play an important role in financing both public and private sector service providers. The private sector also invests in environmental protection as a response to regulation, legislation and specific incentives. As it is of considerable prominence – and growing interest – at present, this tool focuses on the direct role of the private water sector in water supply and sanitation.

The motives for growing involvement of the large and/or international private sector are:
- *Financial*. Government passes on the cost and work of raising funds;
- *Political*. Necessary but unpopular reforms (e.g. raising tariffs, collecting unpaid bills, reducing the workforce) are carried out by private companies rather than politicians;
- *Expertise*. Private companies, if large or international, bring essential know-how in some technical and economic fields; -*Risk-sharing*. Private companies are typically better at handling risks.

Small-scale or community-level private sector involvement depends *on government economic policies* enabling access to finance. Micro-finance and community banks allow poor people to finance small-scale water infrastructure, for both domestic and agricultural use.
The main types of private involvement (also known as privatisation and PPP) in water service provision are through:

- *Contracting out* – the least controversial form of private sector involvement. A water undertaking sub-contracts certain functions to private firms, e.g. meter reading;
- *Leasing*. The water system remains in public ownership, but is leased to private operators. In French-speaking areas this is relatively common;
- *Concessions*. Assets remain in public ownership, but use of the system is conceded to private operators for a certain period of time, for example 20-25 years; the private operators are expected to invest in specified improvements and expansion;
- *BOOTs* (Build, Own, Operate, Transfer) and BOT (Build, Operate, Transfer) are concessions, usually for new facilities. After a specified number of years, the facility is handed to a public organisation;
- *Joint ventures* in operating companies;
- *Divestiture.* An extreme form of privatisation, in which full ownership of assets is transferred to private shareholders. Stringent public regulation is required. The only large-scale example is in England and Wales.

Government has a key role in providing a clear regulatory framework, and ensuring that the poor are served and users are protected from excessive costs.

§ **Lessons**

Private sector involvement can best deliver benefits in the following situations:
- Deteriorating levels of service, lack of repairs, backlog in new connections, etc.;
- Severe budgetary pressure on the water undertaking and government reluctance to subsidise;
- Good regulation is provided by government (C6.3), to ensure political and public confidence;
- Tendering is open and transparent, and single bidder situations are avoided;
- Government ensures investment security through legislation (A3);
- Efficiency gains cannot be more cheaply and less controversially obtained by reforms to public undertakings (see B1.7);
- The balance between up-front financial bonus gains and long term higher tariff costs is positive (see policy context, A1);
- Specific targets are set for delivering services to the poor and socially excluded.

Key organisations

The WBCSD (World Business Council for Sustainable Development) is a coalition of 150

international companies united by a shared commitment to sustainable development via economic growth, ecological balance and social progress.
www.wbcsd.ch/
WBCSD, 4 chemin de Conches, 1231 Conches-Geneva, Switerland. Tel: (41 22) 839 3100, Fax: (41 22) 839 3131

Public-Private Infrastructure Advisory Facility (PPIAF)
The Public–Private Infrastructure Advisory Facility (PPIAF) is a multi-donor technical assistance facility aimed at helping developing countries improve the quality of their infrastructure through private sector involvement.

International Private Water Association (IPWA)
The International Private Water Association is a non-profit corporation, established to promote opportunities for private sector participation in water utilities worldwide.
www.ipwa.org/ or administrator@ipwa.org

Selected references and websites

Rees, J. A., TEC Background Papers No. 1, *Regulation and Private Participation in the Water and Sanitation Sector*, Global Water Partnership, Stockholm, Sweden, 1998.
This document argues that there are no guarantees that privatisation will actually yield desired performance improvements.
www.gwpforum.org/ > Library – Publications > TEC Background papers no.1. (See also C6.3).

Bauer, C. J., *Against the current: privatisation, water markets and the state in Chile*, Kluwer, Dordrecht, ISBN 0-7923-8227-7, 1998.
This book is the first empirical and interdisciplinary study of water markets in Chile and combines law, political economy, and geography to analyse the disadvantages, problems, and wider contexts of water markets.

World Bank, *Toolkits for Private Sector Participation in Water and Sanitation*, 1997.
Contact: Fax: (202) 522-1500 E-mail: pic@worldbank.org
Toolkit 1, Selecting an Option for Private Sector Participation, sets out the issues that a government must work through to identify which kind of private sector arrangement best meets the specific needs and circumstances.
Toolkit 2, Designing and Implementing an Option for Private Sector Participation, focuses on how governments move from identifying their preferred option to implementing it.
Toolkit 3, What a Private Sector Participation Arrangement Should Cover, concentrates on the issues and risks that governments must address in the resulting contractual arrangement.
www.worldbank.org/html/fpd/wstoolkits/ (See also B1.4 and C6.3).

Brook Cowen, P. J., Getting the Private Sector Involved in Water – What to do in the Poorest of Countries, *Public Policy for the Private Sector*, Note no.102, The World Bank Group, January 1997. This paper assesses the strengths and weaknesses of some of the options of attracting private investors to water sectors in low income countries. www.worldbank.org/html/fpd/notes/102/102brook.pdf

B1.9 Civil society institutions and community based organisations

§ **Characteristics**

Civil Society Institutions (CSIs), Non-governmental Organisations (NGOs) and Community-Based Organisations (CBOs) can play an important role in developing and communicating integrated water resource management policies.

There is a large variety of players under this banner -from local informal to more formalised

community based organisations and NGOs. These organisations complement government activities and are involved in local-level development, advocacy, action research and social mobilisation. They are important players and apart from their development work often provide a voice for the poor and marginal groups. However, there has been a proliferation of civil society and non-governmental organisations, which, however well-meaning, are often non-accountable and may operate from a narrow self interest with no responsibility for the consequences of their actions. They are not and should not be taken as a substitute for government and government should not abdicate its responsibility.

However, within this spectrum CBOs can play an important role in the management of local water resources, for example in the establishment of rainwater harvesting programmes, local water supply and sanitation or the management of fishery resources. They have shown considerable ability to:

- Advocate on behalf of nature and environmental protection;
- Develop and test new models and tools in water management;
- Increase awareness of the need for sustainable water management (see also C4);
- Mobilise local communities to get involved.

It is important to provide a supportive environment for such self-evolving movements. Tools for support include: creation of 'peer' exchange between CBOs to stimulate learning and competition; creation of apex units to federate, support and promote different local initiatives, and access to finance – for example through local development banks of micro-finance institutions. NGO's have also been effective in supporting local organisations as their values and work culture often allow them to build up the required confidence and, as the flexibility with which they operate improves, efficiency.

§ **Lessons**

- Collaboration between service providers and CBOs can strengthen community ownership and build water management capacity at a local level (B2.1).
- Similarly, working linkages between CBOs and local government (see B1.10) provide a strong structure, allowing local water management issues to be scaled up and strengthen local regulatory capacity.
- It is important to think through which level is most workable and will create a portfolio of activities that justifies the existence of a permanent local organisation. Micro-planning and resource mapping are useful instruments at CBO level.
- Civil society organisations representing either professional categories or interest groups are most effective in societies where there is a commitment to participation and consultation.
- There is a danger that unless CBOs are well structured they may be taken over by narrow and stronger interest groups.

Key organisations

The International Secretariat of Water (ISW) and its worldwide network of civil society organisations have developed knowledge and experience of participatory processes and partnerships between citizen and water user groups and public and private agencies. International Secretariat of Water, 54, Le Royer St. West, Montreal, Quebec - Canada - H2Y 1W7, Telephone : (514) 849-4262, Fax : (514) 849-2822, info@i-s-w.org, www.i-s-w.org

UNED Forum is a multi-stakeholder non-governmental organisation - a network and forum on sustainable development which has promoted outcomes from the first Earth Summit in 1992 and is now working on preparations for Earth Summit 2002. UNED Forum, 3 Whitehall Court, London SW1A 2EL, UK, Tel +44 20 78391784, Fax +44 20 79305893, email: dmorely@earthsummit2002.org, www.earthsummit2002.org/freshwater

WaterAid is a major UK charity dedicated to the provision of domestic water, sanitation, and hygiene promotion to the world's poorest people. WaterAid, Prince Consort House, 27-29, Albert Embankment, London, SE1 7UB, UK, Telephone:+44 0207 793 4500, Fax: +44 0207 793 4545, Email: information@wateraid.org.uk www.wateraid.org.uk/index.html

UNICEF is mandated by the United Nations General Assembly to advocate the protection of children's rights, to help meet their basic needs and to expand their opportunities to reach their full potential. www.unicef.org/ UNICEF House, 3 United Nations Plaza, New York, New York 10017, U.S.A. Tel: (1) 212 326.7000 Fax: (1) 212 887.7465

Selected references and websites

Ostrom, Elinor, *Governing the commons: The evolution of institutions for collective action*, Cambridge University Press, 1990. This book focuses on common property resources. The author shows how communications between rational actors can provide mechanisms to ensure co-operative collective action that is beneficial to all. Examples are provided from irrigation management in Indonesia, Nepal, Peru and the Philippines.

Shivakoti, Ganesh, P., and Ostrom, E., *Improving Irrigation Governance and Management in Nepal*, ICS Press, 2001. A collection of papers dealing with the successful implementation of irrigation governance by user groups in Nepal.

NGO Participation in the Danube River Basin Management Plans: Information, analysis and conclusions. This is the web site for NGO Particpation in the Danube River Basin Management Plans project. The European Union (EU) Water Framework Directive opened an opportunity for active cooperation between EU member states and accession states, specifically in regard to the protection and usage of the vast water resources within the Danube river basin. Public and NGO participation in the creation of the River Basin Management Plans will impose a greater measure of responsibility on the drafters and decision makers involved in this process. Contact: Richard Muller, Regional Environmental Centre for Central and eastern Europe (REC), REC Country Office Slovakia. Web site: www.danuberiver.sk

B1.10 Local authorities

§ **Characteristics**

Local authorities can play an important role in overseeing the implementation of IWRM activities both within their boundaries and within the local and regional watersheds. They act both as regulators and as service providers and have a role in raising finance. Despite varying levels of jurisdiction over water services, local governments have both direct and indirect

responsibility for the water security of their communities and their industrial base.

In the context of IWRM, local authorities affect the aquatic ecosystems through their energy supplies, land uses (including zoning and impermeable areas), point and non-point pollution, construction practices, public education, solid waste and urban drainage practices, among other aspects. Improved integration of the efforts of all the relevant actors toward commonly accepted goals for their water resources is necessary to improve the quality of water bodies and the security of the watersheds and aquifers on which they depend.

The role of local authorities and governments in supporting IWRM is particularly strong where there are moves towards decentralisation and democratisation of planning and resource management. Local governments offer a strong forum for local participation, particularly through internationally recognised programmes, such as Local Agenda 21 planning, and can be instrumental in providing information and supporting dialogue among stakeholders and policy makers (see also C4.2 on communications with stakeholders).

Local governments have a variety of economic instruments available to them to influence the behaviour of their citizenry. These include rate structures and charges, fees for permits and other governmental services, special taxes and surcharges, incentives (such as bonuses and rebates) as well as fines and penalties. These economic instruments are complemented by a variety of regulatory instruments, such as by-laws, which local governments can use to influence the implementation of IWRM practices within their boundaries (see C6, C7).

§ **Lessons**

The wide range of jurisdiction and activity in the area of IWRM makes generalisations about their effectiveness difficult. Nonetheless the following lessons are applicable:

- Stakeholders should be connected to decision making processes and involved in a real dialogue with decision makers that can survive changes in government;
- Public access to baseline information about the quality of local water resources and issues (related to the long-term water security of communities) is essential for the public to be responsibly involved;
- Local leadership is needed to initiate sustainable processes in communities;
- Long-term planning initiatives need to be supplemented by concrete actions to retain stakeholders' interest. For example, local visions for improved stream corridors should be tied to local recognition and reward systems, volunteer water quality monitoring programmes, tree planting and community river festivals. In the short term, such events provide proactive community members and industries with positive reinforcement from the community and their peers, increasing their longer-term commitment to the programme;
- Changes to municipal policies are most effective when linked to concrete changes in official staff roles and responsibilities (such as through an environmental management system process);
- The influence of local governments is limited by their political remit and their financial resources – i.e. they can only be effective given an appropriate enabling environment;
- Stakeholder based initiatives, such as Local Agenda 21 planning, can play a significant role in breaking down political barriers to IWRM activities in urban areas.

Key organisations

Association of Water Boards, The Netherlands The Association of Water Boards is the umbrella organisation of the water boards, providing them with a voice in parliament, national government, international organisations and nongovernmental organisations. Unie van Waterschappen (Unie van Waterschappen), P.O. Box 80200, 2508 GE The Hague, The Netherlands. Phone + 31 70 351 9751, fax + 31 70 354 46 42. www.uvw.nl or info@uvw.nl

The Water Campaign for Local Authorities of the International Council for Local Environmental Initiatives (ICLEI) supports local governments with their stakeholders. The Water Campaign is based on a performance model designed to generate measurable results. Pilot projects are carried out in municipalities in Latin America, Africa and Asia. The ICLEI Water Campaign is a GWP Associated Programme Water@iclei.org or www.iclei.org/water

UESNET disseminates lessons regarding appropriate approaches to urban environmental sanitation within the context of IWRM, so as to reach those who implement investments and effect change. www.uesnet.org/

Water for African Cities Programme The Programme works with city and local authorities, national governments, the private sector, civil society, resource centres and the media. It is a product of the United Nations System-wide Initiative on Africa (UNSIA). The objective of the Programme is to tackle the urban water crisis in African cities through efficient and effective water demand management, to mitigate the environmental impact of urbanisation on freshwater resources and to boost awareness and information exchange on water management and conservation. Water for African Cities Programme, UNCHS (Habitat), P.O. Box 30030, Nairobi, Kenya Tel: 254-2-623039. Fax: 254-2-623588 E-mail: wacmail@unchs.org website: www.un-urbanwater.net

Selected references and websites

ICLEI and the City of Lisbon, *The Local Government Water Code*, Lisbon, Portugal: City of Lisbon Press, 2001
The five principles of the local government water code were elaborated by a working group of local government officials from around the world as part of a process to design a water campaign for local governments. The water code sets out a moral and ethical framework to guide day-to-day decisions related to IWRM. Inclusion of this broader perspective is considered to be a fundamental component of efforts to implement IWRM locally.

ICLEI, *The Water Campaign*, Toronto, Canada: Printing Mill, 2000.
This brief paper gives an overview of local government's role in IWRM and the need for action at the local level in three areas: within the municipal corporation, working with the community, and in catchment and sub-catchment planning and management.

B1.11 Building Partnerships

§ **Characteristics**

A well functioning water partnership is an important approach in working toward integrated water resources management. Establishing such partnerships has been one of the GWP's major goals and will remain a key activity during the coming years. Partnerships have been established at regional and country level and area / basin partnerships are a new focus. A partnership is often

characterised as a working relationship between stakeholders with mutual and equal participation, joint interest and shared responsibilities. Processes in a partnership are typically transparent and based on an open dialogue.

Starting a partnership involves extensive work on many aspects: stakeholder analysis, gap analysis, development of common goals, planning, program design, social changes accompanied by social capacity building, co-operative inquiry, supporting self-organisation and organisational development and (work) conferencing. These are complex processes, where stakeholders may want to achieve many different goals at the same time. Setting up a partnership has a number of dimensions that need to be addressed simultaneously:

- Stakeholders need to get to know each other, to understand and interpret concepts in the same manner, and establish a common 'language' in the partnership;
- Levelling of the playing field between the partners in terms of information, knowledge and expertise; at the beginning there is usually a (large) difference in information levels;
- The partnership needs to develop its goals, outputs and actions based on the will and motivation and collaboration of the partners.

To support the start of a partnership, the following need to be established: framework conditions (a protocol), in terms of form and working modality (e.g. forum), and the scope of content (aspects of IWRM). The method/protocol allows the stakeholders to interact with each other, and generate an outcome that is owned by all. This is possible because there is intensive horizontal communication and no hierarchy. Further, meetings are facilitated by a neutral outsider. The protocol uses aims to create a 'space for dialogue' and is characterised by:

- *Clearly defined roles*, both for the participants and for the facilitating team. By maintaining these roles, the responsibilities will also remain clear: the participants are responsible for finding a response to their own issues and the facilitating team is responsible for maintaining a space for the dialogue;
- *Defining the question / issue*, and defining the group that will be involved in answering this question. If the question is too big for the group, because a specific group is missing, then the question should be altered or the group has to be extended.

Resource persons / specialists can be added to the group. They will work in the same role as the other participants, to avoid a hierarchy based on knowledge-status. The method can be applied in various forms, both intensive and more extensive. Groups may vary from 6 to 60 persons.

§ **Lessons**

Learning and capacity building. Transferring this capacity to others leads to the creation of a community of facilitators who can develop the methods used. The trainees should have some experience in working with groups, as trainer, teacher or manager.

Key organisations

The partnership "Leadership for Environment and Development International (LEAD)" is a global network of individuals and non—governmental organizations, committed to sustainable development. LEAD is an independent, not—for-profit organization, established in 1991 by The Rockefeller Foundation. www.lead.org

LAKENET is a global network of more than 800 people and organizations in 90+ countries working for the conservation and sustainable management of lakes. The LAKENET Secretariat is a U.S.—based

nonprofit organization dedicated to protecting and restoring the health of the world's lakes. www.worldlakes.org

The Mersey Basin Campaign is a government sponsored 25 year campaign: to improve, promote and regenerate the rivers, streams, canals and coasts of Northwest England. It was launched in 1985. It is a partnership that brings together government, government agencies, local authorities, businesses, voluntary and community interests, education and research within a common mission. www.merseybasin.org.uk

Selected references and websites

Netherlands Water Partnership (NWP)
NWP is a network organisation that unites all four main pillars of the Dutch water sector: governmental bodies, research and educational institutes, the private sector as well as NGO's. NWP focuses on information exchange, promotion & marketing and partnership building. NWP is an active member of GWP and is closely involved in the realisation of the ToolBox IWRM.
www.nwp.nl
Netherlands Water Partnership, PO Box 3015, 2601 DA Delft, The Netherlands.
Tel 0031 15 251728, Fax 00 31 15 2151759, e-mail: info@nwp.nl

B2 BUILDING INSTITUTIONAL CAPACITY - Developing human resources

Institutional capacity building is a means of enhancing performance. In the context of IWRM it represents the sum of efforts to nurture, enhance and utilise the skills and capabilities of people and institutions at all levels, so that they can work towards the broader goal. Capacity is needed at two levels: capacity to plan and develop IWRM programmes, and operational capacity. Capacity in institutions is needed to plan, to regulate, to provide services and to allocate resources.

IWRM requires an appropriate policy and legal framework (A1, A2), financing system (A3),

organisational framework (B1) and adequate management instruments (C1 through to C8). To make these frameworks, systems and instruments work, the different parties involved need to possess sufficient information and expertise as well as incentives to function effectively and efficiently. This combination of instruments, skills, resources and incentives results in institutional capacity tailored to the needs of each institution. Capacity building programmes should be preceded by an assessment of both existing capacity and the proposed management tools. In addition to the human capacity, which is the focus of this set of tools, capacity means a whole range of physical resources – for example, monitoring equipment, a computer or a vehicle to enable regulators to visit sites for inspection.

Capacity building is needed at many levels: in civil society (B2.1), for water professionals in all areas - both public and private water organisations, local and central government, water management organisations (B2.2) and in regulatory organisations (B2.3). Reorientation in the thinking of water professionals is important at all levels, as the ideas of IWRM have developed rapidly over the past twenty years.

Water managers need to develop an understanding of the concept of IWRM, its potential benefits and how best to put it into practice. In addition, water professionals need to acquire skills to apply specific (often sectoral) management tools, to make regulations, to set up financing systems, etc. Specialist training courses in such topics as social assessment (C2.7), designing and running participatory and gender sensitivity processes, dispute management and consensus building (C5), institutional design, policy profiling, and working with the media can be valuable.

Additional tools for improving capacity include social change instruments (C4) and information and communication tools (C8). Building participatory capacity often needs consensus building and other conflict management techniques (see C5). In practical terms, building capacity in human and institutional resources costs money – so secure financing is important.

Both individuals and institutions need to be provided with incentives to change their practices and approaches; senior management needs to signal the importance of training by according high status and remuneration for those who provide training in their organisations. Organisational development may be needed to ensure that water management organisations and their managers are open to new ideas and are willing to accept public input and the need to cooperate with other stakeholders.

B2.1 Participatory capacity and empowerment in civil society

§ **Characteristics**

Appropriately organised, the public (civil society) can become a central partner in IWRM. They can therefore become fully responsible for some elements of water management. Hence, effective IWRM requires that government institutions will enable and enhance the active participation of the public – as water users, as voters, as holders of expert local knowledge, as tax/charge payers and/or as providers of labour.

For people to perform management tasks and influence overall management, they need to be organised, e.g. in water users' associations (WUAs). Other groupings include consultative groups, community groups and lobby groups.

Such organisations are necessary to give voice to the public. Initially their sustainability may well require external financial and structural support, e.g. to cover travelling costs, set up a secretariat or finance external expertise. Water users' associations are usually small and deal with only one or a few aspects of water management. To ensure an integrated approach, they must form an integral part of the broader organisational framework (B1). This is especially so in large and complex water systems with many geographical and cross-sectoral interdependencies. In such cases, WUAs may form an "association of associations". The level of participation depends on the context.

Participatory management has been shown to be most successful if the public is involved enough to be aware of the general goals and needs. Therefore, individuals and civil groups need information, skills and "water awareness" (C4, C8).

Participatory management can be helpful in almost all efforts to implement IWRM, particularly in cases of competing use or geographic disputes. Stakeholders and interest groups may need formal training in some activities – for example in managing a community based system, or in measuring and monitoring water use in participatory irrigation approaches. They also need support in the form of access to information and technical knowledge (C4.3).

§ **Lessons**

- All relevant categories of water users should be represented in the association. The sustainability of water users' associations or other consultative groups is strengthened if they are genuinely 'bottom up' rather than government- or project-mandated 'top down' organisations.
- Public participation needs to be carefully managed to avoid being taken over by minority or particularly articulate groups, or by the 'community elite'; where this happens decision making becomes overly influenced by groups with limited legitimacy.
- External funding and structural support can be essential initially for ensuring "balanced" public participation in which the less affluent or *vocal* groups also contribute to decision making. However, sustainability and effectiveness depend ultimately on self-reliance.
- Sustainability also depends upon the existence of an agreed set of formal roles and a recognition of the importance of informal rules, as well as reliable mechanisms to enforce such rules and settle disputes.

Selected references and websites

Rietbergen-McCracken, J., and Narayan, D., *Participation and Social Assessment: Tools and Techniques*, World Bank, New York, ISBN 0-8213-4186-3, 1998.
This resource tool kit aims to share information and experiences on participatory methods in order to support the adoption of participatory approaches in World Bank-supported projects and studies.

Society for participatory Research in Asia, Training of Trainers: *A Manual for Participatory Training Methodology in Development*, Society for participatory Research in Asia, New Delhi,

1987.
This training manual on participatory methodologies has been designed so that the different sections can be used independently. Each section contains theoretical inputs, practical guidelines, and examples of methods used.

Narayan, D., and Srinivasan, L., *Participatory Development Tool Kit*, World Bank, Washington DC, 1993.
This Tool Kit, with accompanying materials, is designed primarily for project managers, engineers, and trainers in the water and sanitation sector.

Agarwal, A., and Narain, S., *Dying Wisdom: rise, fall and potential of India's traditional water harvesting systems*, Centre for Science and Environment, New Delhi, 1997.
This is a detailed discussion of the decline in the use of traditional rainwater harvesting in rural India. (See also C3.3).

NGO Participation in the Danube River Basin Management Plans: Information, analysis and conclusions. This is the web site for NGO Particpation in the Danube River Basin Management Plans project. The European Union (EU) Water Framework Directive opened an opportunity for active cooperation between EU member states and accession states, specifically in regard to the protection and usage of the vast water resources within the Danube river basin. Public and NGO participation in the creation of the River Basin Management Plans will impose a greater measure of responsibility on the drafters and decision makers involved in this process. Contact: Richard Muller, Regional Environmental Centre for Central and eastern Europe (REC), REC Country Office Slovakia. Web site: www.danuberiver.sk

DFID / ODA, *Indicators for measuring and assessing primary stakeholder participation: guidance note*, Department for International Development (DFID), UK, 1995.
This guidance reviews the qualitative, quantitative and time dimensions of indicators for measuring participation. Means of verification are then examined and the paper concludes with a checklist.
www.dfid.gov.uk
Simpson-Hébert, M., Sawyer, R and Clarke, L. *The PHAST Initiative: Participatory Hygiene and Sanitation Transformation: A New Approach to Working with Communities.* 1997 World Health Organisation, Geneva.
An exciting new approach, based on an innovative set of participatory techniques, that has demonstrated its ability to promote hygiene behaviour, sanitation improvements, and community management of water and sanitation facilities. Methodology for participatory assessments: helping communities achieve more sustainable and equitable services. Water and Sanitation Program for East Asia and the Pacific; IRC, 2000.
The MPA is a new methodology building on WHO's Minimum Evaluation Procedures and the SARAR-based methods of participatory evaluation. It combines qualitative PRA assessments with women and men in communities with quantitative database building at programme and country level. Gender and poverty analysis are part of sustainability analysis.

