

A Handbook for Integrated Water Resources Management in Basins



The **Global Water Partnership (GWP)** is an international network whose vision is for a water-secure world. The GWP mission is to support the sustainable development and management of water resources at all levels.

GWP was created in 1996 to foster integrated water resources management (IWRM), and to ensure the co-ordinated development and management of water, land and related resources by maximising economic and social welfare without compromising the sustainability of vital environmental systems.

The GWP global network is open to all organisations involved in water resources management: developed and developing country government institutions, agencies of the United Nations, bi- and multi-lateral development banks, professional associations, research institutions, non-governmental organisations and the private sector.

More information about the GWP and access to the *Catalyzing Change* handbook, Policy and Technical Briefs, and TEC Background Papers is available at www.gwpforum.org. The ToolBox on IWRM can be accessed at www.gwptoolbox.org.



The **International Network of Basin Organizations (INBO)**, established in 1994, is an international network that supports the implementation of integrated water resources management in river and lake basins and aquifers. It links basin organisations and other government agencies responsible for basin management in order to promote the exchange of experiences and develop suitable tools for better basin management at transboundary, national and local levels.

INBO is organised by regional networks of basin organisations, in Africa, Latin America, Central and Eastern Europe, and the Mediterranean. It is also co-ordinating the Network of International Commissions and Transboundary Basin Organisations and the Europe-INBO group of European Basin Organisations to facilitate the implementation of the EU Water Framework Directive.

INBO is managing a multi-year action plan to support the creation and strengthening of basin organisations around the world.

More information about INBO activities and members is available at www.inbo-news.org.



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FOREWORD

Water issues touch all segments of society and all economic sectors. Population growth, rapid urbanisation and industrialisation, the expansion of agriculture and tourism, and climate change all put water under increasing stress. Given this growing pressure it is critical that this vital resource is properly managed.

The pressure on water resources highlights the hydrological, social, economic and ecological inter-dependencies in river, lake and aquifer basins. These inter-dependencies demand more integrated approaches to developing and managing water and land resources. There is a dynamic relationship between basin stakeholders and central governments, who have to work together to ensure the viability of their decisions in meeting sustainable development goals.

To address the multi-faceted nature of water management, many countries are now introducing an integrated approach to water resources management at the national and basin level. This includes improving institutional arrangements and working practices.

To support this process, the Global Water Partnership (GWP) and the International Network of Basin Organizations (INBO) have jointly produced this handbook to provide guidance for improving the governance of freshwater resources. In particular, the focus is on effective implementation of the integrated water resources management (IWRM) approach in lake, river and aquifer basins.

This handbook is written primarily for basin managers and government officials who need to take decisions related to water management. Together, they have to put in place management systems that will mitigate the impacts of natural hazards, supply water for productive purposes (agriculture, industry, energy, transport, tourism, fishing, etc.), supply water for social purposes (health and domestic services) and protect the environment. They must, therefore, manage conflicts on water resource issues between many different users. The handbook is also aimed at non-governmental actors who are involved in basin activities. It provides guidance for integrated water resources management that can be applied in basins regardless of the context (developed or developing countries, humid or arid conditions) or the current state of water governance.

In particular, the handbook:

- articulates the links between challenges and IWRM responses;
- suggests ways of setting up or modernising basin organisations to facilitate the adoption of the IWRM approach; and
- is practical and user-friendly with many examples of experiences in river, lake and aquifer management.

We hope this handbook will help to catalyse positive change for sustainable development. It is one outcome of the collaboration between the GWP and INBO networks to facilitate the adoption of better and more sustainable water resources management. We expect the handbook to be a dynamic document, updated frequently with best practices in water management for basins from all over the globe.

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The handbook can be downloaded from the GWP website (www.gwpforum.org) and INBO website (www.inbo-news.org), or requested on a CD-ROM from gwp@gwpforum.org and inbo@inbo-news.org.

ACRONYMS

AMASURLI	.....	<i>Autoridad para el Manejo Sustentable de la Cuenca Hidrográfica del Lago de Izabal y Río Dulce</i> – Authority for the Sustainable Management of the Lake Izabal and River Dulce Basin
ANBO	.....	African Network of Basin Organisations
AWIS	.....	African Water Documentation and Information System
CA	.....	Comprehensive Assessment of Water Management in Agriculture
CADC	.....	Commission on the Application and Development of the Convention
CAR	.....	<i>Corporación Autónoma Regional</i> – Regional Autonomous Corporation
CEENBO	.....	Central and Eastern Europe Network of Basin Organisations
CEIVAP	.....	Committee for the Integration of the Hydrographical Basin of River Paraiba do Sul
CICOS	.....	<i>Commission Internationale du Bassin Congo-Oubangui-Sangha</i> – International Commission of the Congo-Oubangui-Sangha Basin
CONAGUA	.....	<i>Comisión Nacional del Agua</i> – National Water Commission
CSD	.....	Commission on Sustainable Development
CWRC	.....	Changjiang Water Resources Commission
DHI	.....	Danish Hydraulic Institute Water & Environment
DSS	.....	Decision-Support System
EC	.....	European Commission
EMWIS	.....	Euro-Mediterranean Information System on know-how in the Water Sector

ACRONYMS

EU	European Union
Europe-INBO	European Basin Organisation Group for the implementation of the WFD
GIEBV	<i>Gestion Intégrée de l'Eau par Bassin Versant</i> – Integrated Water Management at Basin Level
GIS	Geographic Information System
GWP	Global Water Partnership
GWPO	Global Water Partnership Organisation
GWP CACENA	GWP Regional Water Partnership for Central Asia and Caucasus
GWP CEE	GWP Regional Water Partnership for Central and Eastern Europe
GWP China	GWP Regional Water Partnership for China
GWP Southern Africa	GWP Regional Water Partnership for Southern Africa
GWP TAC	GWP Technical Advisory Committee
GWP TEC	GWP Technical Committee
ICE	<i>Instituto Costarricense de Electricidad</i> – Electricity Institute of Costa Rica
ICPDR	International Commission for the Protection of the Danube River
ICWC	Interstate Commission for Water Co-ordination
IJC	International Joint Commission
INBO	International Network of Basin Organizations
IRBIS	Irtys River Basin Information System
IWRM	Integrated Water Resources Management
JDS	Joint Danube Survey
LANBO/RELOC/RELOB	Latin American Network of Basin Organisations – <i>Red Latinoamericana de Organismos de Cuenca/Rede Latino-Americana de Organismos de Bacia</i>
LWC	Local Water Commission
MASL	Mahaweli Authority of Sri Lanka
MDBC	Murray–Darling Basin Commission
MENBO	Mediterranean Network of Basin Organisations
MLIT	Japanese Ministry of Land, Infrastructure, Transport and Tourism
MRA	Malta Resources Authority
MRC	Mekong River Commission
MWR	Ministry of Water Resources
NBA	Niger Basin Authority
NGO	Non-Governmental Organisation
NSW	New South Wales
NWC	National Water Committee
NWRMP	National Water Resource Master Plan
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
OIEau/IOWater	<i>Office International de l'Eau</i> – International Office for Water
OMVG	<i>Organisation pour la Mise en Valeur du fleuve Gambie</i> – Organisation for the Development of the Gambia River
OMVS	<i>Organisation pour la Mise en Valeur du fleuve Sénégal</i> – Organisation for the Development of the Senegal River
ORASECOM	Orange–Senqu River Commission
OTCA	<i>Organização do Tratado de Cooperação Amazônica</i> – Amazon Co-operation Treaty Organisation
PCJ	Piracicaba, Capivari and Jundiaí rivers
PP	Public Participation
RBC	River Basin Committee
SAGE	Water Development and Management Plan
SDAGE	Water Development and Management Master Plan
SDAP	Sustainable Development Action Plan
UCPEÑAS-ICE	<i>Unidad de Cuenca del Río Peñas Blancas</i> – ICE Unit for the River Peñas Blancas Basin
UNESCO	United Nations Educational, Scientific and Cultural Organization
VBA	Volta Basin Authority
VBTC	Volta Basin Technical Committee
WFD	EU Water Framework Directive

Part A About this handbook: Why we need a practical guide and how to use it

1 Introduction

This handbook is written for basin managers, government officials and all their partners involved in water resources management. It provides practical guidance for improving the governance of freshwater resources, in particular through effective application of the integrated water resources management (IWRM) approach in lake and river basins, and aquifers. The handbook complements IWRM efforts already underway or planned at national and international levels.

1.1 Key concepts

Much academic work has been done elsewhere to examine different concepts regarding both IWRM and basin management. Here our objective is to provide a practical guide to water management in basins and illustrate the guidelines with concrete examples from basins around the world. It is not possible to cover all aspects of such a complex subject and this handbook complements other publications on basin management and IWRM. However, to help the reader we outline some key concepts in basin management and IWRM (see Sections 1.1.1 to 1.1.4 below), not as definitive statements but as a starting point for what follows.

1.1.1 The basin

The world's useable renewable freshwater resources are found in lakes, wetlands, rivers and aquifers. A river or lake basin is the area bounded by the watersheds of a system of streams and rivers that flow towards the same outlet. In the case of rivers this is generally the sea, but may be an inland water body, such as a lake or swamp. A groundwater basin or aquifer is a discrete body of underground water.

The basin has been recognised as a practical hydrological unit for water resources management. Different disciplines, and different countries, use different terms, such as basin, catchment and watershed, but in this book we use the term 'basin'.

Around the world there are 263 large transboundary river basins (Box 1.A) and hundreds of transboundary aquifers.

Box 1.A. Transboundary basins in the five continents

Continent	Number of transboundary basins	Percentage of continental area (%)
Africa	59	62
Asia	57	39
Europe	69	54
North America	40	35
South America	38	60
Total	263	45

Source: International Network of Basin Organizations

1.1.2 The integrated water resources management approach

The integrated water resources management approach helps to manage and develop water resources in a sustainable and balanced way, taking account of social, economic and environmental interests. It recognises the many different and competing interest groups, the sectors that use and abuse water, and the needs of the environment.

The integrated approach co-ordinates water resources management across sectors and interest groups, and at different scales, from local to international. It emphasises involvement in national policy and law making processes, establishing good governance and creating effective institutional and regulatory arrangements as routes to more equitable and sustainable decisions. A range of tools, such as social and environmental assessments, economic instruments, and information and monitoring systems, support this process.

1.1.3 Basin management

Policies for the use and protection of water resources in a country are set by national governments. Although the implementation of these policies is effective at many scales, where policies are implemented at the basin scale, there is the opportunity to deliver 'whole basin' solutions and to resolve upstream-downstream (for a river) and region-to-region (for a lake or groundwater resource) controversies. The 'whole basin' approach allows the assessment of impact at a system level. In other words, national policies, as well as international agreements and regional conventions for transboundary waters, are applied to natural basins. The relationship between administering water resources within a country and managing water in basins thus becomes dynamic and more responsive to changing circumstances, whether environmental, social or economic.

1.1.4 Basin organisation

We use 'basin organisation' as a generic term to refer to all types of institutions that manage basins. These may be formal large or small organisations or just informal groups of people. Basin organisations vary in function and purpose, in accordance with the mandates and legal arrangements used for their establishment. Chapter 4 *Roles and types of basin organisations* describes the main types of basin organisations. However, as Chapter 4 makes clear, we need to remember that some basin organisations do not fit neatly into these categories. They also evolve as circumstances change.

The handbook is mainly oriented towards strengthening formal basin organisations that have been set up by national laws or international treaties.

1.2 Problems and challenges facing water managers

Much has been written elsewhere about the water challenges we face. Here, we focus on the main issues relevant to basin management.

It is important to recognise both the positive and negative aspects of water. On the one hand, water is essential to human, animal and plant life. Water supports productive activities, agriculture, generation of hydropower, industries, fishing, tourism, transport, for example. On the other hand, water can be extremely destructive, carrying diseases and flooding vast areas. Insufficient water or prolonged drought can result in widespread death and economic decline. Water can also cause or escalate conflicts between communities in a local or national basin, or in transboundary basins shared by more than one country.

We also need to understand the ways in which society uses and pollutes water, or modifies the hydromorphology of water courses. These change the quantity and quality of water in

ecosystems which, apart from their intrinsic value, provide essential 'natural services' of great value to human well being. In many developing countries there is ongoing degradation of freshwater resources – in terms of both quantity and quality – and of aquatic ecosystems. This means fewer benefits, less life support and more water-related risks and hazards.

Clearly, factors such as population growth, demographic changes, economic development and climate change have a critical impact on water resources. Equally, water resources have a significant impact on production and economic growth, on health and livelihoods, and on national security. As the pressures on water resources grow, it is vital that we manage renewable freshwaters properly. But, managing water is becoming increasingly complex and contentious.

In many regions, managing water has always been a major problem because of the natural variability and uncertainty in weather patterns. With climate change this problem is likely to get worse. In some basins, changes in climate will mean less rainfall and lower river flows, while in other basins climate change will mean more floods. These changes will be exacerbated because of other variations such as population and economic growth, urbanisation and rising demands for food, which increase the demand for water, and degrade water courses and aquifers in basins where water is already scarce. The changes in the Senegal River basin illustrate this only too clearly (Example 1.1).

Example 1.1. Senegal River basin: climate variability exacerbates water scarcity

Due to climate variability, the annual flow in the Senegal River has fallen and is now a quarter of what it was in the 1950s. Meanwhile the population has grown and there are 30% more people now than there were in the 1950s. People who live in the Senegal basin now have about one fifth of the amount of water resources available per person compared to those who lived there sixty years ago.

Economic growth, efforts to reduce poverty, and demographic and social changes drive demands for water infrastructure to support food production, generate energy, and provide goods and services. Such developments have a big impact on water resources. For many years, it was assumed that there was enough water for these developments and that natural processes would deal with pollution. But, although the construction of irrigation schemes, hydropower dams, navigable waterways and water supplies for homes, tourism and industries have brought huge benefits to millions of people, these developments have also brought enormous changes to the hydrological regimes, ecosystems and landscapes of most of the world's rivers, lakes and aquifers.

As water scarcity increases and hydrological variability becomes larger, dealing with changes brought about by development presents a formidable challenge. The basin manager now faces huge pressures, risks and conflicts in balancing economic development with maintaining healthy water resources. But, in order to progress, poorer regions of the world must develop water infrastructure. The challenge for governments and basin managers is to balance development with sustainability. This means finding smarter ways to develop and manage water resources and finding responses appropriate to the circumstances in each particular basin.

Basin managers also have to address pollution. As towns and cities spread along riverbanks and lakeshores, water pollution from domestic and industrial waste increases. Advances in agriculture mean that farmers use more fertilisers and pesticides, which also increase pollution. The consequences of biological and chemical pollution, and the alteration of river and lake flows and diminution of groundwater tables, can be dire. Rivers become over-rich in nutrients and aquatic weeds proliferate.

This destruction or degradation of ecosystems puts many communities that depend on natural resources at risk. Biodiversity is lost and fisheries decline. Plus, more and more people are becoming exposed to water-related health hazards. Even the most conservative estimates consider that water-related diseases are currently causing between 2 and 5 million deaths every year and this could increase to 59 and 135 million deaths a year by 2020¹.

However, regions of the world where water resources are already highly developed also face serious challenges. Here, water resources are often overexploited. Basin managers have to manage highly complex interactions between what is happening upstream and what is happening downstream, and the effects on hydrological, biochemical and biological processes. They have to manage both surface and groundwater, and balance management of water for economic activities and the ecological health of rivers, wetlands and lakes. They are also at the centre of debates on inequitable and inadequate sharing of costs and benefits: for example the financial costs of investments and maintenance, costs of adverse social and environmental consequences, and the imbalances in access to the resources generated, such as electricity, irrigated land, and drinking water. These issues challenge not only developed countries but also increasingly challenge water managers in rapidly growing economies and severely water-stressed regions.

The inter-connected nature of water management within a basin directly impacts on communities, administrative regions and political territories (provinces, nations). Those who share a basin are highly inter-dependent. Basin managers must find ways to address these water-related challenges in order to avert problems, such as social unrest, conflict between states, slowing of economic development and degradation of vital resources.

Basins that cover more than one country – transboundary basins – present particular challenges for managers. Historically, transboundary basins have encouraged regional co-operation but, as resources dwindle and demands grow, the potential for conflict over shared waters also grows. To offset this, some basins are using a shared vision approach that incorporates many of the principles of the IWRM approach, for example, the use of participatory processes to consider basin issues in the overall development context of all the riparian states in the basin (Example 1.2).

Example 1.2. Nile, Lake Chad and Niger basins: shared visions

The Nile Basin Initiative is the result of a 'shared vision' approach that seeks to share the benefits derived from good water resources development and management between the riparian countries rather than focus specifically on sharing the water itself. The Shared Vision Program also builds stakeholders' capacity to participate in managing natural resources across boundaries, share benefits and improve water efficiency in agriculture for example, all of which are consistent with IWRM principles. Similar processes in the Lake Chad and Niger basins have led to the development of long-term action plans built on a shared vision.

1.3 Addressing the challenges

Many of the challenges facing water managers are not new. But, because the nature and size of the problems differ from one region to another and from one basin to another, the responses vary widely. There is not and there cannot be a blueprint solution to the problems.

However, addressing these challenges usually needs responses in two key areas: responses that address **structural** issues, including data acquisition, infrastructure and operations and

¹ Gleick 2002

maintenance; and **institutional** responses (often called 'soft' interventions) that cover issues such as policies and pricing, or knowledge and information. Both kinds of responses are important and inter-related.

The structural interventions, because they provide services, tend to be visible, politically attractive and high cost. They thus draw most attention. The institutional interventions are low cost, sometimes politically or socially contentious and often less tangible. Unfortunately, they thus have a much lower profile.

In this handbook, we focus on the institutional or 'soft' responses because there is plenty of scientific and technical information already available on structural issues. There is far less information available on institutional issues but it is only by addressing institutional issues that we can ensure that structural interventions are appropriate, sustainable and work as planned, and that they serve those most in need. Devising appropriate institutional responses lies at the heart of the IWRM approach and enables governments and basin managers to make a significant contribution to managing resources equitably and sustainably.

Many institutional responses are being applied (alone or along with structural responses) to address the challenges in basin management. These solutions are based on devising appropriate rules for governance and setting up appropriate organisational structures.

The rules can be international treaties, norms, laws, regulations, agreements, conventions or policies, as well as common practices. The rules define, for example, access to water resources and how they will be used and managed, and may be formal or informal, written, oral or tacitly accepted practices.

Organisational structures include international commissions or authorities, federal or state/province ministries, basin councils, agencies, multi-stakeholder groups, community or professional associations and non-governmental organisations (NGOs). They may be formal or informal.

In the last few decades, many countries have made significant efforts to improve institutional and legal frameworks for water management. National water laws and policies adopted recently have generally taken into account good governance values and IWRM principles, such as participation, gender and equity issues, environment concerns and economic assessments. At the 2002 World Summit on Sustainable Development, many countries made a commitment to develop national IWRM and water efficiency plans (Example 1.3).

Example 1.3. Africa: incorporating IWRM principles in national policies

In the early 2000s, several countries in Africa integrated the IWRM approach into formal government structures. For example, Ghana set up a Water Resources Commission with a cross-sectoral mandate. The Ghana Water Act (1998), the South African Water Act (1998) and Mali's 2007 Water Code, among others, all take an integrated approach. Burkina Faso completed an IWRM Plan in 2003. Kenya, Malawi, Mali, Senegal and Zambia completed plans in 2008, and Benin, Cape Verde, Eritrea, Mozambique and Swaziland are all in the process of developing similar plans.

The UN-Water global survey of national IWRM plans carried out as part of the 16th session of the Commission on Sustainable Development in 2008, found that 16 of the 27 developed countries and 19 of the 77 developing countries surveyed had fully or partially developed IWRM plans. The report concluded that *"there is a good indication that the IWRM approach is*

being incorporated into national plans and strategies and that tangible benefits are either evident or are likely to be realised in the near future”².

But, now that national IWRM plans are being developed, the challenge is to ensure that they are implemented effectively. In this, basin managers will be at the forefront. They will be working in a variety of contexts as water governance frameworks set up by governments to carry out the plans will differ. Basins entirely within national boundaries will be much simpler to manage than those shared by two or more countries.

Basin-level water management is not new. Some countries, Spain and France for example, have practiced basin water management for decades. Spain has had nine 'Confederaciones Hidrográficas' (Basin Authorities) for more than 75 years and, since 1964, France has had six 'Comités de Bassin' (Basin Committees) and 'Agences de l'Eau' (Water Agencies). In Germany, the Ruhr Association (Ruhrverband), one of 11 river basin organisations in the state of North Rhine-Westphalia, was created as early as 1899, as a voluntary alliance of water works and hydropower producers. International commissions were created many years ago in Europe, for instance for the Rhine, Meuse, Scheldt, Moselle and Sarre rivers, and for Lake Geneva. In the US, the Tennessee Valley Authority was established in 1933. In Australia, the 1992 Murray Darling Agreement mandated the Murray–Darling Basin Commission to take responsibility for co-ordination, planning and sustainable management of water, land and the environment. In 1909, the Boundary Waters Treaty between the governments of USA and Canada established an International Joint Commission for shared waters. In South East Asia, the Agreement on co-operation for the sustainable development of the Mekong River basin was signed in 1995 and led to the establishment of the Mekong River Commission. The Niger Basin Authority and the Lake Chad Basin Commission were established in the early 1960s, while the Senegal and Gambia River Development Organisations were created in the 1970s. Quebec's 2002 National Water Law established integrated water management at the basin level, starting with 33 priority basins. Mexico in 1992, Brazil in 1997 (Example 1.4), and Morocco and Algeria modified their water laws and introduced a basin-oriented management approach. In the European Union, the Water Framework Directive requires all 27 member states to develop basin management plans.

Example 1.4. Brazil: new water management policy and structure

Since 1997, when Brazil promulgated its National Water Law, the government has put in place a new structure to promote water management in an integrated, decentralised and participatory way. A Water Resource National Council and a National Water Regulatory Agency were created, as well as River Basin Committees at the federal and state levels.

Traditionally, the main responsibility of many basin organisations has been for building infrastructure. However, because of the adverse social and environmental impacts that infrastructure development can have, some governments and funding agencies have adopted policies to safeguard against negative aspects. Because of this, in the late twentieth century funding agencies became reluctant to support such 'infrastructure only' projects.

However, it is possible to minimise negative impacts while optimising the benefits of large water infrastructure projects. But this means considering the impact of infrastructure development on the complex dynamics between society and ecosystems, consulting genuinely with all relevant stakeholders, and paying due attention to equity and sustainability issues.

The critical task for basin managers is to get this balance right in the long term. The way to do it is by taking an integrated water resources management approach. Linking national IWRM

²UN-Water 2008

policy setting and planning processes with basin management helps lower risks and leads to more sustainability, promoting economic growth and more equitable development while protecting the environment. The integrated approach recognises and tackles the difficult trade-offs that government policy makers and basin managers need to make in the context of the region's or country's overall strategic development aims. The GWP China Yellow River Partnership provides an example (Example 1.5).

Example 1.5. GWP China Yellow River Partnership: IWRM at river basin level

In response to an invitation by the Ministry of Water Resources, GWP China was established in November 2000. China was reviewing its water law and needed a neutral platform to consider stakeholder inputs and international water law experiences. GWP's participation in this process helped incorporate IWRM in the 2002 China Water Law. Implementing the law, however, is an ongoing process.

Between 2002 and 2008 GWP China established four Water Partnerships in the provinces of Fujian, Hebei, Shaanxi, Hunan and one partnership for the nine Provinces of the Yellow River Basin to bring stakeholders from different sectors and disciplines together.

Since 2006 the GWP China Yellow River Partnership has provided a platform for stakeholders to collectively address the issue of restoring the health of the Yellow River. The Partnership has organised meetings, workshops and dialogues on important issues, and how best to deal with them when implementing the new water law in the River Basin. The meetings included grass-root dialogues with farmers and environmental NGOs for example, on principles of water allocation and water quality demand. The outputs from the consultations between key stakeholders were shared with the Yellow River Conservancy Commission and the Government and helped formulate appropriate policies and legislation.

More information at: <http://www.gwpchina.org> and <http://www.yrra.org.cn> (site under construction)

2 How to use this handbook

KEY POINTS

Chapters 3-10 of this handbook respond to some of the questions most frequently asked about integrated water resources management at the basin level:

- What political and legal factors do basin managers need to understand and take into account? Chapter 3 *Establishing basin management systems*.
- What are the functions and what are the different kinds of institutional and legal arrangements for basin organisations? Chapter 4 *Roles and types of basin organisations*.
- What are the different ways in which basin organisations and basin management can be financed? Chapter 5 *Finance*.
- What type, level, structure and frequency of stakeholder involvement should basin managers seek to establish? Chapter 6 *Involving stakeholders*.
- How should basin managers go about strategic planning? Chapter 7 *Strategic long-term planning*.
- What do basin managers need to consider in developing and implementing basin action plans, and how can they get feedback on how plans are progressing? Chapter 8 *Basin action plans*.
- What data and information management systems do basin managers need for integrated water resources management? Chapter 9 *Basin information systems and monitoring*.
- What are the key communication issues basin managers need to consider? Chapter 10 *Communication*.

This handbook sets out suggestions, rather than definitive answers, and provides illustrations of how pressing challenges in water resources management in basins are being dealt with in practice. The **boxes** throughout the book suggest guidelines for good practice (for example Box 2.A, Box 7.D). The **examples** give actual practices in basins (e.g. Example 1.1, Example 4.6).

Academic publications can be complex and too detailed to be useful to practical managers. Training manuals are good introductions, but they tend to oversimplify complex issues. This handbook tries to bridge the gap and build on existing tools, manuals and guidebooks for applying IWRM at the river or lake basin and aquifer level. It draws heavily on the work initiated by INBO, GWP and others on river basin management.

For the many basins which face, or will soon face, serious water management challenges, and where governance systems are weak, this handbook offers guidelines on establishing appropriate institutional and organisational arrangements. The examples show that it is not a question of applying simple recipes. We need to thoroughly understand the intricacies of how all aspects of water are actually managed at the basin level and work from there. We trust the handbook will also be useful in assessing existing basin governance frameworks and

identifying areas where improvements are needed, especially in basins where agreements and governance structures, such as water charters and basin committees, have recently been set up.

2.1 Integrated water resources management in basins

The GWP defines integrated water resources management as a process that *"promotes the co-ordinated 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 ecosystems"*³. At the river or lake basin and aquifer level, IWRM can be defined as a process that enables the co-ordinated management of water, land and related resources within the limits of a basin so as to optimise and equitably share the resulting socioeconomic well-being without compromising the long-term health of vital ecosystems.

The IWRM approach at the national level does not conflict with the IWRM approach at the basin level, in fact, they are complementary. A comprehensive national framework for IWRM is essential for both national and transboundary basin management.

Within the limits of a basin, it is not an easy task to integrate land uses and water management. This is because land management, which covers planning, forestry, industry, agriculture and the environment, is usually governed by policies not connected to water policy and is managed by many different parts of an administration.

Nevertheless, we can draw practical lessons from the experiences of basin managers around the world who are integrating water management in different contexts. This handbook draws together these practical lessons, illustrated where possible with concrete examples, to share what has been learned so far. The Volta Basin is an example of where such efforts are underway (Example 2.1).

Example 2.1. Volta basin: applying integrated water resources management

The expert team tasked by Volta Basin riparian governments to conceive the Volta Basin Authority (VBA) was explicitly mandated to reflect IWRM and ecosystem management concerns in the design of the basin authority. The convention establishing VBA is being ratified by the Volta Basin riparian countries. (Also see Example 3.7.)