Rekha Dayal, Christine van Wijk, and Nilanjana Mukherjee. *Methodology for Participatory Assessment with communities, institutions and policy makers.* Water and Sanitation Program. March 2000. Web site: www.wsp.org/pdfs/eap_mpa_helping.pdf

B2.2 Training to build capacity in water professionals

§ **Characteristics**

Training of water professionals is an important tool for capacity building and is necessary across the full range of water organisations. The necessary change in approach can be achieved through specially designed courses, through modification of university courses and through on-the-job training programmes. Specific ideas include:

- Providing specific courses on participatory approaches and gender awareness; -Encouraging multi-disciplinary training involving all kinds of water practitioners, including environmentalists, economists, engineers, social scientists and business majors;
- Including water management in degree programmes, in engineering and other faculties, such as economics, environmental sciences, biology, etc, or adding water as the main subject in such degree courses as the MBA;
- Developing modules for on-the-job training to keep practitioners' skills up-to-date;
- Developing modules to train trainers in new approaches and techniques;
- Creation of short courses on water management for policy makers, aimed specifically at senior managers without technical water backgrounds;
- Once formal training is completed, the concepts can be reinforced through a range of training activities (e.g. on-the-job training, short courses, remote learning, sabbaticals, twinning arrangements, international short courses, etc.).

The training of trainers is a specialist area, requiring an understanding of adult learning methods and the significance of the peer group (farming community, professional water community) in creating learning opportunities. Equally, training trainers in information exchange and communication requires significant input into education programmes by water resources management agencies. Methods include in-service courses, seminars and workshops. There is an increasing emphasis on electronic means of information dispersal and training techniques, especially distance learning.

Many information exchange facilitators (such as extension officers, field guides and field agents) come from biophysical science and engineering backgrounds, and need cross-disciplinary training in various skills, e.g. in communication, group interaction facilitation, accounting and programme management and counselling. Knowledge exchange systems like the GWP ToolBox provide valuable support for capacity building.

§ **Lessons**

- Training of senior managers (e.g. in the value of IWRM and new water innovations) can help ensure capacity building throughout the organisation, and support for training of junior staff.
- On-the-job training is highly effective as a learning tool and agent of change in large water organisations.
- The effectiveness of training programmes can be increased if groups of people who regularly work together are trained together.
- Training of trainers requires extensive practical experience by the instructor but is a cost-effective capacity building tool.
- Trainers do not require a high level of technical capability in such topics as how to construct GIS, develop explanatory models, or select the best equipment, but they do need to understand the management of institutions and organisations.
- Experience shows that successful courses to train trainers combine practical activities with classroom learning experiences.
- Regional and even international programmes can be as useful as programmes that focus only on a single country or region.

Selected references and websites

Training of Trainers: A Manual for Participatory Training Methodology in Development
This training manual on participatory methodologies has been designed in such a way that the different sections can be used independently. Each section contains theoretical inputs, practical guidelines, and examples of methods used. The sections are: 1) Participatory training methodology; context and principles; 2) Role of trainer in participatory training; 3) Designing a training programme; 4) Small Groups; 5) Learning-training methods; 6) Evaluation and follow-up; 7) Additional resources.

Society for Participatory Research in Asia, New Delhi, India, 1987.

Water Sector Capacity Building: Methods and Instruments in a World of Knowledge Networks Based on experiences with supporting research and education institutes abroad, De Laat and Ramsundersingh (2000) identifies a number of possible bottlenecks that need to be addressed, such as bureaucratic regulations that only allow "traditional engineers" in certain posts and a lack of incentives to upgrade knowledge. De Laat, P.J.M., Ramsundersingh, A.S., Water Sector Capacity Building, Methods and Instruments in: Beken, van der, et al, A World of Knowledge Networks, 2000

International Network for Capacity Building in IWRM (Capnet). CAPNET – International Network for Capacity Building in IWRM – fosters human resources development for IWRM. It focuses on education, training and applied research. CAPNET is an Associated Programme of GWP. Contact: CAPNET International Network for Capacity Building in IWRM (CAPNET), PO Box 3015, 2601 D, Delft, Netherlands Phone: +31 15 215 1715 Fax: +31 15 212 2921 capner@ihe.nl. www.cap-net.org

GARNET stands for Global Applied Research Network, an activity that is designed to facilitate the sharing of applied research information between researchers working in water and sanitation sector throughout the world. The method to achieve this is through informal, low-cost and decentralised networking links. http://info.lut.ac.uk/departments/cv/wedc/garnet/grntback/html

Sanitation Connection is an Internet-based resource that gives you access to accurate, reliable and up-to-date information on technologies, institutions and financing of sanitation systems around the world. Institutions of international standing contribute to the information base by providing and maintaining a topic of their specialisation. Web site:
www.sanicon.net/index.php3

International Water and Sanitation Centre (IRC), The Netherlands IRC is an independent, non-profit organisation supported by and linked with the Netherlands Government, the United Nations Development Programme (UNDP), the United Nations Children's Fund (UNICEF), the World Heath Organisation (WHO), the World Bank and the Water Supply and Sanitation Collaborative Council. Areas in which IRC's work in water and sanitation is concentrated at present include: community-based technologies, participation and community management, gender awareness, hygiene promotion, operation and maintenance, monitoring and evaluation, information management, research and training, on low-cost water supply and sanitation in developing countries. Contact: IRC International Water and Sanitation Centre (IRC), The Netherlands, PO Box 2869, 2601 CW, Delft, Netherlands Tel: +31 15 215 2939 Fax:+31 15 212 0955, general@irc.nl, www.irc.nl

B2.3 Regulatory capacity

§ **Characteristics**

A clear regulatory framework is an important instrument for IWRM, but ensuring compliance is often difficult. Effective regulation requires human and technical capacity. For instance, to carry out monitoring effectively, an organisation requires the equipment (and the ability to use it) to uncover and deal with non-compliance. Sufficient manpower, expertise and data are essential for the application of the different regulatory tools (C6) and economic instruments (C7). For example,

to improve water quality, a regulatory agency needs to have reliable water quality data and staff trained to interpret these data correctly. An economic regulator needs capacity in financial analysis and access to the necessary information. Regulation, moreover, requires fact finding and investigation. All these tasks need to be underpinned by financial capacity.

Important tools to ensure regulatory capacity are a well-developed legislative framework (A2), the presence of enforcement agencies, mechanisms and structures (B1.5), information and communication systems (C8) and education and training (C4), and water management indicators (C1.5).

Plans for regulatory capacity building must be preceded by an assessment of current capacity, and the establishment of regulatory instruments (C5). This assessment needs to be linked to water resources assessment (C1) and to policy making (A1) and planning (C2). Capacity building should include the building of legitimacy with those regulated.

§ **Lessons**

- Experience shows that capacity building that emphasises skills rather than knowledge transfer can improve the performance of regulatory organisations.
- Training of trainers' programmes have been shown to be highly cost-effective (B2.4).
- Regulatory capacity building can be seen as integral to the development of regulations themselves. If regulatory capacity building receives early attention, the risk of ineffective regulation can be minimised.
- Efforts to ensure that regulatory staff accept the legitimacy of their task, and place emphasis on integrity, are key to building strong regulatory organisations.
- Legitimacy with those regulated is important for ensuring acceptability and compliance.

Key organisations

ESCAP (Economic and Social Commission for Asia and the Pacific)
ESCAP promotes economic and social development through regional co-operation and integration and development assistance activities and projects. ESCAP assists governments in the Asia and Pacific region in development and management of water resources.
unescap.org/
ESCAP The United Nations Building, Rajadamnern Nok Avenue, Bangkok 10200, Thailand.
Tel: (66-2) 288-1234 Fax: (66-2) 288-1000

ECLAC (Economic Commission for Latin America and the Caribbean) - the Spanish acronym is CEPAL - was founded for the purposes of contributing to the economic development of Latin America, co-ordinating actions directed towards this end, and reinforcing economic relationships among the countries and with the other nations of the world. The promotion of the region's social development was later included among its primary objectives. www.eclac.org/default.asp?idioma=IN ECLAC Headquarters Casilla de Correo 179-D, Santiago, Chile Tel: (56-2) 210-2000-2085051 Fax: (56-2) 2080252

UNECA (United Nations Economic Commission for Africa) the regional arm of the United Nations, mandated to support the economic and social development of its 53 member States, foster regional integration, and promote international co-operation for Africa's development. www.uneca.org ECA Headquarters, P.O. Box 3001, Addis Ababa, Ethiopia. Tel: 251-1-51-72-00 , Fax: 251-1-51-44-16

The Office of Water Services (OFWAT), UK The aim of OFWAT is to regulate the water and sewerage companies in a fair and open way so that the companies can improve the quality of service and value for money they provide for their customers. Web site: www.open.gov.uk/ofwat/index.htm Fax: +44 (0)121 625 1400, E-mail: enquiries@ofwat.gtnet.gov.uk

C MANAGEMENT INSTRUMENTS

C1 WATER RESOURCES ASSESSMENT – Understanding resources and needs

A water resources assessment involves taking a holistic view of the water resources in a given country or region related to its use by society. The assessment looks at both the quantity and quality of surface and groundwater. It identifies the pertinent parameters of the hydrological cycle, and evaluates the water requirement of different development alternatives. The assessment pinpoints the major water resources issues and potential conflicts, their severity and social implications, as well as risks and hazards such as flood and drought. The understanding of the

terrestrial and aquatic ecosystems is an essential element of resource assessment.

A good water resources assessment needs to be based on good physical and socio-economic data. Routine physical measurements at monitoring and gauging stations need to be made at appropriate times and with sufficient frequency to allow the assessment to draw valid conclusions. This in turn requires adequate financing of the monitoring system by government. Socio-economic aspects must include analysis of user behaviour, elasticity of demand, and the potential effects of demand management. Water resources assessment for IWRM sets hydrology in a wider context and considers social and economic development issues such as urban growth and changing land use patterns.

Modelling can be used to study impacts and trends resulting from various development options. However, for models to be useful in the pursuit of sustainable solutions, they must address and simulate not only economic efficiency and technical merits, but also the preferences and priorities of stakeholders. Models will only be truly useful when they are integrated into the local institutional and cultural context.

C1.1 Water resources knowledge base

§ **Characteristics**

This tool covers the collection and storage of data on the hydrological cycle (quantity and quality) and access to physical, socio-economic, demographic and water use data in a cross-sectoral perspective. The holistic nature of IWRM requires constant knowledge exchange by water stakeholders, and especially professional water practitioners, facilitated by the Internet and email communication**.**

Hydrological and meteorological offices routinely collect data on elements of the hydrological cycle, and data links can be established to ministries or other institutions with other data collection responsibilities (e.g. Agriculture, Planning, Statistics, Lands, Local Government, and Environment). Given agreed formats, downloading information for use in service programs and GIS can be made using contemporary data technologies and the Internet (see also C8).

Water resource knowledge bases and links need to be built up by considering the associated priority issues that have to be dealt with, such as human health, ecosystems health, land use impacts and forest cover, sectoral competition for water, vulnerability to floods and droughts, demand and willingness to pay. An assessment of the risks and damage involved when decisions are made based on inadequate information can help to determine priorities in developing the knowledge base. It should be noted that water quality is often very poorly monitored and weakly presented in knowledge bases, putting such sectors as environment and health at a disadvantage in situations where basic knowledge is required.

Building a knowledge base into an effective tool requires consistent and routine work over large areas and many years. It also requires the development of working relations and data exchange between sector institutions representing either impacts on water resources or use of water resources. Thus it is important that data collection staff work in a co-ordinated fashion with those working on water resource assessment, so that data continue to be relevant to current problems, adequate for the assessments (C1.2 and C1.5) and so that data users can rely on the quality of the data.

Data need to be converted into information and knowledge which in turn are fed into decision support systems, assisting management in addressing priority issues (see C1.4 indicators and C8.1, information management systems).

§ **Lessons**

- A knowledge base is fundamental to water resources assessment and subsequent decisions.
- It is essential that policy makers appreciate the importance of reliable and representative data, create the necessary institutional responsibilities and make appropriate allocations of financial and human resources reflecting local needs (see B1 and B2).
- Prioritisation of data needs based on key water issues and assessment of risks and damages can help to develop political support and resources.
- When data needed for water resources assessment are collected by a number of different organisations, their systems need to be compatible in terms of standards, quality assurance, electronic access and transfer.
- Cross-sectoral collaboration is essential to obtain the broad knowledge base needed for IWRM approaches (see also A1.2).
- Quality assurance is basic to the usefulness of the knowledge base and in particular in transboundary situations where mutual confidence building and credibility are essential.
- Socio-economic data can be both numeric (e.g. average distance women walk to collect domestic water) or less tangible (e.g. security or risk of walking to collect water).

Key organisations

The goal of the IWRA (International Water Resources Association) is to provide information on water resources technology and to advance water resources planning, management, education and technology. www.iwrn.net/iwra.htm

National Water Research Institute (Canada)
The National Water Research Institute (NWRI) is Canada's largest freshwater research establishment. NWRI conducts a comprehensive programme of research and development in the aquatic sciences, in partnership with the Canadian and international science communities. www.cciw.ca/nwri/nwri.html

HELP (Hydrology for the Environment, Life and Policy) is an initiative to establish a global network of catchments to improve the links between hydrology and the needs of society. Contact: www.unesco.org/science/help, or Dr. M. Bonell, UNESCO Division of Water Sciences, 1 rue Miollis, 75732 Paris Cedex 15, France, Email: m.bonell@unesco.org

International Lake Environment Committee Foundation (ILEC) advances international cooperation for conservation of lake environments and promotes environmentally sound management of the world's lakes. 1091 Oroshimo-cho, Kusatsu-shi, Shiga 525-0001, Japan, Telephone +81-77-568-4567, Fax +81-77-568-4568, info@ilec.or.jp, www.ilec.or.jp

The main objective of UNESCO (United Nations Educational, Scientific and Cultural Organisation) is to contribute to peace and security in the world by promoting collaboration among nations. www.unesco.org UNESCO, 7, place de Fontenoy, 75352 PARIS 07 SP, France. Tel: (33) 1 45 68 10 00, Fax: (33) 1 45 67 16 90

The WMO (World Meteorological Organisation) co-ordinates global scientific activity to allow increasingly prompt and accurate weather information and other services for public, private and commercial use. Activities include weather prediction, air pollution research, climate change related activities, ozone layer depletion studies and tropical storm forecasting. www.wmo.ch WMO, 7 bis Avenue de la Paix, CP 2300 – 1211 Geneva 2 – Switzerland. Tel: +41 22 730 8111, Fax: +41 22 730 8181

The International Water Association (IWA). IWA is a professional organisation that promotes the integrated management of water as the best strategy for securing safe water supplies and adequate sanitation for communities worldwide. International Water Association, Alliance House, 12 Caxton Street, SW1H 0QS London United Kingdom, Phone: +44 (0)20 7654 5500 Fax: +44 (0)20 7654 5555 e-mail: water@iwahq.org.uk, www.iawq.org.uk

The International Programme for Technology and Research in Irrigation and Drainage (IPTRID) is a partnership between research institutions for knowledge synthesis, research and development; capacity building, and knowledge dissemination. www.hrwallingford.co.uk/projects/IPTRID/services.htm

Selected references and websites

WMO/ UNESCO, *Water Resources Assessment: A Handbook for Review of National Capabilities*, UNESCO, 1997.

Hydrological Operational Multipurpose System (HOMS). HOMS is the WMO system for technology transfer in hydrology and water resources. The objectives of HOMS are:
· To provide an efficient means of technology transfer
· To aid in the application of, and training in, appropriate technology – especially in developing countries
· To provide an international framework to integrate the many hydrological techniques and procedures
The hydrological technology available in HOMS is presented and transferred in the form of components. These consist of manuals, procedures and general guidance, descriptions of equipment and computer software, and training aids. Claudio Caponi, Hydrology and Water Resources Department / World Meteorological Organisation.
www.wmo.ch/web/homs/homshome.html

C1.2 Water resources assessment

§ **Characteristics**

Water resources assessment (WRA) is a tool to evaluate water resources in relation to a reference frame, or evaluate the dynamics of the water resource in relation to human impacts or demand. WRA is applied to a unit such as a catchment, sub-catchment or groundwater reservoir. It is part of the IWRM approach, linking social and economic factors to the sustainability of water resources and associated ecosystems. Depending on the objective of the assessment, WRA may look at a range of physical, chemical and biological features in assessing the dynamics of the resource.

Traditional water resource assessment aimed to provide the basis for the supply of infrastructure to meet projected needs. Assessments have a much wider remit in an IWRM perspective, incorporating cross-sectoral tools such as:

- *Demand assessment*, which examines the competing uses of water with the physical resource base and assesses demand for water (at a given price), thus helping to determine the financial resources available for water resource management (see also Economic assessment, C2.8);
- *Environmental Assessment* and Strategic Assessment collect data on the social and environmental implications of development programmes and projects (C2.6);

- *Social assessment*, which examines how social and institutional structures affect water use and management, or how a specific project might affect social structures (C2.7);

- *Risk or vulnerability assessment*, analyses the likelihood of extreme events, such as flood and droughts, and the vulnerability of society to them (see C2.5).

WRA links to the Water Resources Knowledge Base (C1.1) and is a basic input in the planning process (C2). Demand forecasting should use techniques that uncover, for instance, willingness to pay for water at given prices, and further economic analysis will help reveal the true nature of competing water uses. Demand management issues (C3) will also influence the outcome of WRA.

§ **Lessons**

- A water resources assessment often needs to be carried out in several steps of increasing complexity. A rapid water resources assessment may help identify and list the most important issues and identify priority areas. On the basis of this early assessment, more detailed investigations may be required.
- Assessments for large or long-term projects need to include examination of changes in land use and possible soil degradation as well as climate variability and change.
- Linking water resources assessment to Environmental Assessment (EA) (C2.6) has been shown to build cross-sectoral linkages and heighten awareness of key issues.
- Strategic assessment can help in the analysis of changes in the capacity of a river basin, to protect both quantity and quality.

Key organisations

The Regional Committee on Water Resources - Central America (CRRH) promotes the development and conservation of water resources and their sustainable use in order to achieve integral development in Central American countries and improve the quality of life of their citizens. CRRH focuses on meteorology (climate), hydrology and water resources management. crrhcr@racsa.co.cr

The GEMS/Water programme is a multi-faceted water science programme oriented towards understanding freshwater quality issues throughout the world. Major activities include monitoring, assessment, and capacity building. Contact GEMS@cciw.ca, UNEP GEMS/Water Collaborating Centre, National Water

Research Institute, 867 Lakeshore Rd., Burlington, Ontario, Canada, L7R 4A6
www.cciw.ca/gems/intro.html

World Hydrological Cycle Observing System (WHYCOS)
The World Hydrological Cycle Observing System (WHYCOS) provides a co-operation framework in water resources monitoring and assessment by increasing capacity of national hydrological services.
Hyd@gateway.wmo.ch or www.wmo.ch/web/homs/whycos.html

Selected references and websites

Batchelor, C., Cain, J., Farquharson, F., and Roberts, J., *Improving water utilisation from a catchment perspective*, IWMI SWIM Paper 4, Colombo, ISBN 92-9090-358, 1998.
This paper includes a historical review of research that has involved the use of catchment experiments and a discussion on hydrological modelling techniques. Options for improving water utilisation at the catchment and farm scales are identified, and recommendations are made for research that might be undertaken. www.cgiar.org/iwmi/pubs/swimpubs/Swim04.pdf Or Home www.cgiar.org/iwmi/ > Publications – Swim Papers > No.4

McKinney, D. C., Cai, X., Rosegrant, M. W., Ringler, C., and Scott, C. A., *Modelling water resources management at basin level: review and future directions*, IWMI, SWIM Paper 6, Colombo, ISBN 92-9090-376-7, 1999.
This paper reviews state of the art modelling approaches to integrated water resources management at the river basin scale, with particular focus on the potential of coupled economic-hydraulic models, and concludes with directions for future modelling exercises. www.cgiar.org/iwmi/pubs/swimpubs/Swim06.pdf or Home www.cgiar.org/iwmi/ > Publications – Swim Papers > No.6

IWMI Water Balance Framework: A Model for Project Level Analysis. Outlines the IWMI Water Balance Framework, which identifies sources, uses and reuses of water. The framework will be of interest to those involved in the design of irrigation projects and in the formulation of improvements to existing infrastructure of operational rules. Managers of irrigation projects will also find it useful for interpreting water use efficiently, or for identifying interventions to improve the efficiency and sustainability of their projects. IWMI, The IWMI Water Balance Framework: A Model for Project Level Analysis, IWMI, Colombo. Also available on-line:

www.cgiar.org/iwmi/pubs/pub005/Report05.pdf

C1.3 Modelling in IWRM

§ **Characteristics**

Modelling and Decision Support Systems (DSS) are complementary tools. A *model* is a simplified description of a system to assist calculations and predictions. A *Decision Support System* is a means of collecting data from many sources to inform a decision. Information can include experimental or survey data, output from models and expert or local knowledge.

Modelling at the sub-catchment or river basin level can integrate the hydrological, technical,

ecological, environmental, economic, social, institutional and legal aspects of water problems into a coherent framework. Hydrological models simulating water balance elements (such as river run-off, groundwater and evapotranspiration) are quite well developed, as are water quality models for rivers, groundwater and lakes. However, models for most other aspects of water (ecological, environmental, economic, social, institutional and legal) need significant improvement (see C1.5).

At the river basin level, GIS-based modelling techniques can allow policy makers and managers to test "what if" scenarios, on topics such as integrated water quantity, water quality and environmental regulation, the impacts of land use changes on flow regimes, climate change effects on flood and drought frequency / severity, inter-sectoral water allocation policies, effects of uncertainty and risks on water resources management and the impacts of economic incentives for pollution control, water conservation and more efficient irrigation (see also C8.1).

A multi-objective DSS (MODSS) allows users to integrate data in five phases, each requiring consultation with all potential stakeholders:

- *Issue identification* – identifying priority issues, available information, and key stakeholders;
- *Defining land and water management options; Establishment of decision criteria* – defining criteria for selecting options;
- *Data acquisition* – gathering and entering data into the MODSS;
- *Decision support process* – examining the information compiled by stakeholders with diverse viewpoints.

Today, the output of many models is available and accessible on the Internet to any user with a personal computer and the necessary software. Easy access to the output of other models can greatly assist managers in developing their own DSS. There is keen competition among research institutions, universities and consultants to provide modelling products, the price of which is small relative to the time required to learn to use the models effectively. Users of models should be confident that they have access to relevant expertise to provide guidance in the application of these tools, and ensure that appropriate delivery methods have been worked out.

§ **Lessons**

- Putting models on the Internet in user-friendly form has many advantages. It is transparent, i.e. nothing is hidden on computers in the computer laboratory; it makes all model inputs and outputs available for peer review; it facilitates improvements in modelling in future projects, and it ensures that future work can build on past research.

- However, access to the Internet is difficult in some regions. Also, modelling has its limitations, and seemingly irrational human factors may determine the final selection of options.

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CSIRO's Catchment Management Support System is a watershed based decision support system in graphical layout which demonstrates impacts of different land management practices on quality of subcatchment runoff and can be used to demonstrate the impacts of different management actions.

WAMADSS is a knowledge-based computer system which integrates data, information, physical simulation and economic analysis to identify alternative land use maps for solving specific catchment problems.
Centre for Agricultural Resource and Environmental Systems, University of Missouri-Columbia. www.cares.missouri.edu/

Integrated Systems Analysis and Sustainable Development The paper presents integrated systems analysis (ISA) as a "tool" for modelling and for the development of decision support systems (DSS). ISA enhances understanding of the complex relationships between different disciplines in the form of "inputs to transformations to outputs" and also facilitates an understanding of the term sustainable development. The full text can be found at:

http://www.iemss.org/iemss2002/proceedings/pdf/volume%20tre/97_soroczynski.pdf

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McKinney, D. C., Cai, X., Rosegrant, M. W., Ringler, C. and Scott, C. A., *Modelling water resources management at basin level: review and future directions*, IWMI, SWIM Paper 6. This paper reviews the state of the art of modelling approaches to integrated water resources management at the river basin scale, with particular focus on the potential of coupled economic-hydraulic models, and concludes with directions for the future modelling exercises.Colombo, 1999. (ISBN 92 9090-376-7). Also available on-line:
http://www.cgiar.org/iwmi/pubs/swimpubs/Swimpubs/Swim06.pdf

C1.4 Developing water management indicators

§ **Characteristics**

Water management indicators are an important tool in the development of water policies, the setting of targets and goals and monitoring management performance. The appropriate combination of indicators helps to show how well IWRM objectives are being met, and if necessary, can provide a tool to help reformulate policies and programmes. Indicators support transparency and enable civil society and governments to judge performance. They can also be used for benchmarking, to encourage better performance from, for instance, water service providers, and in the use of yardsticks, a parallel technique that uses the performance of a similar

organisation as an indicator of performance (see A3.2). Indicators can be used to examine and compare:

- The spatial and temporal variations in water cycle elements, such as water resources availability (m^3/person/year), water use (litres/person/day);
- Efficiency of water use ('crop per drop' or ensuring the greatest value to society per m^3 of water used);
- The efficiency and effectiveness of service delivery (e.g. water costs ($US/$m^3$), numbers of households served, area served by different types of irrigation system)
- Water quality and biodiversity/ecology (e.g. number of species/km2 or stretch of river, quality of surface water);
- Performance of water service providers.