2.2 Basin management as an iterative process

Policy making, planning and management might be considered as a series of sequential steps in basin management. The first step is to draw up broad policy goals (where we want to get to). The next steps are to specify water management problems to be solved (identify issues), list potential strategies (how we are going to get there), evaluate each of these, select a strategy or combination of strategies, implement the strategy, evaluate the outcomes, learn from these outcomes and revise our plan to make it work better in the future. The steps form a cycle. Of course, in practice this cycle may be interrupted by external forces, but the 'learning-by-doing management cycle' (Box 2.A) helps us incorporate what we learn in the process of planning and managing water and take into account new information as it comes to hand. This means we can adapt how we manage water to changing circumstances, for example political changes, natural catastrophes and changes in demography.

³ GWP TAC 2000

Box 2.A. The learning-by-doing management cycle of planning and implementation



2.3 Entry levels for integrated water resources management in basins

Basin managers may wonder where to start with an integrated approach, who to target and at what level. A simple and effective way to find out where to target action initially is to identify entry levels:

1. *Local level* (sub-basin plan, local aquifer management plan, local water allocation plan in water user districts, local government plan).
2. *Implementation level* (basin or provincial scale management plan).
3. *Policy level* (national and international processes for developing water policies, treaties, and laws).

Example 2.2 illustrates how the current Mekong River basin strategy targets different levels to integrate water resources management throughout the basin.

Example 2.2. Mekong River basin: introducing IWRM at local, implementation and policy levels

The framework for the Mekong River Commission Strategic Plan 2006-2010 is integrated water resources management (IWRM). One of the key management principles in the Strategy is to engage with stakeholders at local, implementation and policy levels.

Local level

The Mekong River Commission (MRC) works with the National Mekong Committees in Lao PDR, Thailand, Cambodia and Viet Nam to foster participation. It does this by educating and raising awareness among stakeholders. The MRC Stakeholder Participation and Communication Plan sets out approaches to engage with a wide range of stakeholder groups at local and national levels.

Implementation level

At the project level, MRC policies allow those who will be affected by a project to influence decisions on project plans, implementation and monitoring.

At the programme level, planning in the Basin Development Programme is participatory. And, to monitor the overall work programme, MRC invites partners (through a formal Memorandum of Understanding) to participate as observers at its Joint Committee and Council meetings. MRC development partners are also actively engaged in MRC decision making through governance meetings.

Policy level

Many actors in the Mekong Region wish to contribute to MRC goals and be proactive in policymaking. In 2008, the MRC initiated a regional consultation to come up with general principles for stakeholder involvement at the MRC level and a policy on stakeholder involvement in MRC Governance Bodies. This will broaden political decision making processes and ownership, strengthen regional co-ordination between stakeholders and the MRC, and foster accountability.

More information at: <http://www.mrcmekong.org>

It is important to recognise, though, that entry levels will depend on the nature of the specific basin (Examples 2.3, 2.4), particularly:

- whether the basin is within one country or several countries;
- the scale of planning and management (transboundary, national, local);
- the stage of development of the basin management organisation;
- the stage of development in the basin, for example as regards the economy, infrastructure;
- the main water management challenges, for example population pressure, sanitation, food production, health, flood and drought protection; and
- the social, economic, political and institutional environment.

Example 2.3. India: starting integrated water resources management at the district level

In India, District Collectors are Central Indian Government appointees in charge of the governance of a district in a state. At this level, there may be an opportunity for a collector to prepare a district land and water management plan for a basin in the district. This will specify what action will be taken across the basin to integrate water resources management. The actions will harmonise with state and national water policies, an overall basin management strategy, and development, poverty reduction, and health and irrigation efficiency goals at different levels.

We also need to recognise that, where they exist, basin organisations are at different stages of development. They are also constantly evolving as new laws are passed and responsibilities and mandates change. This handbook helps basin managers understand management frameworks. Basin managers can work within these frameworks (Box 2.B, Figure 1) to re-organise existing basin organisations or initiatives to become more focused on the IWRM approach.

Example 2.4. Yucatan Peninsula, Mexico: integrating groundwater resources management at the regional level

The Yucatan Peninsula is made up of three states, Campeche, Quintana Roo and Yucatan. The Mexican National Water Law 2004 designates the National Water Commission (CONAGUA) as the federal authority responsible for water resources management. The Yucatan Peninsula Basin Organisation represents the Yucatan Peninsula on CONAGUA. The Basin Council, in co-ordination with stakeholders:

- develops a Regional Action Plan for the Yucatan Peninsula aquifer;
- networks water information systems;
- ensures participation of water users; and
- in co-ordination with the local authorities, has created 42 water culture complexes in municipalities which encourage efficient use of water and discourage pollution.

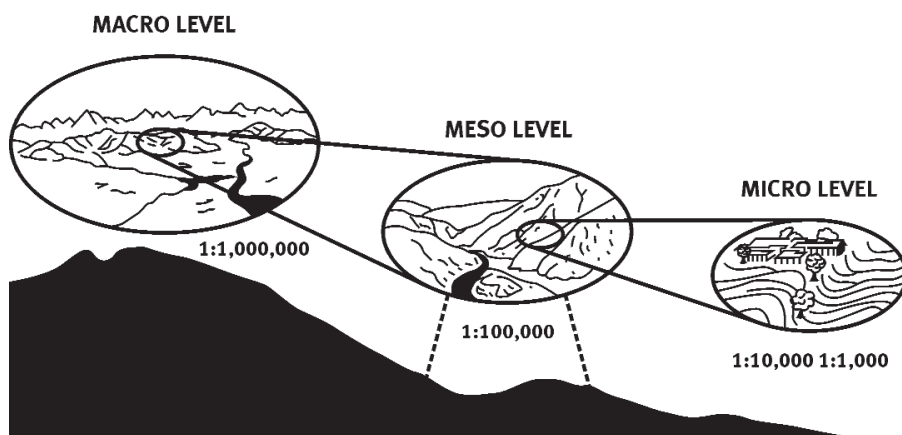
More information at: <http://www.conagua.gob.mx>

Box 2.B. Basin management framework

	Policy/National	Implementation	Operational
<i>Type of basin organisation</i>	Transboundary (e.g.) commission	National, inter-state basin (e.g. commission, authority, association)	Local (e.g. land and water management group)
<i>Basin management strategies and plans</i>	Transboundary basin management agreement or plan; transboundary compact; national basin management plan	Sub-basin management plan or strategy, large sub-watershed or sub-aquifer or lake management plan	Local land and water management plan, storm water management plan, local planning scheme (administered by local government)
<i>Level of decision-making</i>	Highest political decision-making level, transboundary agreements	Province, state, district, territory (or national in small states)	Village co-operative, farm, factory, forest, local government, water use district
<i>Natural resource system (see Figure 1)</i>	Part of a geographical zone, such as a river, lake or aquifer basin	Regional or local ecological system of a lake, river valley within a basin, or sub-aquifer within an aquifer province	Areas with relatively uniform ecological and hydrological conditions

Source: Hooper 2005, p.120, adapted from Newson 1992

Figure 1. Diagrammatic representation of macro-, meso- and micro-level natural water resource systems in a basin management framework. A macro-level system deals with part of a geographical zone, such as a river, lake or aquifer basin. A meso-level system deals with a regional or local ecological system of a lake, river valley within a basin, or sub-aquifer within an aquifer province. A micro-level system deals with a relatively uniform ecological and hydrological unit.



Source: Hooper 2005

A key issue is how the basin administration fits with and relates to other administrative levels – national, provincial, district, community. This needs to be resolved in order to avoid duplication and confusion of responsibilities with other administrative bodies.

What is needed is a clear legal framework that specifies the roles and responsibilities, rights and obligations of stakeholders, the levels of decentralisation, and the processes and means for good water governance. Example 2.5 shows how basin organisations in France fit in such a framework.

Example 2.5. France: national, river basin and local water committees

In France, water resources management and planning is institutionalised at three levels: national, basin and sub-basin.

At **national** level, a Member of Parliament nominated by the Prime Minister chairs a National Water Committee (NWC). The NWC consists of representatives of water users, associations, local authorities and government administrations, as well as experts and the presidents of the Basin Committees. The NWC is consulted on national water policy and gives advice on draft laws and decrees, reforms and draft government action plans. The 2006 Water Law widened the scope of the NWC and created additional committees for water prices, public water supply and sanitation services, fishing and the water information system.

In each of the six large **river basins**, a River Basin Committee (RBC), chaired by a local elected official, consists of representatives from local authorities (40%), water users and associations (40%) and the State (20%). The RBC prepares a Water Development and Management Master Plan (SDAGE) for approval by the State. The SDAGE sets the overall strategy and objectives for water management in the basin. It is a legal framework. Any decision likely to affect water

resources must be compatible, or made compatible, with the SDAGE. SDAGEs were first developed following the 1992 Water Law. Each has now been revised as a River Basin Management Plan that complies with the European Water Framework Directive.

At the **local** level – tributary, sub-basin or aquifer – Local Water Commissions (LWCs) implement the SDAGE and prepare a Water Development and Management Plan (SAGE). LWCs consist of representatives of local authorities (50%), water users and associations (25%) and the State (25%). A Local Water Commission can implement plans through a Local Public Basin Establishment or other local group. Inter-municipal bodies may also undertake studies or work at the sub-basin scale.

More information at: www.gesteau.eaufrance.fr and <http://www.lesagencesdeleau.fr>

Part B Key issues in integrating water resources management in basins

3 Establishing basin management systems

KEY POINTS

- Political will, high-level commitment and water user dialogues are essential in establishing basin management systems.
- Basin management is governed by national water policies and legislation, and international agreements.
- Basin organisations operate within a three-dimensional framework: the enabling environment, institutional arrangements (roles and responsibilities), and management mechanisms.

The management of water resources can be a sensitive political issue. Because of this, basin management needs to have a strong 'voice' in national decision making. This means securing direct lines of communication to ministers and government committees concerned with natural resources management. Links to high levels of government put basin management firmly on planning and economic development agendas. High-level support is key to establishing the legal framework, institutions and management structures that are needed for robust basin management systems.

3.1 Political will and basin management systems

Where there is political will, it is possible to put in place policies, laws, financing arrangements and stable public institutions for water management. With political will, the rules and regulations, and institutions that manage water are more likely to function effectively, even at times of civil unrest and through changes of government. The importance of political will means that it is critical to work with decision makers – to explain what integrated water resources management is and why it is important – to get this high-level support and commitment (Example 3.1).

Although political leadership matters, an integrated approach cannot work if water management is entirely top down and precludes stakeholder involvement. IWRM implies that those who are interested in, or who will be affected by decisions on water resources, will be involved in basin management and that information will be exchanged freely. Freedom of information is crucial in finding good solutions. Where there is no transparency or accountability, where those affected are excluded, or where corruption is endemic, it is difficult to put the IWRM approach into practice.

But that does not mean that, in hierarchical societies, the IWRM approach should be abandoned. The answer in these situations is to take a step-by-step approach. For example, the first steps could be for groups of stakeholders to meet (see Section 2.3 *Entry levels for integrated water resources management in basins*) and find common areas of concern where action is needed. Once issues have been identified, information can be collected and shared, and proposals put forward for endorsement by government.

Example 3.1. Matanza–Riachuelo basin, Buenos Aires, Argentina: the importance of political will

The Matanza–Riachuelo Basin, in greater Buenos Aires, is densely populated and the most urbanised and industrialised basin in Latin America. Waste discharged directly into the river or the storm drainage system seriously pollutes the groundwater.

A first attempt to tackle pollution by the Matanza–Riachuelo Executive Committee failed and, in 2006, it was replaced by the Matanza–Riachuelo River Basin Authority, which was given new powers. If it is to avoid the failures of the past, it is essential that the Authority uses these new powers to implement whatever plan is developed. Its first task must be to focus political will on the problem, something no one has yet been able to do.

There is reason for modest optimism. A recent decision on a case brought by residents in the basin claiming damages for environmental contamination of the Matanza–Riachuelo River was resolved in their favour. The Argentine Supreme Court determined that the Federal Government, the Province of Buenos Aires and the City of Buenos Aires were liable for existing damage and should prevent future environmental damage in the river basin. The Court ordered the Authority to carry out the responsibilities assigned to it under law to clean up the basin and will hold the Authority liable if it fails to do so. In addition, the Court instructed the National Ombudsman and the NGOs who participated in the case to form a chartered body, which will exercise control over the clean-up plan.

3.1.1 Inter-ministerial co-ordination

The approach to integration must be both vertical – across different levels of authority – and horizontal – across different water users and affected groups. A key element of horizontal integration is bringing together ministries responsible for activities that impact on water – ministries of finance, planning, agriculture, transport and energy – and those with social or environmental responsibilities – ministries of health and the environment. Within any basin there will inevitably be conflicting demands for water, for example for domestic use, irrigation, environmental protection, hydropower and recreation as well as issues such as pollution or modification in the flow regime.

Ministerial co-ordination bodies, such as cabinet committees, councils of ministers, are useful for co-ordinating actions across portfolios. However, they only work well when ministers are committed and when they are backed up at the highest level (e.g. by the President, Prime Minister). These ministerial co-ordination bodies need to be established so that there are clear lines of reporting both to senior executives in government and to basin organisations, local government and water user organisations.

When the issue affects more than one country, summits or conferences of heads of state may be needed to bring together leaders to discuss and co-ordinate water issues in transboundary basins.

3.1.2 Water user dialogues

Platforms for cross-sectoral and upstream-downstream dialogues are essential for managing water resources (Example 3.2). Chapter 6 *Involving stakeholders* discusses ways to bring appropriate stakeholder representation into setting priorities and basin planning. In transboundary basins, existing international agreements and long-standing co-operation can pave the way for the establishment of co-operative basin governance (Examples 3.3 and 3.4).

Example 3.2. Orange–Senqu basin: roadmap for water-user dialogue on basin management

The Orange–Senqu basin in southern Africa is shared by Lesotho, South Africa, Botswana and Namibia. The Orange–Senqu River Commission (ORASECOM), established in 2000, recently developed a 'roadmap for stakeholder participation'.

The roadmap sets out how stakeholders in the Orange–Senqu River basin will participate in dialogues with ORASECOM on the co-management and sustainable development of the Basin and its resources to enhance livelihoods. The objectives of the roadmap are to:

- develop and strengthen institutional mechanisms for effective stakeholder participation in the management of the Orange–Senqu River basin;
- build and strengthen capacity in basin forums to effectively participate in decision making, planning and sustainable co-management of the Orange–Senqu River basin; and
- develop and maintain open and effective horizontal and vertical communication between and among the structures of ORASECOM and basin stakeholders by developing accessible, timely and good quality information and dissemination mechanisms to build trust, and improve participation and decision making in the basin.

Members of the Commission defined the core elements of the strategy during an initial three-day workshop. The draft was further developed by representatives drawn from regional research organisations, NGOs and the private sector in each basin state and other countries. Following another workshop, where ORASECOM's technical task team provided further input, the draft was revised and finalised and has been adopted by ORASECOM.

More information at: <http://orasecom.org> (site under construction)

Example 3.3. Tisza basin: long-standing co-operation paves the way for dialogues between countries on basin management

There is a long tradition of co-operation between Romania and neighbouring states in transboundary water management through bilateral agreements – Hungary (1986, 2003), Ukraine (1997), ex-Yugoslavia (1955), Moldova (1995) and Bulgaria (1991). These countries now co-ordinate transboundary water management through the International Commission for the Protection of the Danube River (ICPDR).

Now that some riparian countries are members of the European Union, they are revising agreements to meet EU legal directives. The objectives of the revisions are to achieve good water status, to prevent degradation and control pollution, to prevent and limit the transboundary effects of floods, droughts and accidental pollution, to develop systems for monitoring water status and to ensure sustainable use of water resources.

Following the accidental pollution in 1924 of the Tisza, the main tributary of the Danube, co-operation between Hungary and Romania was strengthened. In the Körös–Crisuri sub-basin, the main sub-basin of the Tisza, co-ordination was led by the ICPDR. Bottom-up pooling of the sub-basin plans led to an overall management plan for the Tisza international river basin. These dialogues paved the way for similar arrangements in all Tisza and Danube riparian states.

More information at: <http://www.icpdr.org>

Example 3.4. Spain and Portugal: long-standing dialogue on shared basins

Spain and Portugal have a long tradition of bilateral co-operation on the five transboundary basins they share (Miño, Limia, Duero, Tagus and Guadiana). A treaty signed in 1864 established international river boundaries and stressed the importance of using transboundary water resources for the benefit of both countries. Other bilateral treaties and agreements, such as those in 1866, 1906 and 1912, followed the initial agreement.

The Albufeira agreement, signed in 1998 in line with the principles of the Water Framework Directive, seeks to balance environmental protection with the sustainable development of water resources in both countries. The two countries will co-ordinate their respective efforts to manage water in shared basins.

The Albufeira agreement created two equal bodies: the high-level Conference of the Parties, and the decision-making Commission on the Application and Development of the Convention (CADC). In addition, a Permanent Technical Secretariat of the Commission will be set up to ensure that CADC is effective and to co-ordinate the development of integrated plans for the river basins in the next hydrological planning cycle.

More information at: <http://www.cadc-albufeira.org>

3.1.3 Water tribunals

In certain, exceptional, cases, tribunals may be set up to deal with dialogues on water that have reached an impasse or on controversial water issues. A tribunal is an independent, but usually temporary body, with judicial or quasi-judicial powers to take major decisions, such as on water sharing, water pricing or modifying river flows. They function as special courts outside national civil and criminal judicial systems. Tribunals examine special problems, make judgements and resolve disputes between countries, states, provinces or water users (Example 3.5). Very few exist purely for basin management. Stakeholders may participate formally at hearings.

Example 3.5. India: Narmada Water Disputes Tribunal

The Central Government of India set up the Narmada Water Disputes Tribunal in October 1969 to adjudicate in the dispute between States about the Narmada River Valley Development and how water should be shared. The Tribunal sat for ten years and made the final binding Award in December 1979.

The Award specified water allocations to Gujarat, Madhya Pradesh, Maharashtra and Rajasthan, the four Indian States that share the Narmada River basin. The Tribunal also

determined the height of the Sardar Sarovar Dam and directed the Government of Gujarat to construct the dam. The responsibilities of the Tribunal were very precisely defined. However, as was common at that time, the Tribunal did not involve stakeholders or address social or environmental issues that arose during basin development. If the Tribunal had adopted some of the ideas and integrated approach set out in this handbook, the process may have been more inclusive and had a wider remit.

More information at: <http://wrmin.nic.in> (Inter-state Water Disputes sub-section)

3.2 Law and policy

In general, national, provincial and local water laws and policies are the rules of the game that determine how all stakeholders play their respective roles in the development and management of water resources. Basin organisations that have been set up by law have a strong mandate, as do those created within an international convention or treaty for transboundary waters. Laws and water policies that spell out the roles, responsibilities and accountability of both the public and private sectors set the scene – the water management framework – for basin management as part of the existing national administrative systems (Box 3.A, Example 3.6). Basin and national water policy management plans should be harmonised.

Box 3.A. Law and policy in basin management

Laws and policies establish the framework for water management:

- Clearly identify the functions, structure and funding of basin organisations and basin management.
- Specify management roles and jurisdictions.
- Ensure fairness and accountability in decision making.
- Avoid fragmentation and overlap of responsibilities.
- Spell out regulatory and enforcement processes for sharing water, abating water pollution, protecting ecosystems or fighting against natural hazards, and determining entitlements to water.

Example 3.6. Our Er Rbia River basin agency, Morocco: the legal framework

Morocco's Water Law of 1995 (Law No. 10-95) establishes the legal instruments for water resources use and conservation. The law calls for the creation of basin agencies. It sets out the legal status and roles of basin agencies, and gives them financial autonomy.

Basin agencies have:

(i) *responsibilities for water policing:*

- the inventory of water rights and concessions,
- monitoring surface and groundwater quality and quantity,
- issuing new permits and concessions for abstracting water,
- controlling use of water resources.

(ii) responsibilities for river basin management:

- formulating and implementing the basin development plan which is to be integrated into the national water plan,
- levying pollution and withdrawal fees which will be re-invested in pollution control,
- providing contracting authorities with financial assistance for controlling pollution and improving water resources and flood management.

3.3 Water management framework

Water management operates in a three-dimensional framework. The three parts of the framework, usually constructed at the national scale, are the enabling environment, institutions and management (Box 3.B). However, not all the elements of such a framework may be in place.

This means that, to begin integrating water management in basins, it is important to get a clear understanding of the water management framework in which decisions about water are made – the national water management framework within a country, or the international water management framework that spans several countries.

Box 3.B. The three dimensions of water management frameworks

Enabling environment	Institutions	Management
<p>Laws and policies</p> <ul style="list-style-type: none"> ■ Frame water resources management within a country and between countries <p>Water user dialogues</p> <ul style="list-style-type: none"> ■ Cross-sectoral and upstream-downstream dialogues ■ Basin committee <p>Budgets</p> <ul style="list-style-type: none"> ■ Financing organisations and investment <p>Co-operation</p> <ul style="list-style-type: none"> ■ Within international river basins 	<p>Roles and responsibilities</p> <ul style="list-style-type: none"> ■ Of basin and other water sector organisations at different levels in the government, non-government and private sectors ■ Effective co-ordination mechanisms ■ Planning process ■ Financing 	<p>Structures to</p> <ul style="list-style-type: none"> ■ Assess water resources (availability and demand) ■ Set up communication and information systems ■ Resolve conflicts in allocation of water ■ Establish regulations ■ Establish financing arrangements ■ Establish self-regulation (voluntary actions) ■ Research and develop ■ Undertake development works ■ Ensure accountability ■ Develop organisational capacity ■ Co-ordinate

Not all the elements in a water management framework have to be in place to establish integrated water resources management at the basin level. In fact, in most cases it's unlikely that they will be. Usually, setting up and maintaining a basin organisation is a step-by-step process that works with what already exists and, at the same time, seeks to strengthen elements of the framework that will help the basin organisation function more effectively. Initiatives to set up new basin organisations or change existing ones need to determine to what extent these are, or are not, in place and allocate resources – time and money – to secure the political will to set them up and strengthen them (Example 3.7).

Example 3.7. Volta basin: establishing the water management framework

The six riparian countries of the Volta Basin, Benin, Burkina Faso, Ivory Coast, Ghana, Mali and Togo, set up the Volta Basin Technical Committee (VBTC) in July 2004. This inter-governmental committee was mandated to establish the enabling environment for a Volta transboundary river basin organisation for integrated water resources management. In doing so, the VBTC consulted the Water Resources Co-ordination Unit of the Economic Community of West African States, experts from each member country and the European Union Water Initiative.

The VBTC set out the statutes, organisation chart, human and financial resources, financial mechanisms, inter-country co-ordination systems and planning processes needed to establish the basin authority. These took into account the national strategies for water resources management of the six member states. They also integrated the programmes of external support agencies, such as the African Development Bank, the World Bank, the Fonds Français pour l'Environnement Mondial and other donors, in order to ensure synergy and develop an appropriate action plan.

Where the framework for water management is weak or elements are missing, some of the steps that might be taken are:

- making an inventory of the state of water resources and ecosystems;
- doing an assessment of needs and priorities for intervention;
- making an inventory of the actors involved in the broader water and development sectors who need to be contacted;
- finding ways to share knowledge, data and information;
- finding ways to co-ordinate decision making between levels and actors;
- encouraging dialogue between stakeholders;
- establishing water allocation mechanisms;
- reducing water pollution and restoring ecosystems;
- handling floods and droughts (climate variability); and
- developing financing mechanisms for water management.

3.4 International agreements

Not only do basin organisations have to comply with national legislation (see Section 3.2 *Law and policy*), but they also have to comply with international or regional legal agreements. This may apply even for basins that do not span national boundaries, for example with respect to human rights legislation or international standards and norms in health or finance. Basin organisations thus need access to expertise on international law to ensure they understand and comply with international or regional legal agreements where they exist.

There are many agreements on water that involve more than one country. But most are very limited in scope or only include a few of the riparian countries in the basin covered by the agreement. Nevertheless, it is sometimes possible to make considerable progress on water sharing arrangements and good practices without formal legal agreements. Taking a legal approach is only possible once political progress has paved the way.

Perhaps the best known international legal framework for water is the Convention on the Protection and Use of Transboundary Watercourses and International Lakes. This Convention established a framework for co-operation between the 56 member countries of the United Nations Economic Commission for Europe to prevent and control pollution of transboundary watercourses. The Convention is built on three principles:

1. the precautionary principle: action to avoid the release of hazardous substances must not be postponed, despite the lack of a proven causal link between the substances and the transboundary impact;
2. the polluter pays principle: the costs of pollution prevention, control and reduction measures must be borne by the polluter; and
3. water resources must be managed so that the needs of the present generation are met without compromising the ability of future generations to meet their own needs.

The Convention requires that states work towards ensuring that transboundary waters:

- are managed in a rational, environment-friendly manner;
- are used in a reasonable and equitable way; and
- ensure conservation and restoration of ecosystems.

The Convention encourages co-operation among the riparian countries through harmonised policies, programmes and strategies to protect transboundary waters. It focuses on water quality. But, although water quality is a key issue for the member states of the UN Economic Commission for Europe it may not be the main priority for developing countries.

Another important international legal framework for water is the UN Convention on the Non-Navigational Uses of International Watercourses which was adopted in 1997. It is the only global treaty universally applicable to international freshwaters. The Convention needs to be ratified or approved by thirty-five states and to date this has not happened. Despite this, the principles of the Convention have been widely applied in developing regional and river basin agreements on water and play an important role in developing relationships between riparian states.

Before such conventions can be negotiated, there needs to be progress on other transnational agreements, as well as good political and administrative relationships. In many parts of the world, regional political or economic organisations, for example the regional UN Commissions and bodies such as the Association of South East Asian Nations, Southern African Development Community, Economic Community of West African States, the Amazon Co-operation Treaty Organisation (OTCA) and Mercosur (Mercado Común del Sur or Southern Common Market), are the best placed to put in place an appropriate political framework so that regional protocols on water can be agreed.

The European Union (EU) has enacted numerous directives relating to water and the environment that apply to all 27 EU member states. The best known is perhaps the Water Framework Directive (WFD) although others are equally important. The EU WFD focuses on the river basin and requires countries to prepare plans for all basins that set out the objectives for the basin and the timescale for achieving the objectives. EU directives are unique to the particular political context in Europe. However, they provide lessons that are useful when preparing agreements in other regions.

4 Roles and types of basin organisations

KEY POINTS

- The mandate of basin organisations is to be the 'leading voice' on basin water management.
- Basin organisations have three main functions:
 1. monitoring, investigating, co-ordinating and regulating;
 2. planning and financing; and
 3. developing and managing.

This handbook uses the term 'basin organisation' to refer to any formal or informal entity that manages water resources at the basin scale. Basin organisations are set up under different arrangements depending on the aim, the legal and administrative systems, and human and financial resources. They are usually, but not always, formal legal bodies. In some cases less formal arrangements also work. But, whatever the set up, basin organisations must be public sector organisations because water resources management is a public good.

Although formal basin organisations are part of the public sector, for water to be managed effectively, a wide range of stakeholders, community groups, economical sectors, non-governmental organisations and private enterprise, need to be involved (see Chapter 6 *Involving stakeholders*).

4.1 Roles of basin organisations

4.1.1 Mandate

In essence, basin organisations are umbrella organisations for basin management. Their mandate is to take a 'big picture' perspective and be the leading voice on basin-wide water issues. This means keeping basin constituencies and decision makers in all sectors and at all levels, in both the public and private sector, fully informed and involved.

Basin organisations can take many forms: statutory decision making and/or advisory bodies, management bodies, development entities and regulatory bodies. Frequently, they operate in conjunction with other government agencies and administrative bodies. Responsibilities for managing water, regulating water and providing water services should be assigned to different agencies to streamline operations and ensure accountability (Box 4.A and see Section 5.1.2 *Developing and maintaining infrastructure* and Chapter 8 *Basin action plans*).