Other indicators can be developed to stimulate water resource management reforms. Such indicators might try to assess links between water provision and poverty, or the equity of allocation of water across sectors by looking at the social and economic value in use.

Indicators have a role at several levels, including at river basin or catchment levels or across shared boundaries and internationally. However, a reliable data collection system that reflects government's priorities and societal needs is an important precondition. (C1.1).

§ **Lessons**

Experience with developing indicators has shown that:

- Whilst devising representative indicators is relatively easy, it is often difficult to collect consistent, reliable and meaningful data to illustrate the performance in reaching the desired goal;
- Although simple indicators may fail to reflect important variations, they are powerful tools for creating awareness and political will, e.g. (rich) women's involvement may mask the needs of the poor, but still highlight the importance of gender issues;
- Indicators are best used in 'clusters', as a combination of indicators will better present the 'whole story' essential for IWRM. The appropriate combination will depend on local circumstances;
- Where indicators are used to compare different regions, countries or water utilities, it is essential that the data elements of the indicator are precisely defined;
- Values of indicators or indices should be reviewed critically, e.g. outlier values of an index need to be investigated and explained.

Selected references and websites

Performance Indicators for Water Supply Services IWA Best Practice Manual, 2000.

Rogers, P., et al., *Measuring Environmental Quality in Asia*, Harvard University Press, 1996.
The book reviews the development of environmental quality indicators and develops new economic concepts. The work covers all of the developing country members of the Asian Development Bank.

GWP, *Towards water security: A framework for Action*, GWP, Sweden, 2000.
The Framework for Action sets out a framework to achieve the Vision for Water for the 21st

Century. It elaborates five priority themes for action: mobilising political will, making water governance effective, generating water wisdom, tackling urgent water priorities and investing for a secure water future. The Framework for Action, together with the World Water Vision, were the two principle documents presented at the second World Water Forum in The Hague. (See also C5.2).

DFID, *Strategies for achieving the international development targets: addressing the water crisis - healthier and more productive lives for poor people*, London: DFID, March 2000.
The UK Department for International Development (DFID) has developed a Target Strategy Paper for Water. DFID's goal is to enable poor people to lead healthier and more productive lives through improved management of water resources and increased and sustainable access to safe drinking water supply and appropriate sanitation. DFID have taken a leadership role in the promotion of international development targets.
www.dfid.gov.uk/public/what/pdf/tsp_water.pdf

Development Indicators, OECD/DAC This website explains the core set of indicators that will be used - at a global level - to monitor performance and adjust development strategies as required. It provides maps, charts and tables for all indicators in the core set. These give an integrated world view of human well-being in its economic, social and environmental aspects. The set will be continuously developed and updated to show results achieved, and the road still to be travelled to reach development goals up to the year 2015. The indicators have been agreed on by the OECD, the United Nations and the World Bank.
www.oecd.org/dac/indicators/ Email: dac.contact@oecd.org

The Gender and Water Development Report 2003: Gender perspectives in policis in the water sector, a report compiled by the Gender and Water Alliance on gender and the integrated management of water resourcesThe report makes gender-specific contributions and impacts more visible and helps to mainstream gender issues in the integrated management of freshwater resources.
http://www.genderandwateralliance.org/english/annual.asp

Know Your Watershed
Know Your Watershed is an information clearing house for watershed co-ordinators to help assure measurable progress toward local goals. www.ctic.purdue.edu/KYW/

C1.5 Ecosystem assessment

§ **Characteristics**

This tool involves the management of water, primarily in river systems and groundwater reserves, in order to minimise the impact of water use on the ecological functions of aquatic ecosystems. The principle is that natural riverine biota will survive and reproduce if natural flow regimes are maintained or simulated.

In the particular case of allocating water for rivers, an approach is needed which will assess the water requirements of the complete ecosystem, including such components as the source area, river

channel, riparian zone, floodplain, groundwater, wetlands and estuary, as well as any particularly important features such as rare and endangered species. This inclusive concept is the "riverine ecosystem". Current thinking suggests that the management of river flows should be undertaken in ways to 'mimic' natural flows (in both temperate and dryland river regimes). This means that water extractions through allocation mechanisms should be undertaken to replicate the natural flows of rivers, not purely for economic production purposes. This requires a thorough understanding of river flow regimes and the need for long-term, accurate data on river flows.

The science of the assessment of environmental flows is emerging. The majority of contemporary ecosystem theories that have been developed to explain how rivers function originate from research on temperate, perennial streams (as does river management and water policy). Several methods have been developed to mimic natural flow regimes and these need further evaluation for determining environmental water requirements for riverine systems. They include the Instream Flow Incremental Methodology developed by the US Fish and Wildlife service (Bovee, 1982). The physical habitat component of IFIM (PHABSIM in the USA and RHYHABSIM in New Zealand (Jowett, 1982)) is seldom useful in an ecosystem or at community levels.

Examples of ecosystem assessments include:

Murray Valley wetlands (see Murray-Darling Basin Commission, Australia; Arthington et al., 1992); the Sabie River Catchment (see Foundation for Research Development, South Africa); the Peel-Harvey Estuary, Western Australia (see Environmental Protection Authority, Western Australia); Thompson River (see Victorian Department of Natural Resources, Victoria, Australia); New Zealand (see Jowett, 1982); USA (see Bovee, 1982).

In short, methodologies for both temperate and dryland environments need to be developed, due to significantly different prevailing rainfall/run-off regimes. Any derivative assessment is best made using expert panel determinations and an effective user community participation procedure.

§ **Lessons**

- It will be difficult in the immediate future to change existing uses for which water allocations have been made and a transition period will therefore be needed. However, as a first step, unallocated, unregulated flows should be recognised as available for environmental flows.
- Further diversion of unregulated flows, from regulated or unregulated systems, should only be on the basis that ecological sustainability of riverine systems is not impaired.
- Links between the river and floodplain and the floodplain and river must be maintained in the interests of water quality and the sustainability of functional riverine ecosystems.
- Decision support systems for determining water allocations for ecosystem needs require state of the art science, coupled with the knowledge, interests and values of resource managers and vested interest groups.
- The concept of early public participation should be endorsed and used in assessing environmental flows, to assess social and biophysical environmental impacts, and lead to the best resolution of problems.

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Pigram, J.J.J. and B.P. Hooper. (eds.) *Water Allocation for the Environment Proceedings of an International Seminar and Workshop*. Centre for Water Policy Research, U.N.E., Armidale. Thoms. M.C. and F. Sheldon, 2002. An ecosystem approach for determining environmental water allocations in Australian dryland river systems: the role of geomorphology. *Geomorphology*, 47, 153-168.

C2 PLANS FOR IWRM – Combining development options, resource use and human interaction

In contrast to prescriptive and rather rigid master plans, an IWRM-oriented planning process takes a more flexible and dynamic approach to planning the development and management of water resources. Planning reflects the total activity in the system, whether defined as river basin, catchment or watershed (interchangeable terms), including for example agriculture, forestry, mining and other land uses. The planning process acquires a special role in strengthening good governance within a strategic water management framework of goals, policies and planned actions to achieve the goals.

National IWRM plans include actions necessary to develop an effective framework of policies, legislation, financing structures, capable institutions with clearly defined roles and a set of management instruments. The purpose of such framework is to effectively regulate the use, conservation and protection of the water resources, balancing requirements for broad economic development and the need to sustain ecosystems.

The emphasis here is on the process of establishing priorities and actions for integrated management of water resources. Priorities include ecosystem protection and conservation.

It is very important to recognise the dynamic nature of the planning process because a significant value of the concept lies in its flexibility. The plans should be continuously monitored and adjusted in order to take account of recent development trends. Only a flexible and non-prescriptive approach will allow for such changes. Often, the geographic limit of water management plans is the river or lake basin (C2.2) but it is important to recognise cross-basin effects as well as the impact on other environmental media, the relationship between rivers and coastal waters (C2.3) and ground and surface water (C2.4). Good plans include social, environmental and economic assessment (tools C2.6, C2.7 and C2.8).

The planning process must take into account not only development options within the water sector itself but also scenarios for development and relations between other sectors that may have an impact on the water resources (e.g. water demand or water quality). Likewise, the consequences of water management decisions in other economic sectors (e.g. tourism or health) should be an integral part of the analyses made during the planning process. It is important that the planning process includes analysis of risks (climatic variations, as well as economic, political and other risks) and addresses the necessary and adequate measures to reduce or manage risks (C2.5). Plans should also take account of potential hazard and the vulnerability of people and ecosystems to extreme events. Planning should also be linked to indicators or targets.

The responsibility for the planning process itself inevitably rests with the authorities, be they national agencies, regional authorities, or river basin organisations. It is important that the responsible authorities design a planning process that allows for involvement and contribution from all affected parties, including the private sector, community groups and disadvantaged stakeholders (see also B2.1).

C2.1 National integrated water resources plans

§ **Characteristics**

Policies and decisions regarding water resources management flow are determined at the national level. National governments and water agencies influence international co-operation on transboundary water bodies. They also develop the national framework of policies, legislation and institutions within which water resources management takes place both at basin and sub-basin level (see A1). Depending on basin boundaries and scales, nations are often part of international basins, as seen in the Nile River Basin and Mekong River Basin. At the same time these nations have basins which are fully within national borders and are thus managed at the national level. The boundaries of groundwater aquifers seldom coincide with those of the river basins. The

management of such aquifers often requires collaboration across national river basin boundaries and in some cases international co-operation is required.

A National IWRM plan will be set within this geographical and political context, and will take into account all activities and developments requiring water or influencing the water resource. Among these are ecological requirements, water supply and sanitation, irrigation, land use and forestry, fisheries, hydropower and industrial use.

A good IWRM plan includes a prioritised series of programmes for implementing the framework. Implementation of the management plan is a prerequisite to the implementation of a development plan and ensures that development takes place in a balanced fashion with due consideration of the national policies and strategies – operational aspects are explicitly addressed.

The formulation of a National IWRM Plan follows a distinct four phase approach:

- Identify the range of water resources issues that occurs across the country and assess their severity, mutual dependence and frequency of occurrence. A "user requirement issue" results from an inadequate matching of user requirements (demand) and water resources availability and quality (supply) while an "impact issue" derives from human activities (which negatively affect the quantity or quality of the water resource) or from natural causes in the case of floods and droughts. International issues should also be taken into account, for instance upstream-downstream issues;
- Identify the management interventions at all levels – national, basin, local – which are necessary to address the issues identified. From the interventions required identify the management functions at each level. Management functions include such items as policy development, planning and co-ordination, water allocation, discharge regulation, monitoring, enforcement and information dissemination. Transboundary problems may require concerted international interventions;
- Analyse the present institutional capacities at all levels – national, basin, local – and examine the potentials and constraints relating to the issues to be dealt with and functions to be undertaken. The capacities relate to factors such as the efficiency of institutional structures and the adequacy of human and financial resources as well as the adequacy of policies and legislation. International structures and agreements may be required to supplement the national institutions (see B1 and B2).
- Prepare strategies for the development of any deficient parts of the framework of national policies, legislation and regulations for IWRM, for the development of institutional roles that allow a co-ordinated implementation of IWRM and the required management instruments and associated skills. International strategies have to be developed in collaboration with other riparian nations.

§ **Lessons**

- A realistic IWRM plan requires the design of functions, structures and procedures to take into account the financial and human resource constraints, the existing institutional structures, the management capacity and the capacity for change.
- Structures should be designed as the need arises, should be flexible enough to meet immediate needs and should leave open the possibility for expansion whenever appropriate. -Multi-stakeholder involvement in the decision processes are essential for the acceptability of the outcome. - Ecosystem requirements and water quality management are often largely neglected but need to be given full emphasis in the planning process.
- Decentralised water resources management is often part of water reforms but implementation is often constrained by central agencies' reluctance to share power and resources.

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Towards sustainable water resources management – A strategic approach. Guidelines for water resources development co-operation. European Commission, 1998.

C2.2 Basin management plans

§ **Characteristics**

Water flows according to natural characteristics and does not respect administrative boundaries. Therefore, from a pure water resources point of view, there might be much logic in managing water according to drainage basin boundaries.

The basin plan is an action plan, a tool that describes the framework for management of the water and related land resources in the basin. It outlines how the concept of integrated water resources management is going to be implemented at the concrete (basin) level. A basin management plan typically addresses such aspects as:

- Physical description of the basin and land use inventories;
- Current water availability and demands;
- Pollution source inventories;
- Aquatic and terrestrial ecosystem needs;
- Vulnerability to floods or extreme meteorological events;
- Identification of stakeholders;
- Implications of changing land use;
- Identification of priority issues (impact issues or user requirement issues);
- Short- and long-term goals for the river basin;
- Water-related development scenarios; future water demands;
- Water allocation and water quality objectives;
- Strategy, measures and action plan for achievement of goals;
- Financing of water use and management;
- Responsibility and schedule for implementation;
- Mechanisms for monitoring and updating.

Because of long retention time and bio-accumulation, lake basin plans need greater focus on prevention of nutrient and toxic pollution, and careful assessment of the shoreline functions. Other issues addressed in lake basin plans include prevention and control of exotic species, inventory of biodiversity and fisheries management issues.

In accordance with the principle of demand-driven development, river basin management and planning should only be established in response to a perceived and expressed demand. Other factors, such as existing institutional and regulatory conditions, social environment (e.g. ethnic boundaries) or strong dependency on groundwater resources, might discourage the management of water according to river basin boundaries (see C3 Demand management and C1.2).

§ **Lessons**

-Involvement of all relevant stakeholders and the general public is essential for the implementation and success of the plan (see also B2.1).
-River basin planning is most successfully applied in circumstances where an appropriate institutional structure (e.g. river basin organisation, see B1.4, or drainage basin organisations for lakes) has been established.
-The long recovery period after stress in lakes means that prevention and planning are much more effective than restoration.
-Conflict is a common feature for rivers and lakes – conflicts between upstream and downstream users, and conflicts in the same place among different users or over time between uses (e.g. fishing vs. recreation, or biodiversity vs. commercial fishing).

Key organisations

RBA Centre (Centre for Research on River Basin Administration, Analysis and Management) The RBA Centre is the research centre of the Delft University of Technology in the field of integrated river basin management. It conducts fundamental as well as applied research. RBA centre, Delft university of Technology, Stevinweg 1, 2628 CN Delft, The Netherlands, tel. +31 15 2784773, fax: +31 15 2787799, rba.centre@citg.tudelft.nl, www.ct.tudelft.nl/rba/index.html

The goal of the RBI (River Basin Initiative) is to establish a global network to share information and link and support activities where the principles of integrated management of biodiversity, wetlands and river basins are demonstrated. RBI is being developed by the Global Environment Centre in Malaysia (Faizal Parish) on behalf of the RAMSAR and CBD (Biodiversity Convention) Secretariats. Contact: Mr Faizal Parish, Director, River Basin Initiative Secretariat, Global Environment Centre, 7A, Jalan 19/29, 46300

Petaling Jaya, Selangor, MALAYSIA. E-mail: fparish@genet.po.my, Tel: +60 3 7957 2007; Fax: +60 3 7957 7003

The GWP Associated Programme on Developing and Strengthening of River Basin Organisations supports organisational initiatives for IWRM at basin level. The Associated Programme is driven by the International Network of Basin Organisations (INBO). Associated Programme on Developing and Strengthening of River Basin Organisations, 21 Rue de Madrid, 75008, Paris, France, tel: + 33 1 44 908860, fax: + 33 1 40 080145, stp-riob@oieau.fr, www.oieau.fr/riob

Selected references and websites

The European Water Framework Directive (see also A2.2 and A2.3)
europa.eu.int/water/water-framework/index_en.html

Management plan for the river basin of the San Juan River
The governments of Costa Rica and Nicaragua have defined a joint project to develop a Management Plan for the transboundary river basin of the San Juan River, which includes the participation of the municipalities and NGOs with the assistance of the Global Environment Forum and the Organisation of American States. Ministry of Natural Resources – MARENA. Nicaragua. Juan José Romero jjromero@sdnnic.org.ni and Ministry of Environment and Energy –MINAE. Costa Rica. Jorge Bonilla sanjuan@sol.racsa.co.cr

Tennessee Valley Authority (TVA), United States. TVA is committed to the management of the Tennessee River system as an integrated whole. Under this approach, six different areas of responsibility-flood control, river navigation, power supply, water quality, recreation, and land use become one. The refinement never stops, but the goal is constant: to distill the maximum benefit from every drop of water in the river system. Tennessee Valley Authority (TVA), United States, 400 W. Summit Hill Dr, TN 37902-1499, Knoxville, United States. Tel: + 1 865 6322101, tvainfo@tva.gov, www.tva.gov

River Basin Management: A Negotiated Approach, initiated by Gomukh, India, and Both ENDS, the Netherlands, sets out to present innovative approaches to river basin management to policy makers on national and multi-lateral policy levels. It actively seeks cooperation with government authorities, academics and private sector experts. The project generates information and recommendations through an analysis and comparison of six case studies which develop and implement a vision on river basin management from a bottom-up (local) perspective. Contact: Danielle Hirsch, Both ENDS, www.bothends.org/encycl/ encycl.html

A scenario approach to water demand forecasting Sets out a methodology for demand forecasting on by river basin, setting the framework for the European Framework Directive approaches. National Water Demand Management Centre, Environment Agency UK 2001

C2.3 Groundwater management plans

§ **Characteristics**

Managing groundwater in the IWRM context means balancing the exploitation of the resource (in terms of quantity, quality, and relevant links to other natural resources) with the increasing demand for water for broad economic development and livelihoods. The balancing will have to take into consideration efficiency, equity and long-term sustainability in terms of maintaining both quality and quantity at desired levels. However, in practice, groundwater is often managed separately from:

- Surface water, though it is part of the overall hydrological cycle, both in quantity and quality;
- Urban wastewater, though it simultaneously represents an additional resource and a potential pollution threat to groundwater;

- Land management, though aquifers are threatened by pollution from urbanisation, industrial development, agricultural activity and mining enterprises.

A groundwater management plan should therefore be part of an IWRM plan (C2.1) in order to avoid the situations mentioned above. Thus, the groundwater management plan, as the national plan, will identify actions necessary to contribute to an effective water resources management framework. It will use stakeholder participation, capacity building, set needs in the wider social and economic framework and recognise clearly the local hydrogeological, socio-economic and institutional situation.

The delineation of appropriate boundaries for the establishment of the groundwater resource planning/management area is a difficult issue which often goes beyond political/administrative limits. Also, in some socio-economic and political real-world situations, risk management decisions – to address excessive abstraction and/or severe groundwater pollution – will override integrated management approaches. Other barriers to an integrated approach include a lack of institutional capacity, limited fund availability or, simply, politics.

The strategies of a groundwater management plan should be appropriate to the specific situation:

- In a baseline situation with insignificant groundwater abstraction, only registration of wells and springs, and resource mapping are needed;
- In a situation of incipient stress with few local competing demands and conflicts, simple management tools for well spacing, supported by a regulatory framework are appropriate;
- With significant stress, where abstraction affects natural regimes and stakeholders, a groundwater development policy and regulatory framework, based on a comprehensive resource assessment, are needed;
- In the unsustainable situation with excessive uncontrolled abstraction and irreversible aquifer deterioration, there is an urgent need for much more rigorous policies, legislation, regulation, and strong management mechanisms.

§ **Lessons**

- National food and energy policies can exert an overriding influence on groundwater development and management strategies.
- A finely-tuned balance of regulations (on water rights in particular (A2.1)), economic tools (e.g. abstraction and pollution tariffs and tradeable permits (C7)) and incentives to use water more efficiently is required to bring stakeholders into groundwater management.
- The effectiveness of stringent reactions to a groundwater crisis may depend on how much society is willing to pay for such an approach. -'Top-down' and 'bottom-up' approaches must be reconciled to achieve effective resource planning/management.
- Implementing management measures will often require capacity building, both in water resource authorities and amongst water users.

Key organisations

Groundwater Management Team (**GW-MATE**): a core group of experienced specialists in the multidisciplinary and multifaceted subject of groundwater management, launched in 2000 to act globally over a period of about five years to develop operational capacity in groundwater resource management and quality protection. Its strategy is to use World Bank project activities, together with GWP regional networks, the points of entry to achieve this goal.
www.worldbank.org/gwmate

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Affairs, New York-USA

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Foster S, Hirata R, Gomes D, D'Elia M and Paris M, *Groundwater Quality Protection: A guide for Water Utilitiess, Municipal Authorities and Environmental Agencies*. World Bank Publication, Washington DC, 2002

Llamas MR, *Groundwater Overexploitation*, UNESCO Congress 'Water in 21st Century: a Looming Crisis (Paris, France), 1998

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Salman MA, Ed. *Groundwater Legal and Policy Perspectives*, World Bank Technical Paper No. 456, Washington, 1999

C2.4 Coastal zone management plans

§ **Characteristics**

Integrated Coastal Area and River Basin Management (ICARM) combines two schools of water planning: Integrated Water Resources Management (IWRM) and Integrated Coastal Zone Management (ICZM). ICARM is not a new management concept, but a process of linking the management activities in the river basin and the coastal zone, where linked issues make this necessary and appropriate. While the two management approaches have developed more or less separately, the situation of the real world calls for the creation of close links. The types of link are:

- *Natural resource links* between coastal and freshwater systems. These are widely recognised and are caused by: changes in stream flows caused by various development projects; land use

changes, in particular deforestation and intensive “green revolution agriculture”, and discharges of domestic wastewater and industrial effluents, have all caused significant adverse impacts in coastal ecosystems. Salinity barrages in coastal zones have destroyed the natural migration patterns for fish and damaged upstream fisheries.

- *Socio-economic links* between river basins and coastal zones are equally important, but less visible. Development of the agricultural sector may often create severe impacts on coastal fisheries, where emissions of surplus fertilisers cause eutrophication, oxygen depletion and reduction in fish stock. Water supply needs of the rapidly growing coastal cities and industries create competition with crucial irrigation needs of the agricultural sector in the hinterland.

These links emphasise the importance of *Institutional links*. Most often, the two areas are managed by separate authorities in different ministries, with weak communication and coordination. However, in order to achieve coherent planning and management it is imperative that the institutions – and stakeholders in communities and businesses – co-operate to overcome differences, through the exchange of information, joint establishment of objectives and strategies, transparent resolution of conflicts, etc.

Depending on local and specific issues, ICARM may be anything from a comprehensive management framework for a smaller region to the addition of a coastal delta or estuary to a large river basin plan. As in IWRM planning, ICARM plans include the actions necessary to develop an effective framework of policies, legislation, financing structures, capable institutions with clearly defined roles and a set of management instruments. The formulation of an ICARM Plan will normally take place at the basin level and can follow a distinct five phase approach:

- Identify the range of issues (natural, socio-economic and institutional) and links which are of priority in the water body;
- Highlight the issues that may be addressed without accounting for upstream-downstream links and address these in conventional IWRM or ICZM frameworks;
- Identify the linked issues at all levels – national, basin, local, etc.;
- For these linked issues, analyse the present enabling environment, the institutional framework and the politically and technically appropriate management instruments to address them;
- Prepare strategies to develop: the deficient parts in the framework of national policies (A1), legislation (A2) and regulations (C6) for ICARM; the institutional roles (B1 and B2) that allow a co-ordinated implementation of ICARM, and the required management instruments and associated skills. International strategies have to be developed in collaboration with other riparian nations.

§ **Lessons**

- A realistic ICARM plan requires the active commitment and joint involvement of both river basin managers and coastal zone managers.
- Institutional deficiencies are often a significant constraint for establishing an efficient management framework.
- Functions, structures and procedures need to take into account the political, social, financial and human resource constraints, the existing institutional structures, the management capacity and the capacity for change.
- Structures should be designed as the need arises and should be flexible enough to meet immediate needs and leave the possibility for expansion open whenever appropriate.
- Multi-stakeholder involvement (C4.2) is essential in the decision processes in order to formulate a plan whose outcome is acceptable.
- Maintenance of ecosystem productivity is an essential element in the planning process.

Key organisations

The UNEP Division for Environmental Policy Implementation has worked with development of ICARM concepts since 1996 through workshops and pilot projects.

The Global Programme of Action for Protection of the Marine Environment from Land-based Activities

(GPA) is one of the lead partners in the FreshCo initiative on linking Integrated Water Resources Management (IWRM) and Integrated Coastal Zone Management (ICZM). UNEP/GPA Coordination Office, United Nations Environment Programme
P.O. Box 16227, 2500 BE, The Hague, The Netherlands Visiting Address: Kortenaerkade 1, 2518 EX The Hague, The Netherlands Phone: +31 70 3114460, Fax: +31 70 345 6648 E-mail: gpa@unep.nl Web: www.gpa.unep.org
UNEP/DEPI Technical Cooperation Branch, United Nations Environment Programme (UNEP)
P.O. Box 30552, Nairobi, Kenya. Phone: +254 2 623886, Fax: +254 2 624249, E-mail: takehiro.nakamaura@unep.org, web: www1.unep.org/unep/depi/icarm

UCC-Water is a lead partner in, and act as a secretariat for the FreshCo initiative on linking Integrated Water Resources Management (IWRM) and Integrated Coastal Zone Management (ICZM).

UCC-Water UNEP Collaborating Centre on Water and Environment Agern Allé 5, 2970 Hørsholm, Denmark. Phone: +45 4516 9200. Fax: +45 4516 9292. E-mail: ucc-water@dhi.dk. Web: www.ucc-water.org

FreshCo - a Partnership on linking integrated water resources management and integrated coastal zone management. This partnership was launched at the World Summit of Sustainable Development in Johannesburg, August 2002. The partnership identifies and disseminates experiences and lessons learned on management of issues related to the freshwater/coast interphase. Around 25 international organisations, NGOs, research institutes, and private companies are partners. www.ucc-water.org/freshco

Selected References

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"Linking Freshwater Resources Management and Costal Zone Management - General Issues Paper" Conceptual contribution from UCC-Water and GWP-DHI Resource Centre 2002. www.ucc-water.org/freshco/ Docs/Issuepapere.pdf

C2.5 Risk assessment and management

§ **Characteristics**

Risk assessments are needed to:

- Inform decisions on appropriate response levels and mitigation strategies to deal with water-related hazards which are both natural and human induced (resource scarcity, water quality, non-average climatic events, public health, ecosystems change);
- Evaluate the risks faced by water service providers and regulatory agencies in undertaking their functions (design and construction; operating failures; market, financial, political and legal risks; compliance risks);
- Analyse the nature and distribution of potential damage caused by water management actions

(e.g. dam building), policies and practices. Potential damage includes not only the physical effects on interdependent water resources, related ecosystems and other waste-receiving media, but also any detrimental socio-economic impacts. This more holistic risk assessment is critical for IWRM.

Conventional risk assessments link qualitatively the probability and magnitude of a hazard event with the costs of the consequences (expressed in monetary terms) if the event actually occurs. These can then be incorporated into an economic assessment (C2.8) to aid decision-making. However, it is increasingly recognised that risk is a cultural concept. Risk assessment has to include evaluations of public perceptions of the dread of the risk and of public priorities for harm reduction. There are now models in which the assessment starts with human needs and preferences, and then considers alternative courses of action available to address these needs within the existing financial and human capital constraints.

Risk management ideally needs to address five key questions:

- *What principles should govern risk mitigation decisions?* (e.g. a precautionary approach, uniform safety standards or subsidiarity principles, should decisions on risk bearing and mitigation be made by private individuals or communities or professional experts, and who should pay for risk mitigation?);
- *What is the appropriate scale and strictness of regulation?* These should depend on the nature of the hazard and the socio-economic characteristics of the related risks;
- *What is the appropriate mitigation strategy?* The option range includes complete hazard avoidance, structural measures, soft hazard reduction measures (e.g. catchment management), vulnerability reductions, risk pooling, loss bearing or sharing and post-event harm alleviation;
- *What are the appropriate policy tools?* These include direct government provision of safety, regulations, economic incentives, land use planning, information provision, community participation and action (see B1.3, C4, C6, C7);
- *What organisations need to be in place?* e.g. stakeholder fora, co-ordination mechanisms as well as hazard regulators and safety providers.

§ **Lessons**

- Sectoral and segmented risk assessments can create major inefficiencies and inequities in the allocation of risk, mitigation costs and benefits of increased security.
- Risk needs to be seen as a social as well as a physical issue. Stakeholder preferences must play a role in establishing risk mitigation priorities and practices (although these are not necessarily 'rational' or well-informed).
- Risk mitigation has to be viewed as an economic good; safety is not a free good as it inflates demand and creates a dependency culture.
- Decisions about which hazards to address (and how and where) have distribution equity implications and thus need to be treated with political sensitivity.
- Designing institutions which can take a holistic and demand-driven approach to risk is a complex and difficult task.
- Risk reduction is not the same as hazard reduction; risk mitigation has to consider the reduction of vulnerability and methods to make loss/harm bearing easier (e.g. insurance).

Key organisations

The GWP Associated Programme on Floods Management is active in several regions and focuses on how to combine policy, institutional, regulatory and physical measures. www.gwpforum.org

Asian Disaster Preparedness Centre ADPC is a regional resource centre working towards disaster reduction for safer communities and sustainable development in Asia and the Pacific. Established in 1986, the Centre is recognised as an important neutral focal point in Asia and the Pacific for promoting disaster awareness and the development of local capabilities to foster institutionalised disaster management and mitigation policies. www.adpc.ait.ac.th

National Institute for Coastal and Marine Management (RIKZ), The Netherlands The role of RIKZ is to provide the Dutch government with advice and information both on the sustainable use of estuaries, coasts

and seas and on coastal flood protection. National Institute for Coastal and Marine Management (RIKZ), Postbus 20907, 2500 EX DEN HAAG, Netherlands Visiting Address: Kortenaerkade 1, 2518 AX DEN HAAG Phone: +31 70 3114311. Fax: +31 70 3114380 website: www.rikz.nl.

Selected references and websites

International Decade for Natural Disaster Reduction secretary, *Report on Early Warning for Hydrometeorological Hazards Including Drought*, Geneva, 1997. The recommendations in this report address two critical issues in early warning for hydrometeorolgical hazards: capacity-building and co-ordination. www.unisdr.org/unisdr/hydrofore.htm Contact: Fax: 41-22-733-86 95

International Decade for Natural Disaster Reduction secretary, *Report on Earth Observation, Hazard Analysis and Communications Technology for Early Warning*, 1997.
This offers a serious look at earth observation, hazard analysis and communication technologies used in the early warning process.
www.gfz-potsdam.de/ Homepage > Search
Article can be downloaded as pdf file from:
www.gfz-potsdam.de/ewc98/docs/reports/Earthen_Words_From_An_Educated_Wordsmith.pdf
Contact: Fax: 41-22-733-86 95

International Decade for Natural Disaster Reduction secretary, *Report on National and Local Capabilities for Early Warning*, 1997. If hazard warnings are to contribute to risk reduction, a range of national and local capabilities for warning systems must also be developed, normally in the framework of national disaster management agencies. www.gfz-potsdam.de/ Homepage > Search Article can be downloaded as pdf file from: www.gfz-potsdam.de/ewc98/docs/reports/f-andy.pdf Contact: Fax: 41-22-733-86 95

European Commission, *Environment and Climate Programme*, Proceedings of the European Expert Meeting on the Oder Flood 1997, 18th May, Potsdam, Germany, Ribamod concerted action, 1999. This volume contains 16 papers covering hydrometeorological conditions, hydrological and hydraulic, management and policy issues. It emphasises the role of risk assessment, access to warning systems and improvement in flood preparedness in minimising flood losses.

Thobani, Mateen, *Private Infrastructure, Public Risk*, Finance and Development,1999. Publication discusses the risks involved in private contracts for public utility services and infrastructure, as well as the key role of government.

C2.6 Environmental Assessment (EA)

§ **Characteristics**

Environmental Assessment (EA) is a tool for anticipating the environmental effects of policy changes and new developments, enabling the incorporation of management or control measures into project and policy design. It is routinely used all around the world to improve the planning of projects and is increasingly being used to examine strategies, policies, plans, and sector programmes, when it is known as Strategic Environmental Impact Assessment (SEIA) or Strategic Environmental Assessment (SEA). EA is required when projects are likely to have significant effects on the environment. Criteria for deciding whether IWRM projects should be subject to EA include:

- The size or scale of the project (e.g. described by design capacities);
- The sensitivity of the affected area (e.g. wetlands ,wildlife habitats and biodiversity);
- The character or complexity of the likely impacts (e.g. physical impacts from hazardous wastes or social impacts (see C2.7), for instance in resettlement schemes).

The basic methodology of EA is to study the environment in which a project is planned (the "baseline"), describe the activities that will take place during each phase of a project (i.e. the construction, operation and decommissioning), describe the likely environmental impacts and, where significant adverse impacts are predicted, develop an Environmental Management Plan (EMP) to mitigate them. A programme to monitor changes from project impacts in environmental parameters forms part of the EMP.

Impacts of particular importance in many IWRM projects are:

- Projected quantitative changes in availability of water for beneficial uses, such as fisheries, recreation and tourism, potable water supply, irrigation and industrial use;
- The extent to which water quality standards and/or other beneficial use objectives will be achieved;
- The length of stream or expanse of lake or coastal waters that will be positively or negatively affected by any discharges, and the magnitude of the changes in water quality parameters;
- Public health impacts from chemical or bacteriological pollution; - Socio-economic impacts (see C2.7 Social Assessment).

§ **Lessons**

- The best results are often reached when EAs of progressive levels of detailing are mainstreamed in the planning, design and implementation process allowing early consideration of alternative schemes and adjustment of project designs at times when most flexibility exists. Once the design and siting of a development are complete, any further mitigation of environmental effects will rely on "end-of-pipe" adjustments or compensation provisions, and these are usually the most costly and the least effective environmental management options.

- EA facilitates public consultation by providing a context in which the public can both learn about and express opinions on development proposals and their envisaged effects. People potentially affected by the project can exert influence to reduce adverse impacts, maximise ancillary benefits and ensure that they receive appropriate compensation.

- EA allows the authority involved to make better decisions, such that environmental (and social) costs and benefits are considered alongside the technical and financial costs and benefits. Conditions that ensure the most efficient use of resources can appropriately be incorporated into the EMP.

Key organisations

International Association for Impact Assessment [http://www.iaia.org/] This website provides information on the activities of the IAIA including its listserver, IAIA Handbook, and IAIA. There is also an extensive listing of relevant websites. Its resources section covers ten areas in impact assessment, including risk assessment, social impact assessment, policy assessment and training.

EIA Centre [http://www.art.man.ac.uk/EIA/EIAC.htm] This site provides information on the EIA Centre and gives an overview of their activities including research, training and information. The website also provides an on-line information service on EIA and SEA sources as well the Centre's EIA expert network, a list of Centre training activities and documents regarding developing country initiatives in EIA.

The Institute of Environmental Assessment (IEA) http://www.greenchannel.com/iea/] This Institute is the

Competent Body for the European Eco-Management and Audit Scheme (EMAS) for the UK. The site gives information on the Institute's activities and its members. It has an extensive list of publications including recent conference papers on EIA.

Selected references and websites

Resources on EIA [http://www.gdrc.org/uem/eia/impactassess.html] This is an electronic index of EIA information sources. It provides links to document and information repositories on EIA, tools methodologies and techniques that have been developed as well as organisations and current initiatives dealing with EIA.

EIA in general [http://www.brad.ac.uk/staff/pghopkin/whatisea.html] This site provides a brief overview of what an EIA is and the process for conducting one by identifying the most environmentally suitable option at an early stage, the Best Practicable Environmental Option and the alternative processes.

World Bank Homepage[http://www.worldbank.org.] In its "Topics in Development" section, the World Bank's *Global Environment Facility* contains environmental information, documentation, and publications. A search for environmental assessment will lead to the “EA Sourcebook and Updates” a guide to many aspects of EIA as undertaken by the World Bank Group and its clients. John Glasson, Riki Therivel, Andrew Chadwick (1994)

Introduction to Environmental Impact Assessment UCL Press Limited, London Introduces the principles, processes and procedures for EIA, the origins and development of EIA and examples of practice in the UK, Netherlands, Canada, Australia, Japan and China. In addition it reviews the prospect of improving EIA through envirmonmental audits and strategic assessments. Riki Therivel and Maria Rosario Partidario (1996)

The Practice of Strategic Environmental Assessment Earthscan UK. Reviews international SEA guidence and regulations and provides case studies from around the world.

Patera, A. and Riha, J. (1996) *Environmental impact assessment as a tool for integrated water management.* European Water Pollution Control 6(1): 38-49

Holder, V.T. and Veerheem, R. (1997) *Strategic EIA in Netherlands - ten years experience.* Environmental Assessment 5 (3) pp31-34

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Donnelly, A., Dalal-Clayton, B. and Hughes, R. (1998). *A Directory of Impact Assessment Guidelines*, 2nd Ed. International Institute for Environmental Development, London

Petts, J. (Ed.) (1999) *Handbook of environmental impact assessment*. Blackwell Sciences, Oxford.

Gilpin, A. (1995) *Environmental impact assessment: Cutting edge for the twenty-first century*. Cambridge University Press, Cambridge.

C2.7 Social Assessment (SA)

§ **Characteristics**

SA is a tool used for ensuring the systematic analysis of social impacts of a proposed development or policy action, particularly if these are varied and extensive, and/or a proposal is expected to attract extensive opposition. Social impacts include all the social and cultural consequences of actions that affect the ways in which people live, work, play, relate to one another, organise to meet their needs, and generally cope as members of society. SA has long been used by social scientists for analysing the conditions, causes and consequences of social phenomena and social life.

SA is useful in examining the impacts of *structural reforms* such as privatisation of state owned

enterprises, agricultural reform, reform of basic services, utility reform, civil service reform and fiscal policy. It is also used for *large and complex projects* (e.g. dams and impoundments, wetlands management). An SA study will consider population impacts, community/institutional arrangements, communities in transition, individual and family level impacts and community infrastructure needs.

SA is particularly useful for assessing:

- How the costs and benefits of reforms are distributed among different stakeholders over time;
- How specific groups such as the poor are able to cope with reforms, both physical and institutional, and how they can gain access to market opportunities;
- How assets (physical, financial), capabilities (human, organisational), economic and social relations (e.g. gender, exclusion) of stakeholders, and institutions affect policy outcomes;
- Gender issues – how women's views, interests and needs shape the decisions that affect their lives as much as men's, in whatever cultural context they live in;
- The psychological and health effects experienced by individuals and the social and cultural effects experienced by communities;
- The institutional and financial effects experienced by societies.

To make the assessments, SA uses a range of tools:

- Qualitative data collection tools (focus groups, semi-structured key informant interviews, ethnographic field research, stakeholder workshops);
- Surveys that capture direct impacts and behavioural responses to reform, or specific dimensions (e.g. time-use patterns) which affect reform outcomes;
- National survey data or statistics.

Whilst it may sometimes be necessary to rely on qualitative descriptions, quantitative information should be provided where feasible. Change and predicted effects can be assessed in terms of levels of risk, altered amenity value, community identity and cohesion, etc. (see also Economic Assessment C2.8).

§ **Lessons**

- SA should inform and improve the quality of decision-making. -SA also has as much value for managing social impacts and managing the discourse of project/policy development as it has for anticipating and documenting impacts.
- Although often seen as part of EA (Tool C2.6), it may be better carried out separately from main environmental studies, since specialist skills in social sciences may be needed, and the timescales and study areas of the physical and social analyses may be very different.
- SA should focus on the ways in which people are affected rather than on technical and economic considerations.

Selected references and websites

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The World Commission on Dams, *Dams and Development: a new framework for decision making*, 2000 Earthscan, London. Contains guidelines for social assessment. www.dams.org

C2.8 Economic assessment

§ **Characteristics**

Economic assessment consists of a set of decision-making tools intended to select the best and most appropriate projects within the water sector and in comparison with other sectors. It is strongly consistent with IWRM.

There is a basic distinction between cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA). CEA aims to select the cheapest (most cost effective) method of attaining given objectives, while CBA selects the project with the highest excess of benefits over costs. Economic assessment techniques take account of all costs and benefits on a year-to-year basis over the life of the project

or programme, discounting future cash flows at an appropriate rate. Depending on type, results are expressed as: discounted cost per unit (e.g. of water saved or of treated effluent); Net Present Value (of the surplus of benefits over costs at a specified discount rate), or Internal Rate of Return (discount rate at which benefits and costs are equalised). Financial and economic values are usually differentiated (e.g. taxes and subsidies would be disregarded for economic analysis); a more refined model includes environmental costs and benefits.

Economic assessment can be linked with participatory approaches and demand assessment, and can focus on women's issues and broader health/livelihood effects of water use. Good economic assessment that reinforces IWRM demands a clear understanding of the direct and indirect impacts of proposed projects. It is a tool that identifies external impacts and equity (i.e. who pays and who reaps the benefits) as well as efficiency. Economic assessment tools can be highly effective in changing the culture of water managers and increasing public awareness of IWRM. As such they may be termed social change agents (C4).

§ **Lessons**

When used seriously and consistently, economic assessment can provide an objective way of choosing the best water projects. But it can also be used cynically, e.g. to satisfy external funders, or to window-dress a pre-chosen project. Other problems include:

- The "technocratic" nature of CBA or CEA, and the use of a single number or single criterion to choose among complex projects;
- Technical disagreement among practitioners (e.g. on which discount rate to use, on defining the "without case scenario", or the inclusion of environmental costs and benefits);
- Its use is not compulsory and its findings are not upheld by any legal requirements (in contrast with environmental assessment).

The following are preconditions for the usefulness of economic assessment:

- Politicians and senior administrators are committed to its serious use in selecting public investments;
- A suitable guidance manual is available for sector professionals, responsible officials and consultants employed (capacity building, B2);
- The policy context is conducive to the selection and successful operation of projects (see A1);
- A range of options exists, sufficiently different to give a real choice (using IWRM), and are compared consistently. Assumptions and the 'without project scenario' should be realistic, to avoid casting the project in an artificially favourable light;
- Spurious accuracy is avoided; 'it is better to be approximately right than precisely wrong'.

Key organisations

The Asian Development Bank is a multilateral development finance institution dedicated to reducing poverty in Asia and the Pacific. ADB's water policy stresses the need for integrated cross-sectoral approaches to water management and development. www.adb.org/Documents/Policies/Water/default.asp
Headquarters, P.O. Box 789, 0980 Manila, Philippines. Tel: (632) 632-4444, Fax: (632) 6362444

The World Bank
www.worldbank.org/ (see A3.1)

The African Development Bank
www.afdb.org (see A3.1)

The Inter-American Development Bank
www.iadb.org (see A3.1)

Bank-Netherlands Water Partnership Program (BNWPP) is an operational instrument to stimulate innovative approaches to water management in World Bank operations and the broader development community. BNWPP, Room MC 5-850, 1818 H Street, N.W., Washington, D.C. 20433. Phone: 202-458-2613, Fax: 202-522-3306. lbijlsma@worldbank.org

Selected references and websites

Sinha, B., and Bhatia, R., *Economic Appraisal of Irrigation Projects*, New Delhi, 1981.
The authors use the UNIDO (United Nations Industrial Development Organisation) methodology to analyse an irrigation project in Bihar, India. The book aims to teach engineers and scientists how to carry out an economic, social, and environmental appraisal of water projects.

P. Abeyungawaya, *Environmental Project Evaluation*, Asian Development Bank, Manilla, 1999. This book covers the appraisal of investment projects from an economic perspective, introduces the appropriate methodology required and finally shows how to include environmental economics in the appraisal. The book gives several examples from the Asian Development Bank project.

P. Dasgupta, S. Marglin & A.K. Sen, *Guidelines for Project Evaluation*, UNIDO, 1972. This book addresses primarily government project evaluators and covers the justification for project evaluation, contains a detailed discussion of the shadow prices, discusses the meaning and significance of national parameters, and presents four case studies. Still highly practical despite its age.
www.unido.org/doc/stdoc.cfm?did=50121 E-mail: publications@unido.org

Asian Development Bank (ADB), *Guidelines for the Economic Analysis of Projects*, 1998. Provides guidelines for ADB staff, consultants, and officials of developing member countries in assessing project proposals for economic viability and financial sustainability.
www.adb.org/Documents/Guidelines/Eco_Analysis

Asian Development Bank (ADB), *Handbook on the Economic Analysis of Water Supply Projects*, 1999.
Practical manual written for non-economists involved in the planning, preparation, implementation, and management of water supply projects
www.adb.org

Pricing and service differentiation of utility water and sanitation services for the poor: a strategic marketing approach; a project to study how utilities can use pricing and service differentiation to benefit all and move towards financial sustainability. This develops a methodology for water utilities to structure service delivery and tariffs to serve low-income customers. www.lboro.ac.uk/wedc/projects/psd/index.html

C3 EFFICIENCY IN WATER USE – MANAGING DEMAND AND SUPPLY

Demand management reflects a major shift in the approach to water resources management, away from traditional supply development (construction of physical infrastructure to capture more water for direct use) to an improvement in efficiency of use, conservation, recycling and reuse of water. Demand management examines changing demand and the way people use water in order to achieve more efficient and cost effective water use. It can help to reduce wasteful use of the resource, which represents an opportunity lost as well as the use of water without an economic purpose. Demand management can sometimes obviate the need for physical or infrastructure investments, providing real efficiency gains to society. Demand management works best in an IWRM

framework which looks across sectors and makes proper links between policy instruments and impacts.

Demand management applies at the river basin level, at the level of large users of water (utilities, industry), and at the level of agricultural users and households and communities. While different techniques may be used at each level the approach is similar. Demand management aims to change human practice and behaviour directly and is hence linked closely with social change instruments (C4), regulatory and economic instruments (C6 and C7) and communication and knowledge (C8). The use of demand management should be supported in the overall policy framework and built into planning for IWRM (C2). Serious effort is required for demand management since most water users believe they have a right to use (and waste) water freely, without appreciating the impacts of wasteful water use on society and the environment. Education should change attitudes in the long term and communication campaigns are needed to change short-term behaviour on water saving in drought emergencies.

C3.1 Improved efficiency of use

§ **Characteristics**

The key to improved efficiency lies in setting up mechanisms for changing people's attitudes and behaviour towards water use. Such mechanisms include:

- *Education and communication*, including programmes to work with users at school, community and institutional levels (C4);
- *Economic incentives*, including tariffs and charges for water use (domestic, industrial, agricultural) and for the provision of environmental services (C7);

- *Subsidies or rebates* for more efficient water use can be useful.

Regulations and by-laws can be used to set standards for water consumption (C6). These may explicitly aim to prevent "waste, misuse or undue consumption" in public water supply. Bylaws and regulations can also cover standards and use of water appliances, e.g. water fittings and appliances, which are required to achieve minimum standards of water efficiency. Such tools can change behaviour and stimulate the introduction of lower water consumption technologies.

Technologies for reducing consumption vary by application and context – e.g. drip irrigation to replace flood irrigation, and retrofitting and pressure reduction. In agriculture, crop patterns are modified to reduce water use (France, Tunisia). Shifting the management of irrigation water at field level to farmer groups (with governments retaining the responsibility for bulk supply) creates the possibility of more efficient use and can make volumetric charging possible.

Use of indicators such as product labelling and access to technical support information is important (C4.3) as are water campaigns, awareness raising, and performance indicators (C1.4). A useful technique is the *water audit*, which, by using simple procedures, can easily identify gross inefficiencies in water use in, for example, industrial plants.

Improved efficiency of use is achievable in almost all situations, but the specific tools vary widely according to circumstances. For example, tariffs for water use are only effective if linked to volumetric use, with means of measurement such as meters or discrete volume measures. Efficiency is also ensured by providing a service that is used. Stakeholder dialogue helps tailor water management to meet the needs of society without waste. Ignoring the needs of special groups, such as women in the case of domestic water supply, or subsistence farmers in the case of irrigation, means that both capital and operational investments are often wasted.

(See also B1.7 (role of the private sector), B2.3 (regulatory and enforcement agencies), C7.1 (pricing of water and water services), C6.3 (regulations for water services).)

§ **Lessons**

- Improved efficiency of use requires a package of many tools which are selected to meet the local circumstances and are focused on key target groups.
- Education and communication campaigns should be directed towards main users, (e.g. women's or farmers' groups or industrialists – according to specific social and cultural conditions (see C4)).
- Efficiency in use may be undermined by policies in other sectors (e.g. subsidies to energy used for pumping groundwater for irrigation).
- Water regulations are more effective if widely publicised and firmly enforced.
- Pricing is often effective in improving efficiency in municipal water supply and is being increasingly used in irrigation as management reforms can open the possibility of volumetric charging.