Box 4.A. Assigning responsibilities for managing water, regulating water and providing water services

Regulating (government ministry or other government authority):

- develops and implements pricing regulations;
- develops water quality standards and guidelines;
- develops legislation for standards and policies;
- authorises and controls withdrawals and discharges, and works modifying river flows and ecosystems;

- audits the performance of the water sector for compliance with standards.

Managing (natural resources manager or basin management agency):

- undertakes strategic water assessments;
- develops policies and strategies to comply with regional or national objectives and standards;
- develops and oversees strategic water research;
- plans development of water resources;
- allocates water;
- finances basin action plans;
- manages surface water and groundwater quantity and quality;
- co-ordinates inter-agency and community actions;
- develops programmes to build capacity in the water sector;
- promotes public participation and awareness.

Operating services (public, private or public–private utility):

- builds and operates water supply, sewerage, waste water treatment plants, drainage and irrigation systems;
- maintains infrastructure;
- provides technical advice and assistance;
- charges for services;
- operates under some form of legal agreement usually with the regulator for operating rights and the resource manager for utilisation of the water resource.

Basin organisations function according to their specific mandate, usually determined at a high level by central government to align with government goals and policies. The mandate very much depends on the reasons the basin initiative was started and reflects the critical issues in the basin (Example 4.1). It is very important to clearly define the boundaries of the mandate (by law for formal organisations), the reporting lines and to spell out who sets the 'rules' for making decisions and participation.

Example 4.1. Québec: mission and mandates of basin organisations

The Québec Water Policy, adopted in November 2002, created basin organisations for 33 major watercourses to integrate water management at basin level (GIEBV, Gestion Intégrée de l'Eau par Bassin Versant). The basin organisations, as neutral consultation platforms, organise integrated water resources management at the basin level, in order to promote sustainable development.

Mission

Their mission is to mobilise local and regional water stakeholders, to co-ordinate actions likely to impact water resources and associated ecosystems, and ensure public participation.

Mandate

In order to fulfil their mission, basin organisations have the following mandates:

- develop, and update a Water Master Plan through public information and participation;
- sign basin contracts with relevant water stakeholders and monitor implementation;
- inform water stakeholders and the general public of basin issues;

- participate in the implementation of the St. Lawrence integrated management plan, in order to ensure a solid relationship between the GIEBV and St. Lawrence integrated management.

More information at: <http://www.robvq.qc.ca> and <http://www.mddep.gouv.qc.ca>

4.1.2 Core tasks

Although basin organisations carry out many tasks, they tend to focus on three main areas:

- monitoring, investigating, co-ordinating and regulating,
- planning and financing, and
- developing and managing.

The Comprehensive Assessment of Water Management in Agriculture (CA), together with the Global Water Partnership and the International Network of Basin Organizations has drawn up a list of the main tasks in integrated water resources management in basins in these three areas (Box 4.B). Depending on the purpose for which the basin organisation has been created, and the arrangements for management, it may cover some or all of these functions (Example 4.2). The critical issues from the integrated water resources management perspective are that, in carrying out these tasks, the basin organisation should be flexible, work at all levels and work collaboratively.

Box 4.B. Main functions of basin organisations

Monitoring, investigating, co-ordinating and regulating

- *Collecting data* Collecting, managing and communicating data regarding water availability, water demand (including environmental requirements), and water quality to support different basin functions.
- *Prevention, monitoring and enforcing* Monitoring and control of water pollution, salinity levels and ground water extraction – ensuring that they remain within accepted limits; and enforcing relevant laws and regulations to prevent degradation/overexploitation and to restore ecosystems.
- *Co-ordinating* Harmonising policies and actions undertaken in the basin by state and non-state actors relevant to land and water management.
- *Resolving conflicts* Providing mechanisms for negotiation and litigation.

Planning and financing

- *Allocating water* Defining mechanisms and criteria by which water is apportioned among user sectors, including the environment.
- *Planning* Formulating medium- to long-term plans for developing and managing water resources in the basin.
- *Mobilising resources* Ensuring financing, for example, by collecting water user fees or water taxes.

Developing and managing

- *Constructing facilities* Designing and constructing water infrastructure.
- *Maintaining facilities* Maintaining water infrastructure.
- *Operation and management* Ensuring that dams, navigation and water distribution

infrastructure, and wastewater treatment plants are properly operated; that allocated water reaches its point of use; and that surface and ground water are conjunctively managed.

- *Preparing against water disasters* Protecting from floods and developing emergency works, flood/drought preparedness plans, and coping mechanisms.
- *Protecting and conserving ecosystems* Defining priorities and implementing actions to protect ecosystems, including awareness campaigns.

Based on the Comprehensive Assessment of Water Management in Agriculture 2008

Example 4.2. Changjiang Water Resources Commission, China: mission and functions

The Changjiang (Yangtze) Water Resources Commission (CWRC) is a river basin authority charged by the Ministry of Water Resources (MWR) with water administration in the Yangtze River Basin and other river basins of south-western China. For more than half a century, the CWRC has been responsible for managing the basin, comprehensive basin planning and the Yangtze River Basin Master Plan.

Following a period of extensive infrastructure development, the regulation and development of the Yangtze is entering a new phase. In this context and faced with new tasks and challenges, the CWRC is turning to innovative approaches to "ensure a healthy Yangtze and promote harmony between man and river". It vows to be the voice and steward of the Yangtze, perpetuating a healthy Yangtze for the benefit of the generations to come.

The mission and functions of the CWRC are to:

- organise and supervise the enforcement of Water Law and other relevant laws;
- exercise the water administrative functions as enacted in the Water Law, authorised by the MWR;
- prepare a basin master plan and special-theme plans and oversee their implementation;
- deploy preparatory work and technical review for planned projects;
- integrate water resources management in the basin;
- guide, co-ordinate and supervise flood control and drought relief activities in the basin;
- water resources protection in the basin;
- construct and manage central government funded water development projects;
- unify management of river sand extraction, including supervision, co-ordination and guidance;
- organise implementation of soil conservation in priority areas, including soil loss control, dynamic monitoring, supervision and guidance;
- operate and manage state-owned assets of water projects.

More information at: <http://www.cjh.com.cn/eng>

4.1.3 Evolution

Because regional and national contexts change, basin organisations also evolve over time. Basin organisations need to adjust to changes in political direction, administrative reforms, or relations between riparian countries. This may require changes in their governance system and structure, and changes in their mandates, for example. They also need to be able to adapt to emerging issues, such as climate change, ecosystems protection, among others.

Basin organisations very often start as 'commissions', particularly in the case of

transboundary basins. Often they are initially set up to address one or two critical problems rather than all water-related issues, but this may change over time. For example, the need to improve navigation and security on the Congo River triggered the creation of the International Commission of the Congo-Oubangui-Sangha Basin (CICOS) in 1999 by four riparian states. But, since then, the mandate of CICOS has evolved and become much wider. Now it encompasses integrated water resources management in the basin (Example 4.3) and is likely to expand to include other riparian states.

Example 4.3. Congo River basin organisation: evolution

The International Commission of the Congo-Oubangui-Sangha Basin (CICOS) was created in 1999, by Cameroon, the Central African Republic, the Congo and the Democratic Republic of the Congo, initially to deal with navigation. As a basin organisation, CICOS really got under way in 2004. In 2007, the initial agreement was amended giving CICOS the mandate to integrate water resources management in the basin.

The organisation is currently developing water resources information systems, action plans and management capacity. Angola, at present an observer, and other riparian states are likely to join CICOS. Member states are creating intermediary structures. In addition to the challenges posed by navigation, the Congo basin faces other significant challenges, including managing forest resources and developing infrastructure, such as the Oubangui–Chad transfer and the Inga dam.

More information at: <http://www.cicos.info/siteweb>

In other cases, organisations initially set up under the umbrella of government may split into several units with some evolving into autonomous institutions (Example 4.4).

Example 4.4. Mahaweli Authority, Sri Lanka: evolution and changing role

The Mahaweli Authority of Sri Lanka (MASL) covers 40% of the island. MASL is responsible for hydraulic infrastructure, water storage, hydropower, regulating water distribution, irrigation, and collecting and processing agricultural products.

The government of Sri Lanka, with support from the World Bank, is reforming the MASL. The reform will distribute and subcontract many tasks, decentralise decision making and bring in charges for water services. The Kala Oya basin (in the northwest) was selected as a pilot basin for the reform. Decision making was decentralised to the Kala Oya Basin Organisation which focuses on environmental issues and involves civil society.

In 2003, an evaluation of the pilot project showed that:

- the draft water law needed modifications to avoid conflicts and dysfunction;
- the responsibilities and powers of each party and the co-ordination mechanisms, particularly the responsibilities and powers of the Basin Committee, should be clearer;
- project planning and programming should focus more on demand regulation, but this is hindered by weak economic indicators;
- communication about the basin organisation activities should be improved.

More information at: <http://www.mahaweli.gov.lk>

Another example of how basin organisations change is the evolution of the French Water Agencies (see Chapter 5 *Finance*, Example 5.3). These were initially created in 1964 to finance a plan against pollution, and improve sanitation systems. But, since then, their role has changed considerably and they now focus more on environmental issues in planning and decision making within the implementation of the European Water Framework Directive.

Even if the legal status remains the same, the mandate and functions of a basin organisation very often evolve in response to political and administrative reforms, and new challenges. An example of this is the shift in approach in the Organisation for the Development of the Senegal River (OMVS). Since 2002 the OMVS has moved from pure infrastructure development to an approach that takes IWRM into account in developing and managing infrastructure (Example 4.5).

Example 4.5. Organisation for the Development of the Senegal River: evolution

When the Organisation for the Development of the Senegal River (OMVS) was created in 1972, the major concern was to develop infrastructure to address water stress resulting from a cycle of droughts, develop agriculture, reduce the cost of hydro-electricity and open up Mali by improving navigation. At that time, OMVS was mainly dedicated to infrastructure 'development', although it played an important role in sharing costs and benefits between riparian countries.

In 1998, the Programme for the Mitigation and Monitoring of Environmental Impacts drew attention to the lack of management and the risks this involved. The Observatory of the Environment was created in 2000, as a tool to support basin management.

In 2002, the Conference of Heads of States and Governments, meeting in Nouakchott, highlighted the need for an integrated basin management approach. The Observatory of the Environment therefore became the Observatory of Sustainable Development, shifting its focus from management of shared resources to the management of information and data for sustainable development. It is expected that a Water Development and Management Master Plan will be developed at basin level. Part of the plan will be for integrated water resources management programmes at the local level.

In 2006, Guinea joined the initial members, Mali, Senegal and Mauritania, and became a member of OMVS.

Today, OMVS is both an agency that constructs the infrastructure necessary for the sustainable development of the basin and one that functions as an integrated water resources management agency.

More information at: <http://www.omvs.org>

Basin organisations are usually set up to deal with issues which are not, or not fully, covered by other institutions. Collecting and exchanging information and data have often been entry points for developing initial basin structures. In many cases, even well-established basin organisations did not initially involve stakeholders. Since then, this has become more common practice and they have had to set up mechanisms to improve public participation.

At a transboundary level, the catalysts for basin co-operation have been the need to resolve conflict, to guarantee free navigation, to deal with floods, and the need to co-operate in designing and constructing infrastructure (Example 4.6). Then, when decision makers become aware of the value of involving stakeholders, the mandate of basin organisations broadens. Sometimes there is also a change in the scope of the basin organisation, for example in transboundary basins which expand as more countries become members.

Example 4.6. Organisation for the Development of the Gambia River: lessons from evolution

The Organisation for the Development of the Gambia River (OMVG) was created in 1978 by Senegal and Gambia to develop and enhance the water resources of the basin and integrate socioeconomic development of member states.

The programme initially dealt with the development of infrastructure on the Gambia river (bridges and dams) and set up a large High Commission. For more than ten years, OMVG was not very active, and had no concrete outcomes. In 1991 member states, with a new wish for regional integration, agreed to reform the High Commission, dramatically cut staff – reducing from 40 to 10 – and change the mission of OMVG.

In 1997, OMVG started two projects: building a bridge and two hydropower dams on the Gambia river.

Feasibility studies for the hydropower dams are complete and the African Development Bank is working to mobilise funds. Donors have committed to provide almost 60% of the investment needed.

Several lessons can be learned from the evolution of the OMVG:

- strong political will is indispensable if co-operation in shared basins is to be effective;
- the experience of others is always useful, as long as the recipe is adapted to the context of the particular basins; and
- constant dialogue between states with different linguistic and administrative cultures is essential if courageous decisions are to be made, both for institutions and programmes.

OMVG now feels the need to move forward by implementing an integrated management approach that will:

- optimise the use of natural resources in order to secure food for the population;
- improve livelihoods; and
- achieve energy autonomy while paying more attention to the conservation of the environment.

4.2 Types of basin organisations

There are many types of basin organisations and, as the examples in this section show, the terms used to describe them vary from country to country. Basin organisations may be created afresh, but are more likely to evolve from existing entities to fit local needs and practices. The institutional set up of basin organisations will depend on local legal systems and leadership styles, so that what is called a basin council in one country may be different in form and function from what is called a basin council in another. Again, the examples illustrate this point well.

Below is a short summary of the different types of basin organisations that are commonly found around the world. The key distinguishing features are whether the basin organisation is a formal government body enshrined in law, a temporary official arrangement but with limited legal powers, or an informal or non-governmental body with no legal powers. Other distinguishing features are in the functions of basin organisations: whether they own dams, canals, water ways, hydroelectricity power plants, dykes and irrigation works and build, operate and maintain such water infrastructure, or, whether the basin organisations are only responsible for soft water management tasks.

The cost of running a basin organisation will depend on its mandate and institutional set up and this has to be considered when deciding what type of institutional structure is needed (see Section 5.1.3 *Operations of the basin organisation*).