Key organisations

The International Commission on Irrigation and Drainage (ICID) is dedicated to enhancing the worldwide supply of food and fibre 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. International Commission on Irrigation and Drainage, 48 Nyaya Marg, Chanakyapuri, New Delhi 110021, India. Tel : 91-11-6116837, 91-11-6115679. Fax : 91-11-6115962 E-Mail : icid@icid.org, www.ciid-ciid.org

The IWMI (International Water Management Institute) is a non-profit scientific research organisation focusing on the sustainable use of water and land resources in agriculture and on the water needs of developing countries. IWMI works with partners in the South to develop tools and methods to help these

countries eradicate poverty through more effective management of their water and land resources. www.cgiar.org/iwmi/ IWMI Private Bag X813, Silverton 0127, South Africa. Tel: (27-12) 845 9100, Fax: (27-12) 845 9110

The Institutional and Management Options Working Group (IMO-WG) of the Water Supply and Sanitation Collaborative Council concerns itself with the institutional and management options that prevail in the water supply and sanitation sector with specific reference to water demand management. It analyses, documents and disseminates case studies on different institutional arrangements and management practices. Contact: Ms Lilian Saade, e-mail address: imo@ihe.nl, phone number: +31 (0) 15 215-1770 or fax: +31 (0) 15 212-2921, P.O. Box 3015, 2601 DA, Delft, the Netherlands

Selected references and websites

United Nations Bureau of Reclamation (USBR), *Achieving Efficient Water Management: A Guidebook for Preparing Agricultural Water Conservation Plans*, December 1996, Updated by Bureau of Reclamation, Prepared by Hydrosphere Resource Consultants, Second edition, September 2000. This Guidebook aims to help agricultural water districts and irrigation organisations prepare water conservation and management plans to achieve more efficient water use. It is aimed at organisations of all sizes and complexities, both federally-supplied and private. Home page: www.usbr.gov/main/index.html Publications page: www.pn.usbr.gov/project/wat/publications/index.html

The UK Environment Agency's National Water Demand Management Centre (NWDMC) aims to promote water conservation initiatives and increase uptake of water saving practices. www.fwr.org/nwdmc.htm See also: www.environment-agency.gov.uk Home > Water Resources > Search "National Water Demand Management Centre"

Waterwiser, USA: The Water Efficiency Clearing House. Information on references on a variety of water resources issues. www.waterwiser.org/

WHO Regional centre for environmental health activities clearing house on water demand management and pollution control, www.clicomm.com/ceha

C3.2 Recycling and reuse

§ **Characteristics**

Recycling and reuse is a useful planning and management tool at *the river basin level*. Urban effluent can be treated and returned to aquifers or rivers for dilution by natural flows and re-abstraction downstream (although there is a need to ensure the quality of returning effluent will not impose ecological or health risks). Treated effluent from industrial or municipal treatment plants may be piped directly for use in agriculture and horticulture (although the level of treatment should be adequate to minimise health risks, and recycled sewage only used for crops with low uptake of water/pathogens). Irrigation return water from drainage canals can be reused if mixed with fresh water. Water returned to rivers or used for groundwater recharge should be controlled in both

quality and quantity by discharge permits or other regulatory tools (see C6) which take into account the needs of the aquatic environment and water available for dilution.

Recycling and reuse is feasible for *individual water users* in industry, institutions and large buildings, and at household level, to make the most of available water through recycling treatment processes. For instance, in water-short urban areas, water from rooftops or paved surfaces can be used for toilet flushing, sometimes with additional grey wastewater.

Recycling and reuse has wide applicability in general, but particular techniques or levels of recycling and reuse depend on local priorities and possibilities, and economic feasibility. It is most appropriate in areas where there are extreme water shortages, high water costs and high technical capabilities. High levels of technical management, monitoring and regulatory skills are needed for recycling and reuse to be both safe and effective. However, some less sophisticated techniques are being developed, such as guideline ratios for safe mixing of wastewater and fresh water, which can make this tool suitable for less developed areas. Also, low technology options of using grey water for irrigation are useful.

Use of recycling/reuse approaches can be stimulated through policy instruments (charges and tariffs which can increase the cost effectiveness of recycling and reuse, see C7.1), regulations and by-laws (C6.2) and incentive schemes to stimulate change. Regulations can be introduced to require changed industrial practice in water use. Awareness raising (C4.3) and the use of information and communication tools (C8) can stimulate recycling and reuse.

§ **Lessons**

- Industrial water users can make major savings by modifying manufacturing processes to recycle cooling water.
- Recycling and reuse are not always cost effective, and policy interventions should look at the economic implications of changing use patterns.
- Reuse within a river basin is universal, but planned reuse is better than the normal unplanned approach as care is needed to avoid the build up of persistent or toxic chemicals in the system.
- Irrigation return water, and urban and industrial effluent should be monitored in particular for toxic chemicals, heavy metals, pesticides and fertilisers.
- Water recycled for potable use should be treated to the highest bacteriological and chemical standards, but it still may not be aesthetically acceptable to some users.
- New programmes for recycling and reuse should be accompanied by training and awareness raising programmes.
- Household level water recycling may impose extra burdens on women if the system is to be maintained properly.

Key organisations

WA Specialist Group on Water Reuse The Group is an international knowledge network, working together worldwide to achieve more sustainable water use by recycling water to meet the world's water needs. It forms part of the International Water Association (IWA). International Water Association, Alliance House, 12 Caxton Street, SW1H 0QS London United Kingdom, Phone: +44 (0)20 7654 5500 Fax: +44 (0)20 7654 5555 email: water@iwahq.org.uk, www.iawq.org.uk

Environment Agency's National Water Demand Management Centre (NWDMC), United Kingdom. Mission is to 'provide a focus for information and expertise to ensure acceptance of water conservation throughout society'. One of its key aims is to promote water conservation initiatives and increase uptake of water saving practices. The need to meet existing public and commercial demand for water, whilst

minimising impacts of abstraction and waste discharge on the environment, is a challenge which faces all major water users and providers. Recently, many water companies and water users have focused attention on methods to monitor and minimise water usage, and as a result a wide range of demand management initiatives have been developed. Environment Agency's National Water Demand Management Centre (NWDMC), United Kingdom, Guildbourne House, Chatsworth Road, BN11 1LD, Worthing, West Sussex, United Kingdom. Tel: + 44 19 03 832275, Fax: + 44 19 03 832274, paula.wood@environment-agency.gov.uk, www.fwr.org/nwdmc.htm

Selected references and websites

Haarhoff, J., and Van der Merwe, B., *Twenty-five years of wastewater reclamation in Windhoek, Namibia*, Water Science and Technology, Vol 33 No 10-11, pp 25–35, IWA Publishing 1996. Full article available in pdf file at www.iwaponline.com/wst/03310/wst033100025.htm Homepage: www.iwapublishing.com/

Blumenthal, U. J., Peasey, A., Ruiz-Palacios, G., Mara, D. D., *Guidelines for Wastewater Reuse in Agriculture and Aquaculture: Recommended Revisions Based on New Research Evidence*, WELL Study Report Task No 68, Part 1, 2000. www.lboro.ac.uk/well/studies/t68i.pdf

D Leggett, R Brown, G Stanfield, D Brewer, E Holliwell CIRIA Report PR080 – *Rainwater and greywater use in buildings*. Decision-making for water conservation. CIRIA 2001 ISBN: 0 86017 880 3

C3.3 Improved efficiency of supply

§ **Characteristics**

Efficiency in the supply and delivery of water includes efficient use of the resource, as well as efficiencies in canal and pipe distribution networks. Efficiency of supply can take place on many levels. *Rainwater harvesting* is an approach whereby rain is collected and stored in the soil profile, or in tanks, ponds, or cisterns, providing water for irrigation or domestic purposes, rather than immediate evaporation. Rainwater harvesting is particularly useful where rainfall is highly seasonal and can reduce the volume lost to the community in run-off. It has applications in both rural and urban areas where rainfall can be collected from roofs and hard surfaces.

At the level *of water utility*, efficient supply management may involve improvements in:

abstraction, treatment, bulk transfers, local distribution, consumer meters, revenue collection, appropriate economic analysis and accounting procedures. Important tools for improving water supply efficiency for utilities include:

- Universal metering;
- Distributional zonal metering;
- Leakage and pressure reduction.

Dual supply systems of different water quality for different uses can be a cost effective option (and may be useful for recycling and reuse, C3.2). In irrigated agriculture, where there are often heavy water losses (up to 50%) before the water reaches users, there is much scope for improvement. Improvements in conveyance and distribution and field application can be used to change traditional open canal systems to pipe conveyance and sprinkler/drip irrigation.

A balance needs to be struck between the capital investment needed to expand supply capacity and investment in operations and maintenance, and the cost of rehabilitation to make the most efficient use of existing resources and facilities. Water savings will often postpone major capital investments in supply infrastructure (see also A3.5 on investment appraisal).

Introduction of efficient supply approaches in utilities or irrigation systems may need retraining and institutional reform. (See B1.6, targets and incentive structures for public service providers, including the need for better paid and trained staff, B2.2 increasing IWRM capacity and training of water professionals). Changes may also need investment in the distribution systems (subject to economic and financial appraisal). See other sections: financing and incentive structures (A3), role of service providers in IWRM (B1.9), institutional capacity building (B2), consensus building (C5.3), regulations for water quality (C6.1), information and communications (C8), and information for awareness raising (C4.3) .

§ **Lessons**

- Improved supply efficiency can postpone the need for new capital investment, but careful economic and financial analysis will be needed (C2.8).
- Some supply side techniques are capital intensive with high investment costs, such as the lining of irrigation canals.
- Rainwater harvesting is an effective intermediate technology with small capital requirements and potential for community development and management.
- Technology changes in, for example, the delivery of irrigation water, need to be accompanied by appropriate changes in irrigation management.
- All changes need to be supported by training and awareness raising campaigns (C4).
- Even though rainwater harvesting may only provide water for a proportion of the year, it may be welcomed by poor women as an alternative to carrying water from a more dependable source.

Key organisations

The GWP Associated Programme Network for Green Water Harvesting creates a movement for rainwater harvesting. It creates awareness, facilitates exchange of experiences and stimulates action. www.Cseindia.org

The Institutional and Management Options Working Group (IMO-WG) of the Water Supply and Sanitation Collaborative Council concerns itself with the institutional and management options that prevail in the water supply and sanitation sector with specific reference to water demand management. It analyses, documents and disseminates case studies on different institutional arrangements and management practices. Contact: Ms Lilian Saade, e-mail address: imo@ihe.nl, phone number: +31 (0) 15 215-1770 or fax: +31 (0) 15 212-2921, P.O. Box 3015, 2601 DA, Delft, the Netherlands.

Selected references and websites

Agarwal, A., Narain, S., *Dying Wisdom: rise, fall and potential of India's traditional water harvesting systems*, Centre for Science and Environment, New Delhi, 1997. (See also B2.1).

GARNET (Global Applied Research Network) research network for the theme roofwater/ rainwater Harvesting, http://info.lut.ac.uk/departments/cv/wedc/garnet/tncrain.html

C4 SOCIAL CHANGE INSTRUMENTS – Encouraging a water-oriented society

Changing water practices to achieve IWRM requires changes in the deeply held attitudes of individuals, institutions, professionals and social organisations within civil society. By definition, social change instruments are not neutral, one person's positive change is often seen as destructive by others. Therefore it is important to ask, 'change from what to what?' as well as 'how can changes take place?' The key to encouraging an IWRM oriented civil society lies in the creation of shared visions, through joint diagnosis, joint creation of options, joint implementation, and joint monitoring. This itself requires broad stakeholder participation in water planning and operating decisions, and is another strong tool for encouraging such new civil orientation.

Participatory approaches in IWRM are powerful instruments for social change. At all levels –

national, regional and local – it is often the most deprived social groups that need to be involved in the participatory process (B1.9 and C4.2). However, it should be remembered that participation is costly in terms of time and money, and may postpone important investments. Participation does not do away with conflicts of interest, although is can clarify the real issues and open the door for conflict resolution (C5). Most importantly, participation can marginalise the poor or vulnerable still further if the mechanisms or fora are captured by the wealthy or more articulate, or a narrow advocacy group. Gender and poverty are two of the main causes of social exclusion and should not be overlooked.

Social change can be brought about through instruments that emerge from participatory experiences and offer people the chance both to claim rights and also to take on the consequent responsibilities. Participation needs to be supported by people with well-informed attitudes who can respond to the need for changing patterns of water management. Hence education, training, and awareness raising are important tools for social change.

Tool C4.1 focuses on the role of education curricula in building water knowledge for social change. C4.2 describes techniques for better communication with stakeholders. The level of knowledge in itself is crucial – knowledge asymmetry, where one group is much more aware of issues and data than another, breeds lack of trust. Knowledge can empower groups and strengthen good governance (C4.3).

C4.1 Education curricula on water management

§ **Characteristics**

This tool involves the incorporation of locally relevant sustainable water management topics into pre-school, primary, middle, and high school education. Bringing water issues into education programmes provides a means of encouraging young people to understand not only the wider water concepts, but also the effects of their own behaviour on water, its quality, and ecosystems.

There are many ways that water issues can be introduced into the general curriculum both inside and outside the classroom. In the classroom, people can:

- Develop and use water textbooks such as more general environmental textbooks in middle schools and use these with Internet support sites and CD-ROMs;
- Develop experiential models around water to add to science, geography, and history courses;
- Use actual local projects as learning classrooms for water management lessons, and use visits to water infrastructures to broaden the middle school learning process.

Water managers and teachers can co-operate to:

- Think about how local water assets can be used as learning resources for local communities and schools;
- Hold joint seminars on water issues and brainstorming in order to devise methods which use assets to help meet learning goals.

Learning programs at visitor sites (such as wetland centres, river banks or reservoirs) can also be used as educational tools. Educational programmes should be integrated with local museum and science exhibits on major public and private waterworks and infrastructure.

§ **Lessons**

- Studies on introducing water conservation behaviour show that the most efficient way to affect adult behaviour is through educating children at school.
- Educational tools are particularly effective in middle schools, but can also be applied at the elementary, and high school levels.
- Introducing local science projects into the classroom learning environment will give students a feeling for the realities of water issues.
- Promotion of environmental education can focus on the children as well as on teacher training.
- The integration of environmental issues in education curricula has become well established and offers lessons on how to stimulate knowledge and understanding of water issues.
- Good practice at school (e.g. providing latrines, especially for girls, and promoting hygienic practices) can increase school attendance and influence the wider community.

Selected references and websites

Umgeni Water (South Africa) offers a significant amount of different material (including videos, teaching manuals, teaching aids, water test kits) through an online ordering catalogue. www.umgeni.co.za/services/education/mailorder

Aquatox 2000 Experimental Kits Water quality education for schools in several regions in the world, including an Experimental Kit and an Activity Book. www.idrc.ca/aquatox/en/experiment/intro.html

Educating Young People about Water Overview of 100 different water related curricula in the USA can be downloaded from this website. www.uwex.edu/erc/eypaw/ e-mail erc@uwex.edu

C4.2 Communication with stakeholders

§ **Characteristics**

There are many tools available which allow information exchange among diverse water stakeholders, and are suitable for different settings and types of people. They include:

- One-to-one exchange using telephone, email and fax services, and exchanges during social experiences, conferences, symposia and professional meetings;
- Text material such as newsletters (paper and electronic), printed manuals, newspaper and electronic media reports, bulletin boards, and email chat about IWRM experiences;
- Interactive web-based watershed information systems which specify best management options

for specific land types in a catchment (land systems, land management units, planning areas, sub-watersheds), and which are congruent with overall river basin management goals and targets;
- Interactive Geographical Information Systems built for use within agencies or for targeted partners in a water management context (see also C8.1);
- Field days, farm demonstrations and workshops to exchange best management practice experiences in IWRM at the local level;
- Professional workshops to exchange experiences in state-of-the art tools for IWRM;
- Radio broadcasts and video presentations;
- Open houses;
- Village level capacity building through discussion with farmers and village leaders;
- National and regional technical and study tours allowing professionals and practitioners to exchange first hand results of IWRM.

As in Water Campaigns, (C4.3) it is essential to address the needs of stakeholders in selecting the mechanism for communication. Local authorities and programmes such as Agenda 21 offer important means of communication (see B1.10). See also B2.1 and C8.2.

§ **Lessons**

Like other professionals, water practitioners learn best from face-to-face interaction with each other or a mentor, sharing common problems, concerns and successes. Good information exchange is enhanced by:

- *Appropriateness:* providing information that is relevant to the IWRM task at hand, has been tested in the field and rigorously proven through research and development. Information must also be applicable to the type of problem, the level of institutional capacity and technical ability of the practitioners. If capacity is lacking, special efforts will be needed to facilitate information exchange. Internet based information is key, but where it is not easily accessible alternatives must be used;
- *Accessibility:* building on the current capacity of practitioners rather than requiring major upgrades in individual or organisational or technical ability; -*Equity:* information exchange should respect cultural needs and gender issues, and take care not to discriminate against users or providers because of their remote locations.

Key organisations

The Water Supply and Sanitation Collaborative Council provides water supply and sanitation sector professionals with strategies, guiding principles, manuals, source information, and replicable models. Water Supply and Sanitation Collaborative Council, c/o WHO (CCW), 20 Avenue Appia, CH1211 Geneva 27, Switzerland, Tel. +41 22 791 3544, fax +41 22 791 4847, e-mail: wsscc@who.ch

Water Voice Project As a lead-up to the 3rd World Water Forum, the "Water Voice" project is launched to collect grass-roots opinions and comments on water issues from people around the world. www.worldwaterforum.org/eng/voice.html Secretariat of Water Voice, FAX No: +81-3-5212-1648, Postal address: Kojimachi Yubinkyoku Dome, Tokyo, Japan 102-8787

Selected references and websites

The Great Lakes Information Network (GLIN) is described as "a partnership that provides one place online for people to find information about the bi-national Great Lakes region of North America". GLIN has synthesised a large volume of contact information into simple and visually appealing websites that hotlink readers easily to other locations. www.great-lakes.net/

Gorre-Dale, E. Jong, D. de, Ling, J., *Communication in Water Supply and Sanitation Resource Booklet*, IRC, The Hague, 1994. This booklet is designed to support people who are convinced of the need for change in the water sector and who want to know how to put a communication programme into effect. www.irc.nl/pdf/publ/resbook.pdf or www.irc.nl/products/publications/descr/come.html Contact: Fax: +31-15-291 09 55 E-Mail: general@irc.nl (See also C4.5).

Campos, J., and Coupal, F., *Participatory Evaluation*, UNDP, New York, 1996. This handbook has been designed for UNDP staff and their partners interested in applying participatory evaluation techniques to their projects, and who need to have a better understanding of participatory evaluation and how it fits into development programmes.

Deverill, P., Bibby, S., Wedgwood, A and Smout, I *Designing water supply and sanitation projects to meet demand in rural and peri-urban communities*. WEDC 2002 ISBN: 1 843800 06 03

C4.3 Information and transparency for raising awareness

§ **Characteristics**

As many water issues need broad public support and understanding, creating water awareness is increasingly seen as being important. Information is a powerful tool for raising awareness and empowerment through:

- Water campaigns;
- Making information available to the general public through inventories etc.;
- Provision of information through, for example, product labelling.

The aim is to engage the public in such issues as: water conservation; hygienic water use; preservation of wet ecosystems; water user awareness; developing self-regulating water institutions; increasing the willingness to pay or contributions to water services; awareness for planning for emergencies, and strengthening political will (also B1.9). Ideally, public awareness is not one-way communication, but an interaction of many active stakeholders, who influence each other and provide social control by mutually reinforcing, agreed sets of values.

Water campaigns can use a number of communication methods such as:

- Direct use of conventional media (printed media, television, radio) and/or non-conventional media (messages on water bills, games, transport tickets, comic books, etc);
- Organisation of large events and the endorsement of celebrities (generating media attention);
- Use of existing networks (religious networks, social movements, NGO networks, business associations);
- Use of logos (e.g. a water drop) to give identity to the campaign.

Choices need to be made on the reach of the campaign, the target group, the desired change in perception and/or behaviour and the likely influence of the target group on the campaign outcomes.

Public Access to information has been powerful in raising environmental awareness. Example include the Toxic Release Inventory in the US where companies are required to publish lists of all toxic emissions, which can then be used in other campaigns by, for example, NGOs and lobby groups. In the water domain, a requirement to publish information can powerfully reinforce other policy tools such as pollution charges (as happened in Germany), or in the PROPER programme in Indonesia (Shamon David and Wheeler David, Controlling industrial pollution in the developing world, Environmental Quality Management, 69, 70, 1988). They can also be linked to standards to trade, putting pressure on exporters to improve practice.

Product labelling or *environmental certification* is a useful tool for raising awareness. 'Blue' and 'green' labels have been used in water saving devices and eco-friendly products and services. They have encouraged changes in consumption patterns and triggered industries to adopt new standards in often essentially traditional markets like plumbing fixtures or water conveyance. Performance indicators and descriptions on product labels (e.g. showing water consumed in washing machine cycles) are tools which provide information to consumers of water using appliances. Product labelling can encourage industry to adopt new standards and essentially transform traditional markets. This sort of product labelling introduces a profit motive into conservation, and can change producer and consumer behaviour (see also C6 and B2.1). Environmental Management Systems (EMS) such as ISO 14000 use information and declaration of performance to encourage improved practices.

§ **Lessons**

- The impact of a water campaign increases if it can be closely followed by tangible action, such as installing water saving devices or cleaning watercourses.
- Campaigns are most effective when they use a well-targeted range of media.
- The use of existing networks can lower the cost of campaigns, and increase the impact.
- Blue and green product labelling has benefited from strong professional associations providing standards.
- Access to information requires government support, e.g. to ensure that required information is readily available – through Internet or public libraries etc.
- The provision of information needs careful management to ensure its relevance and credibility.

Key organisations

The UNDP (United Nations Development Programme) is the UN's principal provider of development advice, advocacy and grant support. UNDP has six priority practice areas: Democratic Governance, Poverty

Reduction, Crisis Prevention and Recovery, Energy and Environment, Information and Communications Technology, HIV/AIDS. Its commitment to a universal presence has proven especially useful in post-conflict situations and with states that had otherwise been isolated from the international community. www.undp.org UNDP, One United Nations Plaza, New York, NY 10017, USA. Tel: (212) 906-5558, Fax: (212) 906-5364

Selected references and websites

Central America Network for Water Resources Management, for professionals and experiences exchange (CARA Network). University of Costa Rica (UCR).

Alaerts, G. J., Harvelt, F. J. A., and Patorni, F. M. (Eds), *Water sector capacity building: Concepts and Instruments, Proceedings of the Second UNDP Symposium on Water Sector Capacity Building*, Delft, 1999, A. A. Balkema, Rotterdam, ISBN 905410421X, 1999. A total of 35 papers report the first field experience and consider operational guidelines for establishing the amount of water a system can provide, and improving the performance of the sector in general.

The Gender and Water Alliance are preparing advocacy materials.
http://www.genderandwateralliance.org/english/advocacy.asp

Euro-Mediterranean Information System on the know-how in the Water sector (EMWIS).
Information and knowledge exchange tool between the Euro Mediterranean partnership countries, necessary for the implementation of the Action Plan defined at the Euro Mediterranean Ministerial Conference on Local Water Management, Turin, 1999-10-18/19. The EMWIS aims to: -Facilitate the access to information -Develop the sharing of information -Elaborate common outputs and co-operation programs
www.emwis.org/

C5 CONFLICT RESOLUTION – Managing disputes, ensuring sharing of water

Procedures for consensus building and conflict management are central to successful IWRM. Conflicts can occur for many reasons. Areas for potential conflict include: interdependence of people and responsibilities; jurisdictional ambiguities; functional overlap; competition for scarce resources; differences in organisational status and influence; incompatible objectives and methods; differences in behavioural style; differences in information; distortions in communications; unmet expectations; unmet needs or interests; unequal power or authority; misperceptions, and others. Conflict is not always active: the poor and voiceless may already have ‘lost’ the dispute.

Conflicts are inevitable in IWRM but need not end in polarisation or impasse. Conflicts can also be positive. For example, conflicts may help in:

- Identifying real problems needing solutions;
- Bringing about needed change;
- Permitting adjustments to be made without threatening the basis of a relationship;
- Helping to build new relationships;
- Changing the way we look at issues, clarifying purposes;
- Identifying what is most important.

Conflict management refers to a broad array of tools used to anticipate, prevent, and react to conflicts. Identifying which tool to select depends on the root causes of the conflict, as well as the type of conflict and its location. Conflict management tools can be classified into three types: interventions for conflict management (C5.1), decision support/modelling tools (C5.2) and (C5.3) tools for consensus building.

A conflict management strategy will involve a combination of these types of tools. In most water resources cases the tools encourage parties to move beyond positional bargaining and the claim/counter claim process. They try to help parties identify the interests which lie behind each side's position, and to jointly construct "win-win" solutions based on meeting those interests. It must be stressed, however, that not all situations can be resolved with win-win outcomes – at least not in the short term. Trade-off and compromise are often necessary. Conflict management involves both social change and social learning. It has many benefits, including its voluntary nature. Conflict management can help to develop quick procedures and solutions to dispute settlement; more control over solutions by those closest to the issues; greater flexibility for crafting solutions than is offered in formal legal mechanisms, and time and cost savings.

These tools are applicable in almost all aspects of IWRM. They are especially useful in early stages of IWRM planning and design. They are least useful in situations where major legal precedent is being set.

It is most important to stress that the ultimate mechanism for conflict resolution is the law and legal procedures. This section focuses on voluntary mechanisms for conflict management, but in many cases beneficiaries of these techniques would not participate without the knowledge that there is ultimate recourse to compulsory adjudication.

C5.1 Conflict management

§ **Characteristics**

This section looks at four intervention tools for dispute management: *facilitation, mediation, fact finding* and *arbitration*.

Facilitation is often used in situations involving multiple parties, issues and stakeholders, and where issues are unclear. An impartial individual participates in the design and conduct of problem-solving meetings, to help the parties jointly diagnose, create and implement jointly-owned solutions. *Facilitation* works best in low-to medium- level conflicts. In such cases it can be used to

define problems and goals and identify personal and institutional support. Facilitation may be the first step in identifying a dispute resolution process.

Mediation is an *interest-based negotiation process*. The parties choose an acceptable mediator to "guide" them in designing a process and reaching an agreement on mutually acceptable solutions. Parties often share the costs for mediation. The mediator tries to create a safe environment for parties to share information, address underlying problems and vent emotions. Mediation is also often undertaken at the suggestion of outside parties. It is more formal than facilitation and is used when there is some relationship among parties, even if it is acrimonious. It is useful when the parties have reached an impasse.

Fact finding seeks to clarify and make recommendations regarding differences over data or substantive disagreements using one or more outside expert. Particularly useful in a technical environment, it has proved useful in site-specific construction cases, complex issues such as groundwater movement, and the clean up of waste. *Dispute review boards and panels* are a special form of fact finding, providing parties involved in a conflict or dispute with a more objective evaluation of the dispute and all its dimensions by qualified and recognised experts**.** Fact finding approaches are most often used in the earlier stages of a conflict, e.g. before initiating legal actions or negotiations, and are most appropriate in technical or scientific disputes where specialised knowledge is involved.

In *arbitration* the parties submit arguments to an arbiter who acts as a judge. The parties turn over the formation of a solution to an outside party and it tends to produce less satisfactory solutions than mediation or facilitation, with most of the debate centred on claims and counterclaims. Arbitration is often used in the business world or where there is a need for a quick solution between a few parties. It is also useful where there is weak judicial authority, as in many international situations. Within countries arbitration is mostly voluntary and non-binding.

§ **Lessons**

- Water experts often view disputes as factual problems of information and misunderstanding of data. But in practice, disagreements are usually over interests and values rather than facts. *Fact finding* in such cases is of limited use. This is especially true when the task at hand covers broad IWRM issues rather then specific project-related issues.
- *Dispute panels* have been successful (even in very acrimonious situations) where the number of parties is small and the issues tend to be technical. They also offer a useful model for forming dispute clauses in agreements among parties who will be working with each other.

Key organisations

Central America Water Court. Tribunal Centroamericano del Agua. Costa Rica.
In July 1998, a Central America Declaration on Water was approved and at the same time the Central America Water Court was constituted, a non-governmental organisation that supports the communities' demands related to water. The water court provides procedures for conflict management of water users and so helps to fill the gap created by weak legislation to control water usage. Tragua@sol.racsa.co.cr , www.tragua.com

Water Issues Group, School of Oriental and African Studies
Staff, graduate students and associated researchers in the group focus on fresh water as a key

global renewable natural resource.
Web site: www.soas.ac.uk/Geography/WaterIssues/
Contact: SOAS, University of London, Fax: +44 (0) 20 7436 3844

Selected references and websites

The International Commission for the Protection of the Rhine (ICPR) The ICPR's targets include: sustainable development of the entire Rhine ecosystem, guarantee the use of Rhine water for drinking water production and improvement of the water quality of the North Sea. www.iksr.org/

The Nile Basin Initiative's aims include an adequate and acceptable framework for co-operation for equitable and legitimate use of the Nile River Basin water resources.
www.undp.org/seed/water/region/nile.htm or www.nilebasin.org/

Salman M. A., *International Watercourses: Enhancing Co-operation and Managing Conflict*, World Bank, Washington D.C., ISBN 0-8213-4298-3, 1998. (See also B1.1).

Just, R. E., Netanyahu, S., *Conflict and co-operation on trans-boundary water resources*, Kluwer Academic, Boston, ISBN 0-7923-8106-8, 1998.

Transboundary Freshwater Dispute Database.
terra.geo.orst.edu/users/tfdd/ (See also B1.1).

Briscoe, J., *Water Management in Chile, Lessons learned from a Study Tour*, World Bank, Washington DC, 1996.
This document makes a comparative assessment of water management institutions and law in Chile and Mendoza, Argentina. It addresses monopoly and conflict adjudication issues.

C5.2 Shared vision planning

§ **Characteristics**

Recent advances in interactive modelling tools now allow parties to create jointly sophisticated yet inexpensive models of, for instance, the river basin and rivers and groundwater. Such models produce a *simulation tool* which is owned by the parties and is manipulated and used in a visual way. Since the stakeholders themselves create the model, they are more willing to engage in scenario analyses.

Optimisation modelling goes beyond simulation and produces ideas on the best investment or best options given certain assumptions. It should be used carefully in conflict situations.

Valuation is an important tool to support conflict management, and can facilitate the process of sharing benefits (rather than simply sharing water). Even if valuation may not be possible in monetary terms, the exercise of benefit estimation, even if only qualitative, helps to indicate better solutions.

Shared vision modelling is best used in multi stakeholder, multi- issue situations. As parties begin to confront the need to plan for growing scarcity of water under competing demands, it is highly useful to bring sectors together. The process of building a shared vision helps to build a common language about the water resource issues among parties. It is also useful where there is no common database and data sharing is difficult, and where there is little shared knowledge of the resources.

For material on the use of models for information, knowledge and awareness raising see C1.3, C4.2, and C8. See also tools A1 (policy formulation), B1.2 (transboundary organisations), C1 (Water resource assessment and demand assessment), and C2 (plans for IWRM).

§ **Lessons**

- The best modelling applications try to show parties an overall picture of the situation and to put the water conflict situation in context.
- A shared vision can also be useful to begin to illustrate how benefits can be generated from co-operation and thus begin to push parties towards a focus on sharing benefits, rather than simply sharing flows. Valuation supports this approach.

Selected references and websites

Shared Vision Planning was developed during the US Corps of Engineers' National Drought Study. It combines the best traditional planning methods with structured stakeholder involvement methods and the shared vision model. www.wrsc.usace.army.mil/iwr/Planning/Planning.htm

GWP, *Towards water security: A framework for Action*, GWP, Sweden, 2000. (See also C1.4).

World Water Council, World Water Vision Commission report, *A water secure world: Vision for water, life, and the environment*, London, World Water Council, 2000. Written by the independent World Commission for Water in the 21st Century, the Commission Report represents the consensus of its members - experts in water, environment, and public policy.

Http://www.worldwatercouncil.org/Vision/Documents/CommissionReport.pdf

Cosgrove W. J., Rijsberman F. R., *World Water Vision: Making Water Everybody's Business*, London, World Water Council & World Water Vision & Earthscan, ISBN 1-85383-730-X, 2000.
A detailed Vision report was prepared by the Vision Management Unit for the second World Water Forum in The Hague.
Http://www.worldwatercouncil.org/Vision/cce1f838f03d073dc125688c0063870f.htm

Action Plan for the Integrated Management of Water Resources in Central America (PACADIRH) The PACADIRH was developed through a participatory process, and subsequently endorsed by the presidents of all seven countries in Central America. The Regional Plan is not intended to substitute national activities, but to complement and co-ordinate them, taking advantage of the possible economies of scale. Regional Committees on Water Resource (CRRH) of SICA, crrhcr@racsa.co.cr

C5.3 Consensus building

§ **Characteristics**

Consensus building is a strategy or approach that is used for intersectoral water policy dialogue. It is best used in situations of low to medium conflict and tension. However, it can sometimes be useful where parties are in major conflict and have unsuccessfully tried legal or other high-cost approaches.

It usually includes the following steps:

- Starting by defining the problem rather then proposing solutions or taking stands;

- Focusing on interests;
- Identifying numerous alternatives;
- Separating the generation of alternatives from their evaluation;
- Agreeing on principles or criteria to evaluate alternatives;
- Expecting agreements to go through refinements;
- Documenting agreements to reduce the risk of later misunderstanding;
- Agreeing on the process by which agreements can be revised and the process by which other types of disagreements might be solved;
- Using the process to create agreement;
- Creating a commitment to implementation by allowing all stakeholders to participate in decision making;
- Accepting the legitimacy of feeling.

Associated tools are:

- *Joint training*, which brings parties in conflict together to jointly learn about dispute management, consensus building or IWRM;
- *Policy dialogue*, which brings stakeholders together with some end in sight, e.g. to write major policy or regulations. This follows the principle that participation in policy formulation (in a facilitated series of meetings) will yield less conflict and more rapid implementation;
- *Strategic Conflict Assessments*, which can be used as early intervention systems for intervening in ripened conflict, and for designing systems to prevent conflict. In situations of relatively low tension, but competing interests, such as in early IWRM institutional design efforts, these assessments can be done collaboratively. They help parties to learn about each other, and create realistic expectations toward the process. Participating in strategic conflict assessments can change the views of senior officials in complex situations;
- *Interest-based negotiations*, which are sometimes undertaken by unassisted individuals, but more often use a neutral party to create and manage the process. Such negotiations have been successfully used in many situations, including project construction claims settlements, agreements to cost sharing and allocation formulae, regulatory implementation, operations of water infrastructure and realignment of purposes and use, and planning for IWRM.

See tools C1 (demand and resource assessment) and C4.2 (communication with stakeholders).

§ **Lessons**

- Consensus building is most useful in low to medium conflict situations where the parties have some familiarity with each other.
- It is a good “first step” tool in new problem areas. -It can be used at local, regional, provincial or even national levels. -It is an effective tool for raising the *awareness of issues*.

Key organisations

UN Commission on Sustainable Development The CSD ensures the high visibility of sustainable development issues within the UN system and helps to improve the UN's co-ordination of environment and development activities. The CSD also encourages governments and international organisations to host workshops and conferences on different environmental and cross-sectoral issues. The results of these expert-level meetings enhance the work of CSD and help the Commission to work better with national governments and various non-governmental partners in promoting sustainable development worldwide. www.un.org/esa/sustdev/csd.htm Secretariat CSD, United Nations Plaza, Room DC2-2220, New York, New York 10017, USA. Tel: + 1 212-963-3170, Fax: + 1-212-963-4260

Selected references and websites

US Army Corps of Engineers, Institute for Water Resources, courses on: *"Negotiations, Bargaining and Conflict Management"* and *"Alternative Dispute Resolution"* (ADR)
www.wrsc.usace.army.mil/iwr/
Homepage > Training > Course Descriptions

Dialogue on Water, Food and Environment. The objective of this effort is to develop a science-based consensus between all stakeholders from the agriculture and environment sector – including governments, NGO's, research specialists and farmers' organisations. Dialogue on Water, Food and Environment, PO Box 2075, -, Colombo, Sri Lanka. Tel: 94 1 867404, Fax: 94 1 866854, dialogue@cgiar.org, www.cgiar.org/iwmi/dialogue

C6 REGULATORY INSTRUMENTS – ALLOCATION AND WATER USE LIMITS

There are four basic types of regulatory instrument which have a role to play in integrated water resources management.

- *Direct Regulations*, whereby government bodies or independent regulatory agencies establish laws, rules or standards which water and land users and water service providers are required to follow. This is often known as command and control regulation. Such regulations might, for example, include the specification of drinking water quality standards, controls over land use and development within catchments and flood plains,

controls over the quantity and timing of private water abstractions, and controls over the quantity, quality and timing of waste discharges into the water environment.

- *Economic or market regulation* – (C7) economic instruments such as unit pricing, marketable rights or subsidies are employed instead of or in conjunction with direct regulations to influence water or land using behaviour.
- *Self regulation* – professional bodies, industry groups or community groups establish their own rules of conduct and mechanisms to ensure compliance. Governments may still have an important role, however, in allowing self-regulating systems to operate, in encouraging, enabling and building regulatory capacity and in providing vital information.
- *Social regulation* (C4) – this involves changing water use behaviour through persuasion, information and education.

It is now widely accepted that all four of these sets of instruments will need to be employed within a mixed regulatory system. Each have their advantages and disadvantages and each require different expertise and different timescales for implementation. The package of appropriate regulatory tools is likely to vary markedly depending on the socio-economic, political and environmental conditions prevailing in a country.

Direct regulation (B2.3 and B1.5) can only be effective if the agency involved has enforcement capacity and the regulations are regarded by the regulated and the general public as necessary and appropriate. Over-stringent regulations which impose high costs on the regulated can lead to non-compliance or evasion, so undermining the whole regulatory endeavour.

C6.1 Regulations for water quality

§ **Characteristics**

Regulatory instruments for controlling water quality can be aimed at controlling discharges at source, or at managing the receiving environment. They also include regulations for waste minimisation.

Uniform emission or discharge standards apply to all emissions in a specific area (e*mission approach*). Specific emission standards can be set in individual permits. These can be based on

the pertinent *ambient water quality standards (water quality approach)* or on the best available technology (BAT), best practicable technology (BPT) or the best available technology not involving excessive costs (BATNEEC).

A combined approach implies that minimum uniform emission standards are set and that stricter standards are applied if the quality of the receiving water requires it, or if the way the water is used requires higher standards (e.g. for maintaining a delicate ecosystem). Specific regulatory instruments can also be used to protect aquatic ecosystems and riparian habitats, and for the rehabilitation of water resources.

Where discharge standards are difficult to apply, as in the case of non-point pollution, regulations may focus on the techniques or practices; in agriculture for example the *best environmental practice* approach, which will provide guidelines for the application of fertilisers and pesticides, is often used. Regulatory instruments can be developed for the protection of groundwater, taking into account the difficulties of monitoring and rehabilitating groundwater. Other types of regulatory instruments include:

- *Product standards*, which can be set for some pollutants, such as pesticides, and the widespread banning of DDT;
- *Land use controls*, which may influence the setting of ambient or discharge standards (C6.4);
- *Safety regulations and procedures for accidental pollution* may also be useful.

The application of regulatory instruments for water quality control should be based on environmental goals that are set in the policy and planning stage (A1, B1.5, B2.3). Furthermore, administration and setting water quality standards must be closely linked with regulations for water quantity, as these are inter-dependent (C6.2).

§ **Lessons**

- An ambient water quality approach is usually based on set priorities and is more complex to apply than an emission approach.
- An ambient water quality approach requires the availability of rather detailed water quality data from the recipients (C1.1).
- For regulations to be effective they need to be implemented by institutions with the capacity for implementation, compliance monitoring and enforcement (B2.3).
- A water quality approach can lead to different regulatory conditions for similar polluters (and pollutants) in different basins because the condition of the receiving environment, which is used to determine the discharge or abstraction standards, is likely to differ in different locations. This may be politically harder to introduce than the application of uniform standards.
- An emission approach or pollution control based on Best Available Technology is essential for pollutants that accumulate in the environment.
- Product standards are appropriate for diffuse pollution because emissions are difficult to monitor.
- Standards should be achievable in the short term, but they should also stimulate further improvements in the long term through progressive tightening.
- Tools need to be balanced – e.g. restricting infiltration may increase urban run-off.
- In low income countries, definitions of what is ‘safe’ need to be balanced with what is affordable and appropriate.

Key organisations

The International Commission for the Protection of the Rhine provided a forum for member companies to address water quality, provided a catalyst for increased political and public participation in dealing with pollution issues, a network of monitoring stations, knowledge exchange on best practice in water quality abatement, and a setting for the conduct of negotiations. International Commission for the Protection of the Rhine, Postfach 200253, D-56002 Koblenz. Phone: +49-261-12495, Fax: +49-261-36572. sekretariat@iksr.de or www.iksr.org

World Health Organisation The objective of WHO is the attainment by all peoples of the highest possible level of health, a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity. WHO works on water and health, and has established several sets of guidelines for water quantity and quality for various uses. www.who.int WHO Headquarters, Avenue Appia 20, 1211 Geneva 27, Switzerland. Tel: (+00 41 22) 791 21 11, Fax: (+00 41 22) 791 3111

Selected references and websites

Rees, Y., and Zabel, T., Regulation and enforcement of discharges to water, In: F. N. Correia, F. N. (ed.), *Water Resources Management in Europe*, Volume 1: Selected Issues in Water Resources Management in Europe, Balkema, Rotterdam, 1998.
Describes the regulation of surface water pollution and enforcement in The Netherlands, France, Germany, Portugal and The United Kingdom (England and Wales).

Burchi, S., *Preparing national regulations for water resources management; Principles and practice*, FAO, Rome, 1994. Provides practical guidance on the legal aspects of regulation and gives many illustrations from around the world. (See also C6.2 and C6.3).

C6.2 Regulations for water quantity

§ **Characteristics**

Regulatory instruments for ground and surface water quantity control include *permits* for ground and surface water abstractions. The quantities permitted may reflect seasonal needs.

Usually, *general rules* (for example certain volumes of abstracted water) determine when a permit is needed and when it is not. General rules may forbid or limit abstractions for specific

waters or under such specific conditions as times of drought.

Control of water quantity and quality are closely linked. In surface water systems, abstraction reduces flows and hence the ability of a river or stream to absorb and degrade wastes. It therefore decreases the ability of a river or stream to maintain desirable ecosystems.

Illegal or uncontrolled abstraction of groundwater for agriculture, industry and household use is widespread in many areas (e.g. peri-urban settlements) and can have serious implications for groundwater quality. Permanent abstractions above the recharge often result in serious saline intrusion in the productive aquifers, making the water unsuited for domestic or irrigation purposes.

Effective regulation of water abstractions requires information on the available water resources and the present abstractions. Moreover, sufficient institutional capacity must be available to apply the different tools for compliance monitoring and enforcement appropriately. (B1.6, B2.3) The need for institutional capacity should receive attention in the water resources assessment (C1) and policy and planning stages (A1).

§ **Lessons**

- Surface water abstractions and groundwater abstractions should be regulated in conjunction to prevent undesired shifts between the two.
- As in the case of regulations for quality (C6.1), there should be consistency with institutional capacity for their implementation, compliance monitoring and enforcement.
- When regulating water abstractions, non-consumptive uses of water, including those of aquatic ecosystems, recreation and navigation, need to be taken into account.
- In rivers shared between two or more countries water abstractions need to be agreed between the riparians and should be based on negotiated criteria for sharing the water and its benefits.
- Water quantity should be regulated in conjunction with water quality since the two are intimately related. For instance, some domestic or industrial water use can result in polluted return flows that reduce the water's suitability for downstream uses.

Key organisations

GW-MATE offers advice on groundwater management and protection, role of governments, associated policy and institutional issues, and mobilising stakeholders. GW-MATE is a GWP Associated Programme. gwp@sida.se, www.worldbank.org/gwmate

Selected references and websites

Burchi, S., *Preparing national regulations for water resources management; Principles and practice*,

FAO, Rome, 1994. (See also C6.1 and C6.3).

C6.3 Regulations for water services

Water service providers should be subject to the general quality and quantity regulations outlined in C6.1 and C6.2. In addition, governments will be concerned to ensure that providers deliver services in an efficient and cost-effective manner and at appropriate service standards. Service providers typically enjoy significant monopoly power; their output levels, service standards and investments all tend to be lower than under competitive conditions, while their prices tend to be higher. Performance regulation has often been seen as only necessary when the private sector is involved but public monopoly providers also need to be put under regulatory pressure to improve

their performance (B1.6). Effectively-monitored performance targets, possibly employing benchmarking and the publishing of performance league tables, can play a critical role in public sector institutional reform.

The regulation of private sector providers will depend upon the Private Sector Participation (PSP) option chosen (B1.7) and the amount of competition which is allowed in the sector. Regulation is typically least onerous for service and management contracts, but realistic specification of performance targets, good output delivery data and monitoring capacity are essential. The regulatory burden for concessions and divestiture is considerable. Contracts or operating licences will need to establish mechanisms for tariff adjustments, service standard specification, investment requirements, complaint resolution, dispute arbitration and the imposition of sanctions for delivery failures. Price regulation (and preventing hidden price rises through reduced standards of service) is a critical regulatory task, as is ensuring that companies make efficient investment decisions. (See World Bank Toolkits – Selecting an option for Private Sector Involvement.)

In designing a regulatory system for public and private service providers, governments need to clearly specify the regulatory duties; decide how decentralised regulation should be; consider the level of independence and discretion given to regulators; ensure regulatory accountability and transparency, and ensure that regulators have the capacity to monitor and obtain unbiased performance data.

§ **Lessons**

- The monopolistic character of most service providers means that self-regulation is typically inappropriate. Regulation should be separated from provision.
- The regulatory burden can be reduced by allowing comparative (yardstick) competition and benchmarking.
- Regulation of decentralised service providers should normally occur at a higher tier of government to avoid capture and facilitate benchmarking.
- Good independent information on asset conditions, performance standards, operating costs and investment efficiency is an essential prerequisite for effective regulation.
- To be effective regulators must operate independently from both short-term political pressures and the regulated companies.
- Regulation is likely to be most effective if it employs incentives as well as sanctions.
- Regulation should be transparent, with maximum use of published performance targets and achievement levels.

Key organisations

The Office of Water Services (OFWAT), UK The aim of OFWAT is to regulate the water and sewerage companies in a fair and open way so that the companies can improve the quality of service and value for money they provide for their customers. www.open.gov.uk/ofwat/index.htm Fax: +44 (0)121 625 1400, E-mail: enquiries@ofwat.gtnet.gov.uk

Selected references and websites

South Africa National Water Services Act – Department of Water Affairs & Forestry www-dwaf.pwv.gov.za/

Burchi, S., *Preparing national regulations for water resources management; Principles and practice*, FAO, Rome, 1994. (See also C6.1 and C6.2).

World Bank, *Toolkits for Private Sector Participation in Water and Sanitation*, 1997. Contact: Fax: (202) 522-1500 E-mail: pic@worldbank.org www.worldbank.org/html/fpd/wstoolkits/ (See also A3.3 and B1.4).

Rees, J. A., TEC Background Papers No. 1, *Regulation and Private Participation in the Water and Sanitation Sector*, Global Water Partnership, Stockholm, Sweden, 1998. www.gwpforum.org/ > Library – Publications > TEC Background papers no.1. (See also A3.3).

C6.4 Land use planning controls and nature protection

§ **Characteristics**

An important topic for IWRM is the interface between water use and land use. Consequently, regulating land use is part of IWRM. The steady growth of urban agglomerations means that the water impacts of land use become of paramount importance. Urban growth leads to massively increased local discharges of waste effluent with serious impacts on surface and groundwater. In the same way forestry and agricultural activities have significant impacts on both the quality and quantity of surface run-off as well as groundwater formation and quality. Land use planning should be a significant component of implementing national plans for IWRM (see C2).

Land use planning can draw together the various impacts of population pressure or industrial land use on water to ensure sustainable water impacts. Land use planning is vital for safeguarding environmentally vulnerable areas, wetlands and also for riverine ecosystems. But pressure for land development is often intense, and there are frequent conflicts between the land requirements for housing, industry, roads etc. and the need for nature protection.

Examples of tools for controlling land use include:

- *Zoning* identifies areas where specific forms of land use are prohibited or where special rules apply. Examples relevant to IWRM are drinking water protection zones and zones where construction is not allowed because of flooding risks. Protection zones around wells and in recharge areas are useful for protecting groundwater and potable water drawn from wells. Protection zones along watercourses gives some protection against direct pollution, for instance from nutrients in fertilisers;
- *Construction permits* are sometimes required before houses or infrastructure can be built in protection zones or around urban areas to protect water quantity and quality. Land use planning can be used as an alternative to structural flood protection;
- *Building regulations* are likewise a means that can be employed to reduce vulnerability to floods;
- Specific *soil protection and erosion control measures*, such as ploughing parallel to the contour lines and planting trees, can be prescribed. Special limitations may apply in designated nature or wildlife areas;
- *Waste disposal regulations*, e.g. on locations of waste disposal sites, are important for the protection of groundwater.

Before controlling land use, a wide overview is needed on present land use, along with a vision on future land use. Additionally, adequate institutional capacity must be available for planning and for compliance monitoring and enforcement (B1.5, B2.3). This tool also has links to water resources assessment (C1).

§ **Lessons**

- Structural flood protection has some serious drawbacks, such as the costs and the increased damage if the structures fail. Consequently, non-structural measures such as zoning deserve serious consideration.
- Integrating land use controls into IWRM requires effective co-operation and mutual understanding between land use planners and water managers. Co-ordination can be achieved, for example, through an apex body (B1.3).

Key organisations

University of Costa Rica, Research Programme on Synecology and Restoration of Terrestrial Ecosystems (SIRECO)

Land use planning, erosion control and reforestation are of vital importance for water resources management in the tropical rainforests of Central America. The SIRECO programme focuses on measures taken in Central America, such as regulations for construction on steep slopes, establishment of protected areas and integrated river basin management projects. sireco@odd.ucr.ac.cr

Dialogue on Water, Food and the Environment
The objective of the dialogue is to develop a science-based consensus between all stakeholders from the agriculture and environment sector

Dialogue Secretariat, P O Box 2075, Colombo, Sri Lanka. Tel: 94-1-867404, 869080, Fax: 94-1-866854, E-mail: Dialogue@cgiar.org, website: www.cgiar.org/iwmi/dialogue

The UNEP (United Nations Environment Programme) works to encourage sustainable development through sound environmental practices everywhere.
www.unep.org/
UNEP Headquarters, P.O. Box 30552, Nairobi, Kenya. Tel: (254 2) 621234, Fax: (254 2) 226886 / 622615

The World Conservation Union (IUCN)IUCN is the world's largest conservation-related organisation, bringing together states, government agencies, NGOs, affiliates, and some 10,000 scientists and experts in a worldwide partnership. Its 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. IUCN developed a Vision for Water and Nature for the second World Water Forum in The Hague and is involved in a number of water resources initiatives. www.iucn.org/Contact: Fax: +41 (22) 999-0010 E-mail: rita.ferrieres@iucn.org

Wetlands International is the world's leading non-profit organisation concerned with the conservation of wetlands and wetland species www.wetlands.org/ Wetlands International -Africa, Europe, Middle East, P.O. Box: 7002, Droevendaalsesteeg 3A 6700 CA Wageningen, The Netherlands. Tel: 31 317 478884, Fax: 31 317 478885

World Wide Fund for Nature (WWF)
WWF is a large conservation organisation that aims to protect nature and the biolgical diversity.
www.wwf.org

Selected references and websites

Lundqvist, J. (Ed), 2000, *New dimensions in water scarcity*, Food and Agriculture Organisation, Land and Water Development Division (AGLW), Rome, 2000 An overview of linkages between society, water, land use and ecosystems. The report discusses green, as opposed to blue, water flows, different categories of drought, various water scarcity concepts and indicators, and includes a substantial discussion on how to cope with water scarcity, including various coping capability problems.