4.2.1 Basin commissions or authorities

For many decades, international commissions or authorities for transboundary basins and aquifers have been created by bilateral or multilateral treaties, or conventions between riparian countries. Basin commissions may be solely advisory – providing guidance, educating and monitoring – but may also oversee activities and work to fulfil the goals of a government charter or international agreement (Example 4.7).

Example 4.7. The International Joint Commission: a transboundary monitoring, investigating and co-ordinating basin organisation

Established by the 1909 Boundary Waters Treaty, the International Joint Commission (IJC) helps the governments of the United States and Canada to prevent and resolve transboundary disputes, primarily regarding water and environmental issues. The IJC undertakes investigations, and advises and licenses certain works in boundary and transboundary waters. The IJC also brings emerging transboundary issues to the attention of the governments for early action.

The IJC works through boards of control, investigative and surveillance boards, advisory boards, task forces and accredited officers. These, created by the IJC, also assess environmental quality in the Great Lakes and other transboundary watersheds and identify emerging transboundary air quality issues.

The Boundary Waters Treaty provides that the Canadian and US governments may refer questions or matters of difference to the IJC. In these cases the IJC usually appoints an investigative board or task force to examine the facts and advise.

More information at: <http://www.ijc.org>

Commissions are normally established by formal government statements or rulings and may or may not have a permanent secretariat. They often define common rules (e.g. for navigation) and, when necessary, decide on allocations of the available resources between the categories of uses, regions and (for transboundary basins) for the riparian countries. They may also co-ordinate flood and drought prevention, and measures to reduce pollution, and prepare and implement multi-year plans to co-ordinate and reinforce activities at the basin level.

In America and Africa, these commissions and authorities may own water infrastructure and hydropower plants. In the European Union, international commissions are co-ordinating the implementation of the Water Framework Directive in riparian EU member states. In federal countries (e.g. Brazil, Australia), such commissions can be established by the central government and states, provinces or regions to co-ordinate policies and activities on a shared river or aquifer.

Similarly, representatives of different ministries concerned with water resources may come together under a national commission to co-ordinate various activities on the same river or aquifer, and to exchange information or data. In some cases, if a different mandate is needed to address new policy directives, the government may change the statute so that a commission becomes an authority (Example 4.8).

Example 4.8. Murray–Darling Basin Authority: an authority replacing a commission

In 1986 Australia's five States and the national government established the Murray–Darling Basin Commission (MDBC). The MDBC was a platform for consultation on joint management of natural resources in the basin and powers remained within the States. In 2008, the MDBC was replaced by the new Murray–Darling Basin Authority which has stronger, centralised powers. The new Authority has jurisdiction over a large basin (1,061,469 km²) and will ensure the Basin's water resources are managed in an integrated and sustainable way, by:

- preparing a Basin Plan for adoption by the (national) Minister, including setting sustainable limits on water that can be taken from surface and groundwater systems across the Basin;
- advising the Minister on the accreditation of state water resource plans (these were previously accredited by each State or Territory);
- developing a water rights information service which facilitates water trading across the Murray–Darling Basin;
- measuring and monitoring water resources in the Basin (previously the role of the States and Territory);
- gathering information and undertaking research; and
- engaging the community in the management of the Basin's resources.

The new Authority will set limits on the amount of water (both surface and groundwater) that can be taken from Basin water resources as a whole and for individual water resources. It will identify risks to basin water resources, such as climate change, and strategies to manage those risks. Compliance requirements will be specified for State water resource plans as well as environmental objectives, watering priorities and targets for basin water resources. A water quality and salinity management plan will be developed and rules set for trading water rights.

More information at: <http://www.environment.gov.au/water/mdba/index.html>

4.2.2 Basin directorates or agencies

A basin directorate or agency makes planning decisions and has statutory responsibilities. They may set and enact regulations, or have authority to give consent for developments and are usually founded on civil service principles to serve the public with some autonomy within a national legal framework (Example 4.9). They may have an arbitration role, which the interested parties refer to for decision making on any conflict that arises. They are usually in charge of carrying out tasks for medium-term planning and for collecting taxes on water abstractions and discharges to finance or support the investments needed to achieve set objectives. In some cases they can also be responsible for water policy, studies, data collection or production, information sharing and public awareness (Examples 4.10 and 4.11).

Example 4.9. Apele Romane, the Romanian National Waters Administration and basin directorates and committees

The Romanian National Waters Administration (Apele Romane) is the national authority in charge of water resources management and development. It is an autonomous legal entity under the Ministry of Environment and Sustainable Development. It has overall responsibility for water resources management in Romania, including compliance with international and EU legislation.

Under the Apele Romane there are eleven Basin Directorates, organised as basins and groups of basins, and the National Institute of Hydrology and Water Management. Basin Directorates are responsible for the implementation of the national water strategy in their basin territory. Basin Committees were established at the level of each Water Directorate through a 1996 Water Law modified and amended in 2004. The rules regarding their organisation and operation were approved by the Government in 2000. The Basin Committees include representatives of the Ministries in charge of the environment and health, municipal and county authorities, water users, NGOs and Apele Romane.

Functions of the Basin Directorates:

- elaborate, monitor and review the River Basin Management Plan;
- implement the EU Directives to achieve a 'good status' for all water bodies;
- develop and maintain water infrastructure;
- ensure development of water infrastructure in the national public interest, new water and flood protection works;
- monitor water quality and quantity;
- provide water management services according to demand;
- notify, authorise and control water use;
- protect against floods;
- warn water users and local administration authorities about accidental water pollution.

Functions of the Basin Committees:

- agree on integrated water management plans and develop programmes for water management works;
- agree on plans to prevent accidental pollution;
- propose revisions of water management norms and standards;
- establish special norms for wastewater discharges;
- recommend priorities concerning water management investments;
- ensure information collection, analysis and sharing.

More information at: <http://www.rowater.ro>

Example 4.10. Authority for the Sustainable Management of the Lake Izabal and River Dulce Basin, Guatemala: a consultative body with limited powers

The Government of Guatemala created the Authority for the Sustainable Management of the Lake Izabal and River Dulce Basin (AMASURLI) in 1998 to protect the tourist attractions of Lake Izabal and the Dulce River. AMASURLI is a basin organisation within the Ministry of the Environment, but with representation from other public agencies, municipalities and the private sector. Decisions made by AMASURLI are not binding. It is a consultative body with very limited powers.

AMASURLI provides a platform for discussing a wide range of management issues, including agriculture, fishing, mining, water pollution, extension of the farming frontier and navigation.

More information at: <http://www.marn.gob.gt/dependencias/amasurli.html>

Example 4.11. Committee for the Integration of the Hydrographical Basin of River Paraiba do Sul, Brazil: a basin organisation in a federal country

The Paraiba do Sul river basin, in the southeast of Brazil, covers approximately 55,500 km². The basin spans parts of the states of Sao Paulo, Rio de Janeiro and Minas Gerais, and 180 municipalities – 88 in Minas Gerais, 53 in Rio de Janeiro and 39 in Sao Paulo.

The population of the basin is about 5.5 million. In addition, a basin transfer provides water to 8.7 million more people in metropolitan Rio de Janeiro. About 10% of the Gross Domestic Product of Brazil depends on water from this basin.

The Committee for the Integration of the Hydrographic Basin of River Paraiba do Sul (CEIVAP) is made up of 60 members, three from the Federal Government and 19 from each state in the Paraiba do Sul river basin. The 57 state members represent:

- water users (40%);
- public – federal, state and municipal – institutions (35%); and
- civil organisations (25%).

Since 1997, CEIVAP has:

- pioneered implementation of water use charges in Brazil;
- approved the River Basin Plan, including a Program of Investments (to invest USD15 million received from water use charges and USD38 million from other sources), to restore water quality and improve water availability in the basin;
- created the Water Agency for the basin; and
- implemented environmental education and social mobilisation programmes in municipalities.

More information at: <http://ceivap.org.br>

4.2.3 Basin associations or councils

A basin council may be a formal or informal group, comprising government officials, parliamentarians, NGO workers and lay people who get together to discuss water management issues. Councils are usually set up to advise government. A council, unlike a commission, which is also a body of experts, has no regulatory powers. Basin associations (Example 4.12) or councils (also called syndicates) often exist alongside the formal administration and represent different categories of users, NGOs or local community groups. Such associations or councils can have a variety of roles, for example providing advice, raising awareness, educating and stimulating ownership of basin natural resources management and promoting exchange of information. They can also play a watchdog role. They are sometimes set up to solve a specific problem or for a specific basin. For more on this type of basin organisation see Chapter 6 *Involving stakeholders*.

Example 4.12. Ruhr Association, Germany: a basin association in a highly developed basin

The Ruhr is a major tributary of the Rhine River. The Ruhr Association is a self-governing body, subject to North Rhine-Westphalia state law. The 543 members of the Association include cities, municipalities and counties located in the basin, industries and small- and medium-size

enterprises, companies and others, such as owners of hydropower plants. Members pay a subscription fee.

The Association serves a population of 5.2 million people and manages a wide range of infrastructure from wastewater treatment plants to reservoirs, pumping stations and hydropower plants. No new infrastructure is envisaged and plans are oriented towards environmental measures, operation, preventive maintenance and repair. The main tasks lie in restoring water courses to redress the negative effects of over-development of infrastructure. For example, plans include actions to restore fish migration presently hampered by about 1,200 river structures (see Example 8.1).

The decision-making bodies of the Ruhr Association are the assembly of associates, the supervisory board and the executive board. The assembly is made up of 152 delegates selected from the members. The supervisory board has 15 members and exercises supervisory authority. The executive board is the legal representative of the association and takes care of day-to-day operations.

The Ruhr Association Act sets water charges. The structure of the Association means that:

- Being a state controlled but self-administered body guarantees full participation in the accomplishment of tasks and gives sovereignty over fees.
- As the Association is responsible for the Ruhr catchment area, it can orient its work towards natural conditions, unhampered by community boundaries.
- The supra-regional organisation generates cost-saving synergy effects in the operation of its plants.
- The Association can use municipal loans and other credits from the state of North Rhine-Westphalia.

More information at: http://www.ruhrverband.de/ruhrverband_en/html/index.html

4.2.4 Corporations or companies

In addition to the types of basin organisations described above there are also corporations or companies that build infrastructure within a basin. These companies are usually granted a fixed-term concession by government to build infrastructure and manage it for a specified period. Generally they provide services, bulk water and can levy charges for uses, such as navigation, flood control, irrigation and hydropower production. They are not basin management organisations. In general they have a private statute so they do not have a stewardship role in water resources management because this could result in a conflict of interest and might not be in the interests of the public. They may, however, set up committees to consult with stakeholders (Example 4.13). To ensure an integrated approach and to address policy and management responsibilities in the public interest, a separate government body would have to be mandated to regulate such corporations or companies as they would be considered as water users rather than basin organisations.

Example 4.13. Unidad de Cuenca del Río Peñas Blancas, Instituto Costarricense de Electricidad: a consultative committee set up by a service provider

The Electricity Institute of Costa Rica (ICE) is the monopoly public electricity supplier. ICE set up Unidad de Cuenca del Río Peñas Blancas (UCPEÑAS) to carry out its environmental policies. To do this UCPEÑAS modernises management practices, undertakes studies, formulates river basin plans and develops supporting activities in conjunction with stakeholders in the basins concerned.

Although there is consultation with ministries, municipalities and non-government organisations in the basin, executive power is clearly with ICE and, therefore, it is not a neutral body. There are inter-ministerial agreements and agreements with the municipalities and other stakeholders, but there is no representative committee.

The main task of UCPEÑAS is to reduce, as far as possible, the environmental disruption caused by the release of water from the Peñas Blancas reservoir, a very popular tourist destination. The negative effects of flushing have undeniably been reduced. Studies carried out by UCPEÑAS have improved knowledge of the ecology and of the agricultural economy of the basin and, if applied, will lead to more environmentally sustainable development of the basin.

More information at: http://www.grupoice.com/esp/ele/manejo_cuencas/penas.html

4.3 Complementary roles of water management bodies in basins

Different kinds of basin organisations may work in the same basin but play complementary roles. For example, in the Rhône basin in France, the International Commission for the Protection of Lake Geneva (France/Switzerland), the Rhône Basin Committee and Water Agency (for planning, financing and implementation of the European Water Framework Directive) and the National Rhône Company (Compagnie Nationale du Rhône, for dams, dykes, hydropower, navigation, and bulk water) work together. In such cases, the role and mandate of each organisation must be clearly defined by national laws and international treaties.

Box 4.C gives some examples of the organisation of water management in basins in five countries.

Box 4.C. Organisation of water management in basins: some international comparisons

Functions	France	Spain	Brazil	Mexico	Morocco
Water policing – authorisation (discharges, withdrawals)	State services	RBO (Confederation)	Federal or State services	National Water Commission	RBO (Hydrographical Basin Agencies)
Registry of users	RBO (Water Agency)	RBO (Confederation)	RBO (Basin Committee and Water Agency)	National Water Commission	RBO (Hydrographical Basin Agencies)
Strategic long-term planning (master plan)	RBO (Basin Committee)	RBO (Confederation)	RBO (Basin Committee)	RBO (Basin Council)	RBO (Hydrographical Basin Agencies)
Manage concessions to big developers (raw water sales)	Private developers	RBO (Confederation)	Private developers	National Water Commission	RBO (Hydrographical Basin Agencies)
Water charges (pollution, abstraction), basin action plan	RBO (Water Agency)	RBO (Confederation)	RBO (Water Agency)	RBO (new basin organisation)	RBO (Hydrographical Basin Agencies)
Drinking water supply and sanitation (community)	Municipalities	Municipalities and Autonomous Authorities	Municipalities or State	Municipalities or State	Municipalities and Drinking Water National Office
Irrigation (community)	Developers and Associations	Associations	State or Associations	Associations	Morocco Agricultural Development Office
Monitoring, data	State services	RBO (Confederation)	Federal	National Water Commission	RBO (Hydrographical Basin Agencies)
	Water Agency		Basin Agency		
	Various (private)	Autonomous Authorities	State + Municipalities	State	Various (private)

RBO: River Basin Organisation

Source: International Network of Basin Organizations

5 Finance

KEY POINTS

- Basin management systems need adequate, reliable and sustained financing.
- Financing supports three main functions:
 1. stewardship of the resource,
 2. developing and maintaining infrastructure, and
 3. operating the basin organisation.
- There are three basic sources of revenues:
 1. taxes,
 2. tariffs (and other charges), and
 3. transfers.