Falkenmark, M., Andersson, L., Castensson, R., and Sundblad, K., *Water – a reflection of land use*, Swedish Natural Science Research Council, Stockholm,1999. The fact that a land use decision is also a water decision is being supported by this cases-based publication, providing a richness of examples from all over the world that illustrate how land and water are closely linked through the water cycle.

C7 ECONOMIC INSTRUMENTS – Using value and prices for efficiency and equity

Economic instruments can complement the use of institutional, regulatory, technical and other kinds of tools used in the water sector. In general, economic instruments involve the use of prices and other market-based measures to provide incentives to consumers and all water users to utilise water carefully, efficiently and safely. Economic instruments may offer some advantages over other tools, by providing incentives to change behaviour, raising revenue to help finance necessary adjustments, establishing user priorities and achieving overall IWRM management objectives at least overall cost to society. For successful application, economic instruments need appropriate standards (e.g. for discharges or surface water quality), effective administrative monitoring and enforcement capabilities, institutional co-ordination and economic stability.

Economic instruments work best in combination with other supporting measures; they are unlikely to be effective acting alone. The adage "the market is a good servant but a bad master" applies here.

Water pricing is an increasingly common tool (C7.1), applied to recover costs, to give the right incentives to users, and to protect the environment. In practice, there is great variety in the type, level and structure of tariff systems observed both between and within countries in the water services sector, hence there is a rich variety of experience to draw upon. There is more limited experience with the active use of pricing for irrigation water. Pollution charges (C7.2) work in an analogous way, providing a disincentive for the anti social release of polluted wastewater.

The use of water for agriculture often illustrates a widespread problem that arises when water users have rights which are enshrined in law or custom, and cannot easily be revoked or amended. In such cases, the redistribution of water can sometimes be achieved by setting up markets (C7.3) in which rights can be traded, and holders are compensated through the market for surrendering their claims, either temporarily or permanently. Markets can also come to the aid of pollution prevention and control; the "right to pollute" within limits set by environmental regulators can be traded amongst firms, leading to abatement being achieved in the least cost manner.

The use of water is, however, affected not only by its own price, but also by the prices of goods and services that consume water or affect its use in other ways. These prices are often distorted, and produce wrong signals to water users. A balanced programme of reforms has to address corrections to prices in agriculture, industry and other areas that affect the use of water. Taxes and subsidies can also be used to reinforce "green" behaviour.

C7.1 Pricing of water and water services

§ **Characteristics**

The purpose of water pricing or charging is:

- *Cost reflectivity*: charges signal to users the true scarcity value of water (e.g. through abstraction charges) and the cost of providing the service; they provide incentives for more efficient water use and give investors information on the real demand for any needed service extension. Pricing also helps to identify the most cost effective means of meeting both demands and revenue needs;
- *Environmental protection*: encouraging conservation and efficient use; recognising environmental benefits from leaving water in its natural state (see also C7.2, Pollution charges);

- *Cost recovery*: generation of revenues for the efficient operation (and debt service) of the present system and its future maintenance, modernisation and expansion.

As well as ensuring recovery of costs, an effective tariff should be:

- *Affordable*: recognising the vital role of water, the special needs of socially deserving cases, and the importance of safe water and sanitation for public health. Mechanisms to protect the poorest from high charges, while avoiding subsidies to the better off, are necessary. The urban poor often pay more (per unit) for water via the informal private sector than the wealthier pay to the official water utility (C3, C1);
- *Acceptable* to the public: tariffs should be clear, comprehensible and fair;
- *Administratively feasible*: levying and collection of charges should be within the capacity of the water undertaking (links with institutional capacity, B2).

Volumetric tariffs, which charge according to the amount used, are more versatile than fixed charges and can provide incentive for careful use. Tariffs typically combine a fixed and variable element to cover overhead and operating costs respectively. Cost recovery charges for sanitation services are often levied on households and/or industry, typically as a surcharge on the water tariff, but are less easy to set and administer than water consumption charges. Charges are sometimes levied for the cost of connections to public systems, or for the provision of facilities, such as low cost latrines.

Pricing or cost recovery for irrigation systems are beginning to be used, although irrigation water is often heavily subsidised. Volumetric pricing is still the exception, and proxies are used, such as acreage, type of crop, size of harvest; however, with modernisation of irrigation systems, improved charging is feasible.

Direct cost recovery for environmental services or resource management is also rare but has been applied. Charges such as charges for abstraction licences, or discharge permits may be linked to environmental management (see C6 and C7.2).

§ Lessons

Water pricing is applicable under almost all circumstances, but there are several preconditions for a successful cost recovery policy:

- Public acceptance of the need for cost recovery; people may need a public information campaign to persuade them, if they are used to regarding water as a gift of nature;
- Higher charges are easier to implement when there is an associated service improvement (A3.2); -Strong political backing, and the avoidance of extravagant and unaffordable promises before elections;
- Thorough demand surveys and consultation with consumers are essential. In poorer communities with underdeveloped services, willingness-to-pay surveys can be a useful pointer to setting appropriate tariffs, provided that the people who actually pay (often women) are actually consulted;
- Careful provision for poor or disadvantaged consumers. Direct support may be more effective, since subsidies often benefit the rich rather than the poor. -Financial transparency including independent auditing and regular and automatic price adjustments (based e.g. on inflation);
- Firm and clear public regulation of tariffs set by the private sector. (Because of the lack of competition and the high social sensitivity of water, governments usually regulate prices whether charged by public utilities, municipalities or private concessionaires.)
- Consumers tend to respond to price increases by greater care in water use; -The structure of tariffs is just as important as the level of charges in achieving equity and cost recovery aims; -Private companies find it easier to levy and raise charges than their public counterparts.

Key organisations

Organisation for Economic Co-operation and Development (OECD)

The OECD groups 30 member countries sharing a commitment to democratic government and market economy. Its work covers economic and social issues from macroeconomics to education, development and science and innovation.
www.oecd.org

Selected references and websites

Rogers, P., Bhatia, R., and Huber, A., TAC Background Papers, no. 2: *Water as a Social and Economic Good: How to Put the Principle into Practice*, Global Water Partnership, Stockholm, Sweden, 1998. www.gwpforum.org/ > Library – Publications > TEC Background papers no.2 The paper reviews the Dublin principle of Water as an economic good. It establishes the differences between the costs of water, the value of water and the actual prices charged for water. The paper shows that costs and value are based on technical/economics concepts and prices are political/social choices. Several examples are given of the differences between costs, value and prices from India and Thailand. www.gwpforum.org/servlet/PSP?iNodeID=215&itemId=28 Home page www.gwpforum.org/> Library – Publications > TEC Background papers no.2 (available as pdf file). (See also C7.1).

Paul Deverill, Simon Bibby, Alison Wedgwood and Ian Smout, *Designing water supply and sanitation projects to meet demand in rural and peri-urban communities – Book 3*. Ensuring the Participation of the Poor. WEDC 2002 ISBN: 1 84380 018 7

Pricing and service differentiation of utility water and sanitation services for the poor: a strategic marketing approach; a project to study how utilities can use pricing and service differentiation to benefit all and move towards financial sustainability. This develops a methodology for water utilities to structure service delivery and tariffs to serve low-income customers. Contact: Kevin Sansom, DFID, www.lboro.ac.uk/wedc/projects/psd/index.htm

Practical Economics for Environmental Management, DFID 1998. See sub-reports by J. T. Winpenny on *Water* and H. J. Sunman on *Economic Instruments*.

C7.2 Pollution and environmental charges

§ **Characteristics**

Charges can be levied both to reflect the cost of the use of water as a natural resource (for example through demand management charges (C3) such as abstraction levies, or environmental charges (C7)) and to cover costs of service provision. This tool focuses onpollution and environmental charges. Environmental charges are designed to reflect cost of damage to the environment resulting from use of resources, whether surface water or groundwater. Pollution charges, a particular type of environmental charge, are designed to reflect the financial and economic costs of discharging wastes into the environment. By levying a charge, polluters are encouraged to reduce their polluting discharges, and in effect are paying for the reduction of the ambient water quality (in the same way as charges are levied for consumption of water by users).

A charging system has the advantage over pure regulation in that it permits some flexibility in the way firms or other polluters respond. A system combining charges and standards may be best of all since standards provide a greater certainty of outcome than prices alone. Other types of environmental charge include levies on abstractions, or charges reflecting the value of the environmental resources used, and provide an incentive for users to change their behaviour, in response to a price change.

Pollution charges can be levied on specified pollutant discharges on the basis of load and/or concentration, and can reflect environmental damage imposed by pollutants. (Note that pollution charges are distinct from sewerage or wastewater treatment charges, which are tariffs or cost recovery charges, see C7.1).

A desirable pollution charge should:
- Reflect the environmental costs of wastewater pollution;
- Bear some relation to marginal abatement costs faced by the polluter (e.g. industrial enterprise or municipality) and be high enough to induce some investment in pollution reduction;
- Generate useful amounts of revenue for clean-up actions;
- Credit polluters for the release of clean effluent for dilution and mixing.

Levying charges on diffuse (non-point) pollution, e.g. from farms, is difficult to carry out directly, and tends to be done by proxy (acreage, number of cattle, etc) or product (e.g. tax on fertiliser).

Although pollution charges offer a useful incentive to polluters to reduce their polluting discharges, most of the established schemes have as their main aim the collection of revenue to finance pollution abatement programmes. This can effectively raise public support for the charges. The charge in itself offers an incentive to reduce discharge. Revenues from environmental charges are sometimes accumulated to special funds earmarked for environment/conservation activities. As with regulations, pollution and environmental charges need effective regulatory and management capacity (see B2.3). It is important to ensure the acceptability of charges if they are to be effective. Pollution charges can be effective where there is transparency and a clear regulatory framework.

§ **Lessons**
- Few pollution charges are set at levels high enough to encourage to firms to spend sufficient on pollution abatement to meet pollution standards, but the existence of a charge, even at a low level, provides some incentive and may be helpful in raising awareness of the costs of pollution.
- Pollution charges need to be administered as part of an overall system of regulation.
- A precondition for successful pollution charges is the presence of a well-developed monitoring and measuring system (see also C1).
- Pollution charges have a stronger incentive effect on the polluting party if it has to bear the cost of the charge itself and cannot pass the costs on to consumers.
- Planned progressive increases in charges are useful in allowing dischargers to adjust their processes over a given time period.

Key organisations

RIZA - Institute for Inland Water Management and Waste Water Treatment, The Netherlands RIZA is the research and advisory organisation for the Directorate-General for Public Works and Water Management on inland water management in the Netherlands and its international river basins. RIZA is a leading international centre of knowledge for integrated water management. The institute collects data on and conducts research into water quality and quantity. This wide-ranging remit requires a multi-disciplinary

approach. Biochemists and hydrologists, economists and management experts are available in the institute. riza@riza.rws.minvenw.nl, www.riza.nl RIZA, PO Box 17 8200 AA Lelystad, The Netherlands. Tel +31 (0)320 298 411, fax +31 (0)320 249 218

Selected references and websites

Development of a charge system for discharging into water resources – An application of the polluter pays principle.
This on-line article provides a useful example of the application of policy related to water resources pollution and placing a price on the use of water for the removal of waste. It is part of the implementation of the new water law reforms in South Africa. www.thewaterpage.com > Search "polluter pays principle" > The Water Page – SA Pollution

Integrating environment and economics: the role of economic instruments.
Provides a review of the use and effectiveness of pollution charges and other economic instruments in OECD countries.
Environment Directorate, OECD Paris 1993

C7.3 Water markets and tradeable permits

§ **Characteristics**

Water markets & transferable water rights: these tools allow sales of water allocations from one group to another. The markets can apply to either surface or groundwater, and the transfer of rights may be seasonal or permanent. Such markets can:

- Enable water to be transferred from lower- to higher-value uses
- Overcome the resistance of the entrenched property rights of existing holders
- Be a cheaper way for communities or farmers to obtain their water than the alternatives,

which may include creating a new source of supply
- Be used by environmental champions to buy out existing users and preserve the water for habitat or natural amenity.

Water auctions: public authorities make water available to the highest bidders at public auctions. The water lots could be on a daily, weekly, seasonal or even annual basis. Auctions are a useful source of revenue to public authorities, but they can create conflicts of interest if the revenue raising function becomes more important than the issue of efficient water allocation.

Tradeable Pollution Permits: Individual polluters can be allowed the right to buy and sell quotas of emissions subject to an overall upper quota on total emissions. Nutrient trading is a potentially useful instrument to improve water quality.

Certain preconditions are necessary for water markets and auctions to be successful:

- A clear and permissive legal framework, within which individual holders of water rights can transfer their rights, either temporarily or permanently, to other parties (see A2);
- A procedure for considering the impact of these trades on third parties (e.g. downstream users) and, where appropriate, for arranging compensation;
- Recognition of the potential environmental impact of individual trades, and the need to invoke relevant safeguards;
- The physical means of transferring water between potential users;
- Strong provision by Government of the legal, social and economic environment for effective market operation;
- Regulation to avoid build up of monopolies is essential.

§ **Lessons**

- As with charging systems, it is important to ensure that vulnerable groups are protected.
- There is a need for a mechanism for initial allocation of rights (whether for water or pollution discharges) which should be seen to be fair, and be equitable and effective.
- Experience suggests that water auctions can be efficient and effective in some situations.
- Trading schemes can be intensive in terms of information and enforcement, and hence be costly to administer; the high transaction costs of certain markets may outweigh their benefits.
- Markets can help identify the highest value use and assist in conflict resolution (see C5).
- Water auctions may be useful to adjudicate water allocation under competitive conditions, but must be regulated to prevent monopoly build up.
- Markets work best where there are a large number of traders and transactions, so that the risk of build up of monopolistic "market power" is minimised.

Selected references and websites

Marino, M., and Kemper, K. E., *Institutional frameworks in successful water markets: Brazil, Spain and Colorado*, USA World Bank, Washington D.C., ISBN 0821344595, 1999.

Simpson, L., and Ringskog, K., *Water Markets in the Americas*, World Bank, Washington D.C., ISBN 0-8213-4088-3, 1997.
This paper summarises the practice of water markets as an instrument for improving the efficiency of water use.

Landry, C. J., *Saving our streams through water markets – A practical guide*, Political Economy Research Center, 1998.
This manual will help practitioners and policy makers take the first steps toward using water markets to protect instream flows. www.perc.org or www.perc.org/sossum.htm
Contact: Fax: (406) 586-7555 E-mail: perc@perc.org.

Bauer, C. J., *Against the current: privatisation, water markets and the state in Chile*, Kluwer, Dordrecht, ISBN 0-7923-8227-7, 1998.
This book is the first empirical and interdisciplinary study of water markets in Chile, which is the leading international example of free market water policies. The book combines law, political economy, and geography to analyse the disadvantages, problems, and wider contexts of water markets.

C7.4 Subsidies and incentives

§ **Characteristics**

Subsidies can be used to protect vulnerable and poor groups in society but great care is necessary to ensure that they do not simply benefit the better off.

However, subsidies often encourage excessive consumption of water, either when its use is directly subsidised or where the prices of goods and services that consume water are subsidised, or affect its use. Examples include:

- Industrial plants that are heavy water users, operating in a protected, subsidised regime, lack any incentive to conserve water or use it efficiently;
- Low prices in the power/energy sector encourage excessive use of water;
- Subsidised prices for "thirsty" farm crops, causing heavy use of irrigation water.

Setting the right price signals ('getting prices to tell the truth') means that existing distortions in the workings of the market should be removed. For instance, farm prices should become more market-based or industrial firms should operate in a less protected environment or the prices of energy should be liberalised.

Taxes and/or subsidies need to be applied in a selective way to reflect environmental considerations ("green" taxes and subsidies) or other specific policy aims. For example, polluting farm chemicals should be taxed while water-efficient appliances could be subsidised. Subsidies can be used to encourage changes in behaviour (as for instance, to encourage the introduction of drip irrigation, see C3).

Pricing of water alone (C7.1) will not have its desired effect if it is frustrated by policies elsewhere that pull in the opposite direction. This lesson has been clearly learned from attempts to reduce water use in agriculture and to reduce the waste of water and pollution in highly protected industries.

All major policy areas affecting water use should be "joined up" (see also A3 – financing structures and A1, water policies). The market signals faced by water users (whether individual households, institutions, firms or farmers) should be consistent and persuasive.

§ **Lessons**

- The introduction of new subsidies should be very carefully considered, since they tend to be difficult to remove and can become a fiscal burden. However, they can be useful to encourage the uptake of unfamiliar technology (e.g. recycling and water-efficient irrigation methods) or stimulate pilot schemes that might lead to a wider acceptance of desirable practices.
- Subsidies (such as low-interest loans) might also be a way of tackling stubborn market failures (e.g. the habit of needing excessively short pay-back periods for recycling or water-efficient appliances).
- Subsidies can also be used in combination with a tax/charge regime to make the regime more acceptable, since people and firms paying the tax can see that the revenues are being applied for the same purpose.
- Policy reforms aimed at the removal of economic distortions can have double the benefit ("win-win" policies) of economic and environmental gains.
- But there is also *a risk* that general economic reforms that do not address distortions specific to the water sector may aggravate the latter's problems. For instance, trade liberalisation may increase pressure on a natural resource like water, unless accompanied by a concurrent water reform programme. (See policy formulation A1).
- Subsidies may help those who already water services, but not benefit those without access to water.

Key organisations

Organisation for Economic Cooperation and Development (OECD)
The OECD groups 30 member countries sharing a commitment to democratic government and market economy. Its work covers economic and social issues from macroeconomics, to education, development and science and innovation.
www.oecd.org

Selected references and websites

Winpenny, J., *Reforming water resources policy: a guide to methods, processes and practices*, FAO, Rome, ISBN 92-5-103506, 1995.

Water as a social and economic good; how to put the principle into practice. TEC Paper No. 2, GWP (see Section C7.1)

C8 INFORMATION EXCHANGE – Sharing knowledge for better water management

The Rio statement on sustainability emphasised the need for accurate information to facilitate decision-making in water resources management. This information may come in many forms and styles, for example: written reports; biophysical, economic and social data, and first-hand experiences in implementing land and water management practices.

An IWRM information exchange process allows professionals, practitioners and the general

public to exchange and share experiences in implementing IWRM. This exchange and information development becomes a capacity building tool (B2.3). It involves getting wide-ranging and appropriate information into the hands of water professionals, especially those in government decision making agencies, and helping them to share information, ideas, and experiences.

The process places importance on all relevant information sources, not just those from 'technical experts'. It engages local communities by providing opportunities for discussion and enables them to provide and gain access to information readily. In the ToolBox there are many tools associated with communication, sharing of information, building of knowledge and capacity, see B2, C1, and C4 for example, and this set of tools looks at the techniques for managing information, and supporting the IWRM process.

There are four broad types of information; all are involved in supporting IWRM:

- *Data* (quantifiable and qualitative facts about the characteristics of water resources (such as quality, volumes, frequency of occurrence, spatial variability);
- *Information* – interpreted data (how these data can be assembled into meaningful patterns for specific purposes);
- *Knowledge* – information held in the mind (understanding the implications of trends and values in data over time, personal and corporate understanding of resource use practices and their impacts);
- *Wisdom* (agreement about commonly accepted methods of using water resources to ensure sustainability).

To bring these together requires the systematic management of a wide range of materials; the tools described in this section are Information Management Systems (C8.1), and are also discussed in C1.3 (Modelling in integrated water resources management) and C4.2 (Communication with stakeholders).

Alongside this concrete information are people's perceptions. Individual motives, cultural expectations, social conditioning and different priorities can all affect decision making.

C8.1 Information management systems

§ **Characteristics**

'*Information management systems (IMS)'* is the term for a range of electronic systems that arrange, store and exchange data and information. These electronic systems replace more traditional printed catalogues. Two types of IMS, of particular importance to IWRM, are *bibliographic information (and knowledge*) systems (C8.1) and *geographic information* systems

(C1.3). *Bibliographic information systems* are often located within government agencies and commercial companies, and typically include:

-Monitoring and evaluation tools;
-Tools to ensure that correct signals are delivered and received in information exchange;
-Tools to establish best management practices by benchmarking (linked to B1.6).

A *Geographical Information System (GIS)* is an inventory of natural resources (soil, landform, water and vegetation) of an area of the earth's surface. It brings together data and information for decision makers for water planning and management judgements. A GIS allows a user to see and locate patterns of settlement, land use and natural resources in a water catchment, and identify relationships within the data. It can also show land systems, settlement features, best management options, land ownership and planning zones, demographic information and other socio-economic data. With visualisation technology, GIS can allow the user to create 3-D images of a water catchment, 'fly over' these images and view the landscape from different angles, to view changes in land use or environmental conditions over time. A further use of GIS is to geo-reference research and government reports, and to track progress in the implementation of an IWRM Strategy (see also C1.3).

The effectiveness of a water IMS can be measured by:

- The number and variety of actions (e.g. farming practices, improved water management plans) which follow receipt of information;
- The degree to which the agency, farming community, or other groups form a discrete entity for dialogue and information exchange;
- A range of organisational performance indicators (e.g. customer-client dialogue, reporting mechanisms and financial stability).

§ **Lessons**

Knowledge of the social system of a particular setting is vital before designing an IMS. Information is needed on the social structures, gender issues, stage of economic development, human and technological resources and managerial capacities of water resources managers.

- The use of an IMS can lead to better and more consistent decisions.
- The ideal GIS for water managers is an Internet-based, user-friendly system which allows ease of access for a specified and agreed number of purposes. A flexible design will allow users to adapt to new information needs over time.
- GIS works best when the questions like the following are settled in advance. · Who will own and who will manage the GIS? · Has the scale of application been determined and agreed on to suit all users? · Have financial resources been targeted to fund a corporately owned GIS? · Have the data layers been specified? What extra data sets are needed?
- User perceptions are not easy to store in an information management system. (See also C4, use of information in conflict management and C1.3, modelling for water resources management, C1.4, Developing water management indicators, and C4.2, communication with stakeholders

Key organisations

GLOBWINET is an Information Network on IWRM focusing on transboundary river basin organisations, water legislation, and national water administration. GLOBWINET is a GWP associated programme. The first regional node of GLOBWINET is SAWINET in Southern Africa. www.globwinet.org

Selected references and websites

Nieuwkamer, R. L. J., Wolfert, H. P., Tol, A. C. van, and Appelman, K., *River management: framework for development of information and decision support systems for integrated river management,* CUR/LWI, Gouda, 1996.

Browne, N., *The INTERWATER Guide to Information Sources.*
The Guide aims to identify and describe a selection of useful sources of information relating to water supply and sanitation in developing countries. It includes sources available on the Internet as well as those published in conventional formats. www.wsscc.org/interwater/

Organising Local Documentation Services for the Water and Sanitation Sector: guidelines, IRC, The Hague, 1994.
Provides basic guidance on how to organise collections of documents in sector institutions in such a way as to be able to find information quickly and easily, without the help of professional librarians or documentalists.

The Water Information Network (WIN)
WIN is the information system of the Netherlands Water Partnership (NWP). WIN is a relational database very similar to the GWP ToolBox. WIN functions as the main digital entry point to the Dutch water sector and contains a broad spectrum of water-related news, events and profiles of Dutch organisations, companies and people. www.nwp.nl
The Water Information Network, PO Box 3015, 2601 DA Delft, The Netherlands
Tel 0031 15 251728, Fax 00 31 15 2151759, Email: info@nwp.nl

Nieuwkamer, R. L. J., Wolfert, H.P., Tol, A. C. van, and Appelman, K., *River management: framework for development of information and decision support systems for integrated river management*, CUR/LWI, Gouda, The Netherlands, 1996.