Before setting up a basin management system, the funds required for its operation must be quantified and sources of funds identified. The type of basin management system that is to be established has to be adequately funded so it can fulfil its purpose. Although this may seem obvious, too often a basin organisation is set up with unrealistic objectives compared with the funding allocated. Indeed, the finances for basin management are often given scant consideration. This builds under-performance into the basin management system.

Most basin organisations have limited financial autonomy and depend heavily on allocations from central government budgets. These allocations often fluctuate from year-to-year and according to other government priorities. But basin management is a 'public good'. So, irrespective of whether or not a formal basin organisation exists, governments would still have to fund development and management of water resources. Basin management should not duplicate, but should co-ordinate the activities of other agencies, or address new functions not yet implemented. This means funds must be clearly allocated to specific functions.

Developing and implementing an appropriate financing system, based on 'polluter-pays' and 'user-pays' principles, is one of six founding principles of the International Network of Basin Organizations and is a key element of the IWRM approach as defined by the Global Water Partnership.

5.1 Uses of finance

Financing for basin management covers three distinct areas:

1. Stewardship of the resource,
2. Developing and maintaining infrastructure, and
3. Operations of the basin organisation.

5.1.1 Water stewardship

An integral part of a basin action plan is the financial plan that sets out exactly how implementation of the plan will be funded – where the money will come from and what it will be spent on. Without a financing strategy, a basin action plan is useless. But, securing funds

takes time. Finalising a plan before finding the funds to implement it will almost certainly mean that the plan is out-of-date and may even have to be abandoned by the time funds have been raised. Experience has shown that when plans state where funds are going to come from and how they will be spent they are more likely to be implemented successfully than when plans fail to do this. Identifying financing also provides a reality check during development of the plan.

Finance is needed for two aspects of water stewardship. First, financing for institutional or non-structural activities (often referred to as 'soft' interventions) that make things happen – oil the wheels of progress. Such activities are the essence of an integrated approach to water resources management. Activities that oil the wheels include addressing governance, including mechanisms for accountability and transparency, policy and planning processes, law making, participation, monitoring, collection of water charges, data collection and analysis, research, capacity development, awareness raising and communications activities.

Second, financing is needed for the routine tasks and maintenance – collecting hydrological and other data, land management, river restoration, preventing invasive vegetation and pollution, sediment management – that must be done to keep the basin healthy.

These water stewardship activities require secure long-term financing. Basin organisations must cost these activities and include them in medium and long-term – five or six year – financial strategies, as well as in annual budgets.

5.1.2 Developing and maintaining infrastructure

Finance for essential water infrastructure can be either for:

1. **developing and managing water resources**, such as building storage dams and dykes for flood/drought protection, basin management (including land/soil management), preventing pollution and protecting the environment; or
2. **providing water services**, such as hydropower, irrigation systems, domestic and industrial water supplies, wastewater treatment and navigable waterways for river transport.

The distinction between developing and managing water resources and providing water services is important when considering the role of the basin organisation. Responsibility for the former – infrastructure related to managing the resource – is clearly a public good. However, the latter – service infrastructure – can be, and often is, provided by a range of public and private organisations, from inside or outside the water sector, and earns income for the provider. The role of the basin organisation in relation to service infrastructure thus has to be clearly demarcated or there may be duplication and confusion with other roles. For example, if the basin organisation builds an irrigation system and, at the same time, assesses the impact of the irrigation system on water resources and the environment, there is a clear conflict of interest.

Of course, there are instances where this distinction is blurred and objectives are 'bundled' together: when a multi-purpose dam serves both to prevent floods and store water for irrigation, or where basin management is combined with hydropower development for example. The point here is for basin organisations to understand such issues and, where possible, avoid conflicts of interest.

The basin organisation will face dilemmas if it manages 'regional development' funds to provide infrastructure for services whilst, at the same time, receiving a budget from the public purse for stewardship of the basin. Inevitably, the latter role will be compromised. To avoid such conflicts, as we noted in Chapter 4 *Roles and types of basin organisations*, these functions should be separated. Separating the responsibilities will minimise governance failures and corrupt practices, and reduce risks (see Box 4.A *Assigning responsibilities for*

managing water, regulating water and providing water services). If the basin organisation is responsible for providing services, then the stewardship role is better assigned to a higher public authority.

The basin organisation is likely to be one of many actors involved in providing infrastructure and will need to work with the other actors. Cost-sharing mechanisms may need to be agreed to ensure an integrated approach. Inter-basin transfer schemes pose special financing issues. Sharing costs between basins has political implications and will probably need to be resolved at the national or regional level.

In some countries, basin organisations are authorised to receive and manage grants from donors or take loans from banks (local and international). In other countries, all financing must pass through the central government. In either case, if basin organisations are seeking external donor financing, they should meet with donors during the planning stages of any programmes with a view to securing a commitment in principle, and addressing any donor requirements as early as possible.

In the case of infrastructure projects, funds have to be identified and allocated not only for construction, but also for ongoing operating and maintenance costs once construction has been completed. If the basin organisation is to be responsible for operating and maintaining the infrastructure then these costs have to be factored into long-term operating budgets (see Section 5.1.1 *Water stewardship*).

5.1.3 Operations of the basin organisation

Whatever the form of the basin organisation it will need an operating budget. This may be quite small for a basin committee that meets infrequently, but can be significant for a large basin authority responsible for programmes involving infrastructure. Budgets must cover administration, financial management and auditing, human resources and capacity development of staff.

Budgets must also include sums for essential equipment, such as computers and field instruments, modelling and geographic information systems (GIS) software and vehicles. Provision for maintaining and replacing equipment should be included. Often basin managers cannot fulfil their responsibilities because their operating budgets are inadequate.

Administrative costs can be significant. Funds allocated must be used cost-effectively to minimise losses and avoid criticisms of profligate use of public funds. In setting up a basin organisation the size of the budget allocated for administration may be a deciding factor in determining the role a basin organisation can realistically play – as opposed to the role it could ideally play. Funds may also be needed to reform institutions in line with new policies to strengthen or reform basin management.

5.2 Sources of revenues

Because basin management is a public good it will mainly be funded from public sources. There are only three sources of funds: **taxes**, **tariffs** (in the form of charges, tariffs and fees) and **transfers** (the three Ts)⁴. All funds have to come from a combination of these sources. (Water markets are not considered here as they are complex and rarely used worldwide.) Importantly, funds have to be administered within a clear legal framework and accountability enforced by transparent external audit.

⁴OECD 2009

5.2.1 Taxes

Taxes are an indirect source of funds and may be raised in many different ways from citizens and businesses. Central governments make allocations from tax revenues to basin organisations. Sometimes local governments also allocate some of their tax revenue to basin organisations. For example, the Corporación Autónoma Regional (CAR) in Cundinamarca, Colombia, and other Colombian CAR receive a percentage of the land ownership taxes paid to local government in the basin. The basin organisation thus competes with other public organisations for resources. This means the case for budget allocations must be sound.

Taxes can also take the form of special levies. Taxes levied directly on the water sector are not necessarily allocated back to the water sector. National, state, regional or even municipal governments may allocate the revenues from water taxes to anything from schools and roads to water infrastructure and water management. Tariffs, on the other hand, are dedicated charges that may *only* be used for specific purposes stipulated by laws or regulations.

5.2.2 Tariffs

The sums governments allocate to basin management from central budgets are seldom sufficient to cover all basin management costs. Increasingly, costs have to be recovered directly from citizens and businesses that benefit from the services provided by the basin organisation.

5.2.2.1 Charges

Users often pay charges directly to central government and payments are recycled through budget allocations to the basin organisation. However, in these cases, there is a risk that central government will use the revenues for other purposes rather than plough them back into water management. Although unpopular with finance ministries, it is preferable that service charges are paid directly to the basin organisation. To do this, basin organisations will need to have statutory powers to raise revenue in this way as well as the requisite safeguards and financial oversight. The agreement with central or regional government must clearly state that charges for specific services or special levies earmarked for water resources management will be made and retained by the basin organisation.

France and Spain have national water laws that set out such charges, or 'redevances'. Water agencies or 'confederaciones' can directly determine charges at basin level. The charges are mainly levied on withdrawals and discharges and apply the 'polluter-user-pays' principle (Example 5.1).

Example 5.1. French water agencies: 'polluter-user-pays' and 'water-pays-for-water' principles

The 1964 French Water Law (modified in 1992 and 2006) set up a Water Agency in each of the six main river basins in France. The Water Agencies are administrative public institutions with civil status and financial autonomy.

Agencies are financed on the 'polluter-user-pays' principle. Each Agency levies water charges ('redevances') on withdrawals and discharges that affect water quality and modify the water regime. For industries, the charges are calculated according to the type of industry and the amount of pollution they produce. For domestic users, the charges are calculated for each community according to both permanent and seasonal populations, and are collected from users together with payments for metered water consumption.

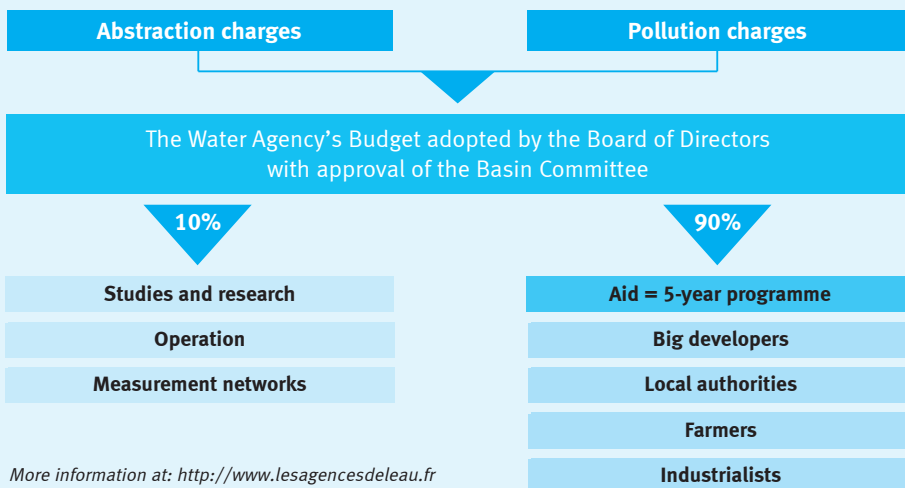
The rates are determined by each Agency and are adapted according to the priorities and quality objectives defined for each basin. They must be approved by the Basin Committee, a multi-stakeholder platform composed of representatives from the State, local governments and users (industrialists, large regional developers, farmers, water supply and sanitation companies, fishermen, and associations for the protection and conservation of the environment).

Based on the 'water-pays-for-water' principle, 90% of the funds collected by the Water Agencies are then reallocated as loans and subsidies to local communities, industries, farmers and other groups to:

- abate pollution (construct, extend or improve purification plants and waste water collection systems, introduce cleaner production processes, etc.);
- develop and manage surface water and groundwater; and
- restore and maintain the aquatic environment.

Ten percent of the funds collected go to cover the costs of the Water Agency and River Basin Committee. For the current six-year action plans the funds collected will amount to €11.6 billion, which will support basin investments or water resource activities to the value of €10.2 billion.

The 'polluter-user-pays' principle



Transparency of costs and 'polluter-pays' principle

Costs	Definition	Example
Direct cost	Capital costs	<i>Principal and interest, depreciation</i>
	Operating costs	<i>Wages, electricity, maintenance of equipment, analyses of the quality of water</i>
Environmental cost	Costs of the damage to the environment caused by a given activity	<i>Contamination of an aquifer, destruction of wetlands</i>
Resource cost	Value of the alternative foregone by choosing a particular activity (= opportunity costs)	<i>Cost of electricity that could have been produced if water would be available instead of being pumped for irrigation</i>

Sum = full cost

Other countries, including Algeria, Morocco, Mexico, Brazil, Romania and Bulgaria, are introducing similar charges (Example 5.2). In Brazil, the charging system was adapted from that used in France and modified to suit the federal system in the country (Example 5.3).

Example 5.2. Algerian Hydrographical Basin Agencies: water charges system

The principle of charging industries for water use is well established in Algeria. It was initially introduced in the 1980s based on the idea that private use of a good then considered a state property (public water) needed to be paid for.

With the adoption of integrated water resources management principles in the first half of the 1990s, the charges, introduced by the 1996 Finance Law, and reinforced in the 2007 Finance Law, reflected an important change. Charges to pay for integrated water resources management were extended to all sectors. While these laws introducing charges have not, or have only very partially, been implemented, they have led to:

- a better understanding of industrial withdrawals, as well as of obstacles to implementing a charging system;
- progress in organisational modalities to calculate charges and in procedures to collect them; and
- acquisition of information related to accounting: recovery costs, yield, reasons for non-payment.

More information at: <http://www.abhahs.com> (Algiers/Hodna/Soumman)

Example 5.3. Piracicaba, Capivari and Jundiaí River Basin in Brazil: adapting water charges to a federal system

The Piracicaba, Capivari and Jundiaí River Basin (PCJ) in Brazil covers an area of 15,320 km². Approximately, 92% lies in the State of Sao Paulo and 8% in the State of Minas Gerais.

In October 2005, after more than a decade of discussion, the PCJ River Basin Committee approved a water use charge. Charges are collected from water users – sanitation and water supply utilities, industries, and farmers – who extract and consume water and discharge sewerage into the rivers and groundwater in the basin. The system of charges was initially applied to the federal rivers, but, is now being applied to rivers in the State of Sao Paulo. The River Basin Committee decided that the same charges will apply to both federal rivers and state water bodies.