ISKM (Integrated Systems for Knowledge Management): An outline of a participatory approach on environmental research and development initiatives. The ISKM framework promotes participation and self-help in managing natural resource projects by providing clear communication pathways to support dialogue and action. As such, ISKM is not a new project type or innovative development concept, but rather a specific approach that emphasises a number of key steps applicable to developing the knowledge and action needed to change problem situations constructively. The framework consists of familiar processes used in other fields of co-operation, and was designed around basic management actions, which include: identifying the problem and setting a management target; searching for information on how to achieve the target; implementing the best management practice available; evaluating the outcome; and adapting the management if required. The approach comprises two phases, which combine to form an effective learning environment. Contact: Will Allen, Landcare Research
www.landcareresearch.co.nz/research/social/iskm.asp

C8.2 Sharing data for IWRM

§ **Characteristics**

Almost everyone in the water sector could benefit from sharing knowledge and data with peers in other countries and sectors. Knowledge to be shared includes technical data and technical information as well as institutional and financial information. But sharing knowledge is not the norm and requires the breaking down of bottlenecks such as the bureaucratic rules which prevent professions of one discipline from developing knowledge in other disciplines, or the lack of

financial or career incentives for a staff person to take time to upgrade his or her skills. Personal contacts, trust and confidence-building measures are needed. (See also C4.3, information and transparency.)

Mechanisms and channels for such knowledge sharing include participation in joint training programmes – workshops, seminars, study tours and conferences. Specific training courses and capacity-building efforts can be tailored to specific needs in specific countries**.** International agencies and networks (such as the GWP) can be instrumental in building and sharing knowledge.

Data sets of resource conditions, socio-economic data etc. need to be available and widely shared, and users need to have confidence about the use and applicability of data. These national data sets are often owned and managed by governments, but they should be available in the public domain (see also B1.1 and C1.1).

New techniques have been developed to ensure that specific stakeholders play a significant role in data management for activities such as watershed management, water resources planning, and social and biophysical impact assessment. These techniques include Interactive Group methods, Delphi Techniques (including Adaptive Environmental Assessment and Management (AEAM)), and computer based techniques which can use community and expert advice to improve decision-making. These techniques use both expert knowledge and local wisdom about resource use in the construction of models to explain catchment processes.

However, building uncontested data sets can take time and should be seen as a process. Where there are disputes over data and research then conflict management tools can support the building of knowledge for IWRM. Data sharing can contribute to conflict management as while building water awareness in society (see also C5).

§ **Lessons**

- Sharing knowledge requires an open mind, stimulated by suitable incentives; mutual confidence may take time to build but is essential.
- Transferring knowledge from one country to another must take account of specific cultural and political contexts.
- At a technical level, information and data sharing systems should be:
  - Based on people management (empowerment and capacity building of organisations) as well as technologies, and able to integrate multidisciplinary information.
  - Demand-driven so that system design and construction and outputs are directed toward the end users.
  - Flexible so that the sharing system can be used in a variety of locations or situations.
  - Transparent and rigorous so that technical and non-technical persons (wide range of stakeholders) can follow the process of information generation and evaluation.
  - Interactive, to ensure a participatory decision-making process.
  - Easy to understand and helpful in increasing awareness of the issues.

Key organisations

International Water and Sanitation Centre (IRC), Delft
IRC is an independent, non-profit organisation that works in water and sanitation. IRC's work concentrates on community-based technologies, participation and community management, gender awareness, hygiene promotion, operation and maintenance, monitoring and evaluation, information management, community water resources management and resource centre development. It provides news and information, advice, research and training, on low-cost water supply and sanitation in developing countries.

www.irc.nl/
Contact: Fax: +31-15-219 09 55, E-mail: general@irc.nl

The third World Water Forum will bring together thousands of water stakeholders to share knowledge on water resources management. Secretariat of the 3rd World Water Forum, Tel: +81 3 5212 1645, Fax: +81 3 5212 1649 E-mail: office@water-forum3.com, www.worldwaterforum.org

The WCA infoNET information system is an integrated information on water conservation in agriculture with direct access to publications, documents, data, computer programmes and discussion. www.wcainfonet.org

WELL Resource Centre Network For Water, Sanitation and Environmental Health. WELL is a resource centre network providing services and resources in water, sanitation and environmental health. www.lboro.ac.uk/well/

Selected references and websites

OASIS is a Resource Centre sponsored by the UK Department for International Development (DFID) working in partnership with the Department, other donors, UN Agencies, developing country governments, NGO's and other stakeholders to provide expertise in water resources issues. This expertise is drawn from the OASIS global network of premier organisations. www.oasis-water.net/html/welcome.html

CASE STUDIES – IWRM IN PRACTICE

CASE STUDIES FROM THE IWRM TOOLBOX JANUARY 2003

This section contains summaries of case studies which are to be found in the GWP ToolBox for IWRM. The cases are on the website, and can be downloaded as PDF files. Many of the case summaries listed below have fully developed case studies attached, although some are still work in progress. An abstract for all these cases is to be found on the website however.

Australia: Implementing water reform in Queensland (#24)

This case describes a series of legislative and policy developments which were undertaken to reform the water sector in the State of Queensland, Australia, in response to national government water reforms, deteriorating environmental quality and over-exploitation of both surface and groundwater resources. It illustrates how several tools of IWRM can be implemented simultaneously. *Tools used*: A1.1, A2.1, A2.3

Australia: The Murray-Darling Basin Commission (#25)

This case describes a cross-boundary integrated river basin management organisation which took IWRM as a fundamental guiding principle. It illustrates a broad range of relevant activities for river basin management reflecting the comprehensive nature of the goals and activities of the organisation. *Tools used*: A1.1, B1.2, B2.1, C3.1, C3.2, C3.3, C7.3

Australia: Building a Catchment Information Exchange Programme (CIEP) (#26)

The Catchment Information Exchange Programme is a knowledge management programme for watershed managers. This case study describes a prototype information exchange process which allows water resources management professionals and users to exchange best practice information for land and water management for different parts of a watershed, catchment or river basin (that is, it can be applied at many different scales). The case also points out some of the institutional barriers to such exchange programmes. *Tools used:* C4.2, C8.1, C8.2

Australia - Groundwater quality protection in Tomago coastal sandbeds (#134)

Describes the process of implementing the precautionary principle to high quality coastal groundwater where sand mining potentially threatened the future of drinking water supplies. Case involved use of policy and science to balance economic activity and environmental objectives.
Tools used: A1.2, B1.5, C2.5, C5.1, C7.1

Australia - Quantification of high flow rights for environment, power generation and other uses (#135)

This case describes the application of environmental flow rules in the Hunter River, in Eastern Australia, the demand for quantification of a high flow right by the major power generation operator in the valley and the subsequent resolution. *Tools used*: A1.2, A2.1, C1.3, C2.5, C5.1

Belgium (Flanders) and the Netherlands - Cross-border co-operation for small-scale river basins (#127)

This case study describes cross-border co-operation between the Netherlands and Flanders within the River Basin Committee for the River Dommel. In this Committee, local and regional governments discuss how water quality and quantity can be improved. *Tools used*: B1.4, C2.2, C5.2, C5.3, C8.2

Belgium, France and the Netherlands: International co-operation in the Scheldt and Meuse river basins (#28)

Issue linkages as a means to overcome upstream-downstream conflicts of interest in the Scheldt and Meuse River Basins, and River Basin Commissions as a forum for addressing such conflicts and promoting co-operation. *Tools used:* B1.2, C5.1, C5.2, C5.3

Benelux: Water conservation and farmer participation (#29)

The present case study describes a process for improving water use efficiency in an agricultural region by involving farmers and market gardeners in implementing technical and management solutions. It also illustrates how a water resources problem affecting two countries can be solved through transboundary co-operation. *Tools used*: B2.1, C3.1, C4.2, C8.2

Brazil: River basin committees in Sao Paulo State as instruments of participatory IWRM

(72)

The state of Sao Paulo has adopted a law creating River Basin Committees (RBC) with equal representation of the state, municipalities, and civil society. This requires, amongst other aspects, the creation of a co-ordinating committee and RBCs, and the preparation and adoption of state plans for water resources. *Tools used:* A2.3, B1.4, B2.1, C2.2

Brazil: Believe in belém novo, it can do more – city of Porto Alegre (#98)

Using a participatory process to develop income-generating strategies, Porto Alegre and local residents identified and implemented measures to increase the efficiency of local fishermen, including the construction of waterfront facilities and the creation of a co-operative. This had a positive effect on the shoreline environment and social fabric of a very marginalised community. *Tools used*: B2.1, C4.2

Brazil: Community reforestation project – city of Rio de Janeiro (#100)

Programmes to address environmental degradation in local governments can be designed to employ local residents and encourage community input into management practices. By involving the local community in environmental projects, the long-term effectiveness of the undertaking can be ensured. *Tools used:*C 2.1, C4.2

Canada: The Walkerton tragedy and IWRM Failure (#133)

This case examines the tragic events of May 2000 in Walkerton, Canada, when 7 people died and 2300 became ill due to unnoticed contamination of the water supply system. The case reveals the need for vigilance in the maintenance and regulation of municipal water supplies. *Tools used:* A2.2, B1.6, B2.3, C2.5

Central and Eastern Europe – Civil society and the Danube Basin Planning (#120)

This case is about non-governmental organisations raising awareness about their participation in the Danube River Basin Management Plans in nine Central and Eastern European countries, according to the European Union's Water Framework Directive 2000/60/EC. *Tools used:* B1.9, B2.1, C2.2, C4.2,

China: Environmental protection and poverty alleviation at Baixi Reservoir (#117)

The case describes how commercial interest and environmental protection of a new reservoir in a mountainous valley in Eastern China were combined in a programme for economic development for local communities. *Tools used:* A2.1, A3.1, B1.7, B2.2, C4.2, C5.3

China: Mountain-River-Lake integrated development programme, Jianxi (#118)

This case describes a comprehensive programme to reverse severe environmental (and economic)

degradation in the province of Jiangxi, Eastern China using an IWRM approach. *Tools used*: A1.2, A3.1, B1.10, C1.1, C1.2, C1.3, C2.2, C4.2, C8.1

Colombia: Participatory Management of the Watershed at La Quebrada El Chocho (#76)

Illustrates the use of participatory diagnostic and management methods to develop an IWRM approach in a small watershed (Campoalegre village area with a population of 1,500). With the community's participation, new approaches to the rational use of water, e.g. good management, regulations, payment for water, could be introduced. *Tools used:* B1.9, B2.2, C1.1, C2.5, C4.3

Colombia: Involving children in the protection of water resources (#106)

An approach for linking the Environmental Educational Plan to the local situation, leading to the involvement of primary schools in the protection of the local water resources *Tools used*: C1.2, C1.4, C4.1, C4.2, C4.3

Colombia: Building institutional co-ordination for water resources management (#108)

The case describes the application of a Common Agenda to integrate activities between water-related institutions for the protection, use and management of water *resources in Colombia. Tools used:* A1.1, A1.2, A2.1, B2.1, C5.1, C5.3

Colombia: The association of community organisations and IWRM (#109)

An organisational strategy to strengthen the continuity of community management to the provision of public services (W&S) and the conservation of water resources. *Tools used:* B1.9, B2.1, C5.1, C5.3, C8.1

Costa Rica: Introducing environmental charges for watershed protection (#1)

This case describes how a new law was passed in Costa Rica, and a number of pilot projects on water pricing were implemented. Generated funds support catchment protection initiatives. *Tools used:* A1.2, A2.3, C6.4, C7.1

Costa Rica: How an IWRM approach would achieve better water allocation - The Lake Arenal Watershed (#10)

This case describes the complex interplay between people, ecosystems and water users in Lake Arenal, a reservoir used to generate hydroelectricity and irrigate agricultural land, and analyses the difficulties involved in achieving integrated management of their water resources. *Tools used:* B1.4, B2.1, C2.2, C5.3

Egypt: The role of water users' associations in reforming irrigation (#110)

The case describes the institutional and management changes involved in introducing participatory irrigation management in Egypt, in the context of wider policy changes. The government of Egypt is now committed to a long-term irrigation improvement programme, which will continue for the next 15 years.

Central America - The Plan Trifinio for the Upper Lempa: Opportunities and challenges for the shared management of transboundary Watersheds (#126)

This case study describes the management of a transboundary watershed shared by three countries – El Salvador, Guatemala and Honduras – and how, through the political willingness of these three countries, an international treaty was adopted. *Tools used:* B1.2, B1.5, B1.9, C2.2, C5.1, C5.2

Estonia and Russia: Managing transboundary waters in the Lake Peipsi/Chudskoe Basin (#16)

This case describes the actions and initiatives required to establish effective transboundary cooperation in lake management, following the break-up of the Soviet Union. The environmental quality of Lake Peipsi has been deteriorating for the past fifty years. The break-up of the Soviet Union caused problems, as there was no international mechanism for sharing the management of what became a transboundary state. But political changes (e.g. Estonia is now an Accession country to the EU) and the need for economic co-operation of the lake – a shared resource (for fishing, transport, etc) – have stimulated transboundary co-operation following IWRM principles. *Tools used*: A1.2, B1.2, B1.9, B2.1, C1.1, C2.2, C4.2, C4.3, C5.2, C8.2

France – Management plan for the Astian Aquifer (#20)

This case is concerned with establishing an institutional structure for the management and restoration of groundwater located in the littoral area of the "Languedoc-Roussillon" region, France, where competing uses (agriculture and tourism) threaten the aquifer.
Tools used: C1.2, C3.3, C8.1

Guatemala: Towards IWRM in the basin of Lake Atitlán (#9)

Efforts to move towards IWRM approaches in the Lake basin are hampered by poor coordination, weak investment funds and little public participation. The case illustrates that without a properly established enabling environment, IWRM is hard to achieve. *Tools used*: B1.4, B2.1, C2.2, C4.2

Honduras: Community-government water management in urban marginal areas (#74)

Joint government-community approach to building non-conventional local water supply systems, linked with community development and approaches to protect local watersheds through conservation of water and land resources. Involved 45,000 people in a rapidly growing peri-urban area during the 2.5-year pilot phase. *Tools used:* B1.9, B1.10, C3.3, C7.1

Honduras C.A. – Flood warning system, La Masica Municipality (#125)

This case study describes a flood warning system in La Masica Municipality, Honduras C.A. It was based on a low technology and simple management system so that it could be implemented by the combined forces of the municipality, the community and national and international organisations. It has answered the urgent need of people living in areas at risk from floods. It aims to ensure the sustainability and adequate management of the system so that human lives can be saved. *Tools used*: B1.9, B1.10, B2.1, B2.2, C2.5, C4.2

India: Gujarat Jal-Disha 2010 - Community water management in the context of drought (40)

A state-wide initiative in Gujarat, involving many communities in a variety of local settings. It illustrates the processes required for building societal consensus for sustainable water resources management and links state level planning and instruments to local management. *Tools used:* B1.9, B2.1, C1.1, C3.1

India: Water as a catalyst for development: a case study in a tribal area (#116)

This case study illustrates the role of water harvesting and storage in promoting agricultural and rural development in a semi-arid area of Gujarat, India.
Tools used: B1.9, B2.1

Indonesia: Participatory strategies for integrated bay and watershed planning and management (#85)

This case describes participatory strategies and management plans applied to two similar bay management projects: the Bay of Santa María in Mexico and the Balikpapan Bay in Indonesia. *Tools used*: A1.2, B1.5, B2.2, C1.2, C2.2, C5.2

Japan: Rainwater management, Sumida City (#99)

This case describes how a city has created a rainwater utilisation system to combat problems of flooding and inadequate water supply. In wider terms, it shows how co-ordinated action by a large number of local people has the potential to improve IWRM conditions and urban water security in a wide variety of areas. *Tools used:* A1.2, C3.3

Jordan: Amman Zarqa Basin - Using reclaimed water (#79)

This case demonstrates use of IWRM tools to incorporate water and its re-use in water resource planning in the Amman Zarqa Basin in Jordan, working with farmers' groups. *Tools used:* C1.2, C2.2, C4.2, C6.1

Kenya: Community management in Lake Victoria Drainage Basin (51)

This case describes a process of decentralisation of water resource management involving water resource assessment, focus on poverty alleviation and a participatory approach. Combines government and community involvement in decentralised water management. *Tools used*: B2.1, C4.2

Malta: Use of leakage control in water management strategy (#22)

The case study illustrates the importance of setting leakage control in the wider strategic management at corporate level, with significant implications for resource use in Malta. *Tools used*: C1.4, C3.1

Mekong River Basin: Transboundary water management (#137)

The case describes the development of and the resources required for the co-operation of riparian countries along the Mekong River, resulting in the Mekong agreement on water allocation. *Tools used*: A1.2, A2.1, A3.1, B1.2, C5.1

Mexico: Civil society initiatives to restore the Xochimilco Watershed (#71)

This case describes how mediation and blending of traditional (indigenous) and modern water management techniques can be brought together to restore water systems.
Tools used: A1.2, B1.9, B2.1, C4.3, C5.1, C5.3

Morocco: Community management of water resources in the Imlil Valley near Marrakech (#77)

The case highlights approaches to improving traditional institutions in 5 villages and the value of local indigenous solutions and technologies. It shows that failure to set issues in an IWRM context, taking the whole river basin into account, led to continued pressure on water resources. *Tools used*: A2.3, B1.9, B2.1, C3.3, C7.1

Morocco: Demand management in urban water supply (#103)

This case study highlights the problems facing the drinking water supply of the Rabat-Casablanca coastal area and the measures taken to reduce water demand. These measures are linked to technical issues, tariffs and the implementation of new ways of managing the drinking water and sanitation departments. *Tools used:* B1.7, C3.1, C3.3, C4.3, C7.1

Nicaragua - Evaluation of the National Water Action Plan (#12)

This case analyses why a 'text book' planning exercise in Nicaragua has failed to have any real impact. *Tools used:* A1.1, A2.1, A2.2, B1.3, C1.1, C7.1, C7.2, C8.1, C8.2

International co-operation in the use of the Niger River Basin (#46)

The case describes the Niger Basin Authority, a joint effort of the nine countries sharing the Niger Basin. The authority was established to enhance co-operation and foster, promote and coordinate studies and programmes relating to the basin. *Tools used:* B1.2, B1.4, C5.2, C8.2

Peru: Participatory regional development planning - the provincial municipality of Cajamarca (#97)

Inter-institutional consensus building for a sustainable development plan, bridging the interdependency between urban and rural needs. *Tools used:* B2.1, C4.2

Philippines: Economic incentives for water pollution prevention and abatement (#82)

This case describes an industrial wastewater effluent fee programme, which was developed to create economic incentives for industry to reduce wastewater discharges and raise revenues to finance local government management of the programme. *Tools used:* B2.3, C6.1, C7.2, C7.1

Philippines - Laguna de Bay resource use and allocation (#115)

Laguna de Bay faces problems related to increasing demand for its water resources for various uses including domestic water supply. While the present water quality is suited to its dominant use (fisheries), the challenge is to reach a certain water quality level that would satisfy the multiple and sometimes conflicting uses. This case illustrates that involving users more directly in conservation and management, and having effective regulations, can lead to a more sustainable use of the lake. *Tools used:* B1.5, B1.10, C4.2, C6.1, C6.2

Slovakia: Community-based management of wetland nature reserve Šúr (#119)

The management of protected areas involves different types of decision-making. Although formal and technical methods still remain a necessary element of any environmental decision-making process, it is now well recognised that they are insufficient on their own. In protected areas, planning and decision-making require the construction of formal and informal dialogue processes among major stakeholders, individuals and collectives. *Tools used:* A3.1, B1.9, C5.1, C5.2, C5.3

Slovenia: Awareness raising through school programmes (#4)

Public participation was seen as central to achieving a change in flood management to a more integrated approach in the Kamniska Bistrica River Basin. A broadly-based programme of seminars was used. This case describes some specific activities undertaken with children to raise awareness in children of IWRM concepts and shows how they helped to raise awareness in the community *Tools used:* B1.9, B2.1, C4.1, C4.3, C6.4

South Africa: Strategic management planning for low-income and unplanned communities - City of Cape Town (#101)

A stable economic base and a sense of community responsibility are essential to the provision and maintenance of basic services in low-income and unplanned communities. This can be achieved by involving a broad range of community interests and expertise in service delivery planning and implementation. *Tools used:* B1.6, B2.1

Spain: Managing water demand in the Upper Guadiana Basin (#18)

This case demonstrates how, under certain circumstances, groundwater depletion can be rapidly reversed through an integrated programme of legal and economic measures. *Tools used:* C3.1, C7.4

Tanzania: A national strategy for Integrated Coastal Management (#84)

This case describes the experience in Tanzania on building an enabling policy, institutional capabilities and a functional national programme for integrated coastal management. The participatory approach has involved interagency working groups and adherence to a strategic and adaptive policy process. *Tools used:* A1.1, B1.3, B2.2, C1.1, C5.1, C5.3

Tanzania: Critical analysis of river basin management in the Great Ruaha (#121)

Analysis of existing river basin management frameworks, multi-user perspectives and competition for water resources in the Great Ruaha River Basin, Tanzania. *Tools used:* B1.4, C1.2, C6.2

Thailand: Rainwater harvesting in the North-eastern Region (#38)

People's participation in cost recovery, operation and maintenance in a programme to modernise traditional rainwater harvesting and provide village water supply in the Northeast region of Thailand where rainfall is limited and irregular. *Tools used*: C3.1, C4.2, C7.1

The Netherlands: "Room for the Rhine" (#88)

The search for new types of flood protection measures and preventing future flood damage in the Rhine Basin. *Tools used:* A1.1, C1.1, C2.2, C4.3

The Netherlands - Integrated planning for the Veluwe Randmeren Region (#89)

This case describes the process of an integrated plan for the development of the Veluwe Randmeren, four lakes in the Netherlands, involving all relevant fields of expertise and stakeholders. *Tools used*: A1.2, B1.9, C4.2, C4.3, C5.2, C5.3, C8.1

The Netherlands – Separating rainwater drainage from wastewater sewerage systems in a

neighbourhood of 's-Hertogenbosch (#90)

This case study describes the separation of rainwater drainage from wastewater sewerage systems in the Netherlands and how stakeholder participation became an important part of the process. *Tools used*: A1.2, A2.2, C3.2, C4.2, C5.2, C6.4

The Netherlands: An integrated approach for combating surplus flood water in the northern part of The Netherlands (#136)

One of the most controversial measures in combating floods is the use of emergency overflow areas. Most other measures (even if they are more expensive or damaging to the environment) are usually more easily accepted by stakeholders. Accepting the fact that your house may be flooded deliberately (although this may only occur once in a lifetime) is next to impossible. Therefore a study was undertaken into the possibilities of using selected polder areas (pieces of low-lying reclaimed land) for controlled flooding, while taking all stakeholders into account. *Tools used*: A1.2, B1.9, C2.5, C4.2, C5.3

The Netherlands: Altering the course of the River Hunze in the provinces of Drenthe and Groningen to diversify land use (#144)

This project involves a great number of governmental and private partners who are aiming to realise a completely different natural landscape with possibilities for more diverse land use options than are feasible in a purely agricultural environment. *Tools used*: B1.7, B2.1, C5.2, C6.4

Tunisia: Reform of irrigation policy and water conservation (#19)

This case describes the introduction of a new irrigation strategy in Tunisia, designed to address growing water shortages and to introduce reforms applicable to both modern large-scale and traditional smaller-scale irrigation systems. *Tools used*: A2.3, B2.1, C7.1, C7.4

Turkey: Introducing participatory irrigation management (#57)

The case examines the move from centralised irrigation management to participatory approaches using Water Users' Associations in the region of Antalya, Turkey. *Tools used*: A2.3, B2.1, B2.2, C7.1

USA: Integrated flood plain management (#86)

This case describes integrated flood plain strategies in the US, involving the participation of three levels of government and the private sector. It shows how flood plain management requires integration of hydrology, engineering, and social science issues. *Tools used:* A1.2, C2.5, C6.2, C6.3, C6.4, C8.2

USA: Comprehensive water conservation strategies- City of Tucson (#102)

Effective water conservation programmes require diverse and comprehensive strategies designed to influence every segment of the population. The public education component of this work can be aided by partnerships with all sectors of the community, which can also contribute to the development of programmes tailored to each group. Financial incentives and education, used in conjunction with regulations and enforcement, can achieve positive results in water conservation. *Tools used:* C3.1, C4.2, C4.3, C6.2, C7.1

Vietnam's Law on water resources and related legislation for the implementation of IWRM (#112)

Vietnam's Law on Water Resources provides an enabling environment for the implementation of Integrated Water Resources Management (IWRM). While the law and related legislation provide excellent examples of the issues that must be considered, the process of adoption and progress in implementation highlight the potential constraints to and opportunities for the successful implementation of IWRM. *Tools used*: A1.2, A2.1, A2.3, B1.3, B1.4

Vietnam: IWRM principles strengthen the sustainability of rural water supply and sanitation (#122)

The case demonstrates that an integrated approach to rural water supply and sanitation provides a basis for sustainability, participation and positive impacts for the poor.
Tools used: A1.2, A3.1, B1.9, B1.10, C1.1, C4.3

International Co-operation in the use of the Senegal River Basin (#45)

This case describes the Senegal River Development Organisation, a joint effort of Mali, Mauritania and Senegal to manage the Senegal River Basin in a co-ordinated manner. *Tools used*: B1.2, B1.4, C5.2

Zimbabwe: Community management for small dams and irrigation (#87)

This case describes community management of resources, to improve long-term food and economic security among communities in Zimbabwe. It shows how to promote awareness of environmental issues and responsibility for the rehabilitation and protection of dams within the catchments of the communities. *Tools used*: B1.9, B2.1, C4.2, C5.2, C8.2

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