The charges are USD5 per 1,000 cubic meters of water extracted, USD10 per 1,000 cubic meters of water consumed, USD50 per ton of discharge, and USD7.50 per 1,000 cubic meters transferred to another basin.

The water use charges:

- recognise that water is an economic good and give an indication of its real value;
- stimulate the rational use of water; and
- collect resources to finance programmes and interventions set out in the Hydrographical Basin Plan.

All financial resources collected are used by the Water Agency to restore water quality and improve water availability in the basin according to strategies established in the River Basin Plan and approved by the Committee.

More information at: <http://www.comitepcj.sp.gov.br/>

Licences, 'canones' or 'water rights' are another form of charging (Example 5.4). They are tools to regulate water use. Basin organisations should require water users, including municipal authorities and utilities whether public or privately operated, to pay for licences to extract water. Likewise, wastewater discharge into a river or lake should require a licence. Non-consumptive uses of water, such as mining, navigation and energy production, should also require a licence. Basin organisations should make sure they have the legal power to charge users for these services and retain the revenue to invest in basin management.

Revenues from fines for pollution may also be given to basin organisations to clean up polluted areas and prevent further pollution.

Example 5.4. Costa Rica: 'polluter-user-pays'

The Costa Rica Environmental Waste 'Canon', 2005, is based on the principle that those who contaminate should pay. Payments are calculated according to the quantity of waste generated.

A second 'canon', the Environmentally Adjusted 'Canon', 2006, recognises that water is a public good, and promotes the efficient use of the water resources. It includes two components:

- payments for the right to use water resources for activities such as agriculture, industry, tourism, human consumption, trade; and
- payments for environmental water services to cover the costs of conservation and the costs of restoration of ecosystems.

More information at: <http://www.drh.go.cr>

5.2.2.2 Tariffs and fees

Tariffs and fees paid by users for services should at least cover all operating costs and should also cover renewal costs and the costs of managing water resources for the benefit of citizens (Example 5.5). Tariff rates for different customers may vary based on their ability to pay. Income from fees may be put into a 'solidarity fund' which can be used to balance the needs of upstream and downstream users, and to subsidise poorer social groups.

Example 5.5. Walloon Region, Belgium: application of the cost recovery principle

The European Water Framework Directive (WFD) requires Member States to establish a cost recovery pricing system by 2010 to promote effective use of water resources and ensure that each sector (households, industries, agriculture) contributes appropriately to financing water services. Systems should be based on the 'polluter-pays' principle, amongst others.

To comply with WFD, the Walloon Region established a new legislative framework and reformed water pricing. Water pricing now takes into account all the costs, from protection of water intakes to wastewater treatment. In accordance with the 'water true-cost' principle there are no longer any subsidies. A single pricing structure is applied to all Walloon users (households, farmers, industries and administrations) based on 'services true-cost', 'water supply true-cost' and 'sanitation true-cost'.

The Walloon Region also improved transparency in water services by introducing citizen regulation of water prices and by standardising the accounting systems of water resources operators.

More information at: <http://environnement.wallonie.be>

Because customers are often widely spread geographically, systems to collect payments can be costly and complicated, especially if the total revenue is small. One way to bring down costs is to include basin management fees as a component of the fees charged for other services, for example electricity, as people are more willing to pay for electricity than they are for water. Another way is to arrange for a component of the fees collected by the other party to be used by them to carry out a water management task. For example, hydropower companies may be willing to pay for maintaining a basin upstream to ensure adequate flows to a reservoir.

5.2.3 Transfers

Transfers include grants, and charitable and voluntary contributions. Grants include bi- and multi-lateral funds, such as official development assistance (ODA). One remarkable example is the Water Financing Program of the Asian Development Bank that includes the introduction

of IWRM in 25 river basins⁵. Concessionary loans from international financing institutions, such as the World Bank or regional or bilateral development banks, include a *grant element*, but they are best treated as a repayable source of funds (see Section 5.2.4 *Repayable sources of finance*). These funds are usually directed to central governments. Developing countries also often receive general budget support – donor aid transferred directly to the central treasury. To benefit from a share of these types of funds – as budget allocations or loans – basin organisations will need to present proposals to central government as well as discuss proposed spending with donors during planning. This means making sure that water resources management is a priority in national development plans and poverty reduction strategies.

Discussions on financing often focus on ODA and donor funding. But the funds from these sources are modest for all but a few developing countries. Moreover, with donor funds increasingly channelled through central treasuries as direct budget or sector support, there is often very little available for directly funding of national basin organisations and their programmes. In contrast, many transboundary basin organisations or international commissions in developing countries receive a significant amount of grants or loans from ODA.

Because there is often very little direct funding available, it is important not to overlook the funding available from non-governmental sources. Many charities, NGOs and volunteers contribute cash or in-kind resources for specific projects, such as environmental restoration, monitoring water quality and maintaining ecosystem habitats. However, these funds remain modest compared with other sources.

5.2.4. Repayable sources of finance

The three basic sources of revenue (discussed in Sections 5.2.1-5.2.3) constitute a cash flow for the basin organisation which can be used to raise further repayable forms of finance, particularly loans. Large, solvent basin organisations in some countries may also be in a position to raise bond finance, usually with the backing of state or central government. There may also be scope for raising equity (risk finance) for infrastructure projects, such as multi-purpose dams and, in some cases, new irrigation schemes.

5.3 Financing transboundary basins

Financing for basins shared by more than one country is a special case. Up to 40% of the world's population live in basins shared by two or more countries. Extraction and pollution of water resources in one country directly impacts other countries in the basin. Similarly flood and drought management activities can have significant impacts upstream or downstream, affecting other countries in the basin. This poses challenges in allocating costs for transboundary basin management.

Regional bodies, such as the European Union and the Southern African Development Community, and multi- or bi-lateral agencies, such as the Global Environmental Facility, may provide funds for managing transboundary basins. Countries sharing a basin may agree to allocate budgets and make transfers to the transboundary basin organisation under a legal cost-sharing agreement or treaty (see Section 7.4.1.2 *Sharing costs and benefits* and Example 7.5). Infrastructure projects may also generate revenues but, in these cases, there need to be checks and balances to ensure that those responsible for the infrastructure do not influence, unduly, decision making in the basin organisation.

⁵See www.adb.org/water/WFP/basin.asp for more information.

6 Involving stakeholders

KEY POINTS

- Ensure key stakeholders are represented in basin management.
- Distinguish between information, consultation, participation and empowerment.
- Carefully consider the balance between informing all and involving a few.
- Ensure administrative processes do not jeopardise real participation.
- Ensure participation is transparent.
- Boost ownership of basin action plans by establishing and maintaining community participation.
- Ensure financing for involving stakeholders is adequate.
- Ensure communication between those managing local action plans, heads of government water agencies and heads of basin organisations.
- Develop the capacity of disenfranchised groups so they can participate in planning and implementation at appropriate levels.

6.1 Identifying stakeholders

Basin management requires a clear understanding of stakeholders: who is involved in making decisions on water and land resources management in a basin and who will be affected by those decisions. Once this is understood, ways of getting the right mix of stakeholders involved at appropriate levels of basin management can be organised.

To identify who is involved and who is affected it is useful to draw up a matrix of stakeholders, and their roles and responsibilities. This can be a useful first step in understanding decision making at different levels in basin management (Example 6.1).

Example 6.1. Namoi River Valley, Australia: identifying stakeholders in basin management

In the Namoi River Valley, basin managers faced a complex range of issues on floodplain management, salinity management and soil erosion on agricultural land. They drew up a 'stakeholder matrix' that identified the types of stakeholders and the kinds of economic activities they pursue in the basin.

Scale	Private	Public
Local (operational)	<p>Farmers and graziers</p> <ul style="list-style-type: none"> ■ estimated at 165 families <p>Rural businesses</p> <ul style="list-style-type: none"> ■ several farmers operate off-farm business ventures; ■ suppliers and extension services (supply agrochemicals, farm machinery, irrigation equipment and fertilisers; includes consultants and advisers); ■ transport (private stock and grain transport companies). <p>Land Care Groups</p> <ul style="list-style-type: none"> ■ groups supported by government grants, but mainly locally owned and organised by farmers. 	<p>Agricultural extension agents</p> <ul style="list-style-type: none"> ■ extension services of resource management agencies, primarily Departments of Agriculture, Conservation and Land Management (limited, and decreasing); ■ consultants (provide independent agronomic and on-farm financial advice; based within the region); ■ shire officials; ■ three shires (Gunnedah, Quirindi, Murrurundi Shire) influence land ownership transfers, collect land taxes, and require local environmental management plans.
Regional/State (implementation)	<p>Businesses</p> <ul style="list-style-type: none"> ■ banks (includes agricultural development banks, loan services); ■ wholesalers; ■ services (supply agrochemicals and fertilisers); ■ transport (private stock and grain transport companies). <p>Agricultural extension and technical officers</p> <ul style="list-style-type: none"> ■ chemical companies; ■ private consultants. <p>Organisations</p> <ul style="list-style-type: none"> ■ Regional Development Board ■ Private grower organisations (NSW Farmers, Grains Council of Australia). <p>Media</p> <ul style="list-style-type: none"> ■ local and regional newspapers, television and radio stations (profile major resource management issues; influence changes in attitudes; market products and services). 	<p>State officials (agricultural extension and technical officers)</p> <ul style="list-style-type: none"> ■ includes Conservation and Land Management, Department of Water Resources, Department of Agriculture, Environment Protection Authority, National Parks and Wildlife Service, State Rail, State Forests, Rural Lands Protection Board; ■ includes some regional policy and planning by government. <p>Regional basin management organisations</p> <ul style="list-style-type: none"> ■ North West Total Catchment Management Committee; ■ Liverpool Plains Land Management Committee; <p>Academics;</p> <ul style="list-style-type: none"> ■ social, economic and biophysical research scientists from local and regional universities, and research field stations.
National (strategic/policy)	<p>National businesses</p> <ul style="list-style-type: none"> ■ banks (national policy affects borrowing capability, interest rates); ■ wholesalers (impact on product values and input costs); ■ services (provide consultancy services); ■ transport (provide national infrastructure). 	<p>Philanthropic organisations</p> <ul style="list-style-type: none"> ■ Australian Conservation Foundation; ■ Inland Rivers Network. <p>Officials and programmes in federal organisations</p> <ul style="list-style-type: none"> ■ Murray–Darling Basin Commission; ■ Land and Water Resources Research and Development Corporation;

Scale	Private	Public
	<p>Organisations</p> <ul style="list-style-type: none"> Private grower organisations (NSW Farmers, Grains Council of Australia); organic farming organisations. <p>Media</p> <ul style="list-style-type: none"> national newspapers, television and radio stations (profile major resource management issues; influence changes in attitudes; market products and services). 	<ul style="list-style-type: none"> Rural Industries Research and Development Corporation; National Landcare Program; National Dryland Salinity Management Program. <p>Media</p> <ul style="list-style-type: none"> as for private stakeholders (includes ABC TV and Radio).
Global (strategic/policy)	<p>International agribusinesses</p> <ul style="list-style-type: none"> none thought to be influential, although much agricultural produce is exported through national organisations to international markets; global markets influence local farming practices (e.g. planting decisions). 	<p>Academics and researchers</p> <ul style="list-style-type: none"> none thought to be influential, although several international researchers will use the Liverpool Plains as a comparative field site for research. <p>Treaties</p> <ul style="list-style-type: none"> federal government requires states and regions to comply with national policies derived from international agreements, such as the General Agreement on Tariffs and Trade and the Asia-Pacific Economic Co-operation, and global environmental initiatives including Ecologically Sustainable Development treaties. <p>Philanthropic organisations</p> <ul style="list-style-type: none"> none thought to be influential.

Source: Hooper 2005, pp.67 and 68, adapted from Hooper 1995

6.2 Getting stakeholder participation

There are many ways to involve stakeholders in basin management, both formally and informally. Stakeholder involvement depends on the mandate of the basin organisation (see Section 4.1.1 *Mandate*) and stakeholders (Example 6.2).

Example 6.2. European Water Framework Directive: stakeholder consultation

One of the objectives of the European Water Framework Directive (WFD) is to make water policy more transparent through the active participation of all stakeholders. According to article 14, Member States must *"encourage the active involvement of all interested parties in the implementation of [the] Directive, in particular in the production, review and updating of the river basin management plans"*.

The Directive calls on Member States to *"ensure that for each river basin district, they publish*

and make available for comments from the public" the timetable and work programme, the identification of the main water issues in the district, and the draft river basin management plan.

The Directive provides the framework for public consultation, but each Member State of the EU implements the Directive in its own way. Good public information is a pre-requisite to public consultation.

To ensure consistency between districts, most countries set up a national framework. In international river basins, countries often establish co-ordination mechanisms and, in some basins, the riparian countries adopt a common strategy for public participation. Their experience shows that consultation should be as local as possible and take a bottom-up approach at the basin and sub-basin scale.

The first public consultations generated a better understanding of public expectations. The experiences of Member States showed that water is of great public interest. It was also shown that raising the awareness of decision makers and senior administrators at local, regional and national levels is essential. Communicating appropriately, using simple language tailored to the general public, proved crucial. Most important of all, decision making processes must be transparent. There must be ways to explain the decisions made and to account for the results.

More information at: <http://europa.eu/scadplus/leg/en/lvb/l28002b.htm>
http://ec.europa.eu/environment/water/water-framework/index_en.html

Methods to involve stakeholders depend on many factors: how often stakeholders need to be involved, the kind of society, the nature of information the basin organisation needs from them, the type of representation that is appropriate, the political value of engaging pressure groups and access to the basin organisation and decision makers. Taking part in village meetings, 'town hall' meetings, surveys of basin stakeholders' opinions and basin advisory groups, are just some of the ways stakeholders can be encouraged to get involved. The development of the Andhra Pradesh Water Vision is a good example of how one government involved village stakeholders (Example 6.3).

Example 6.3. Andhra Pradesh Water Vision: gathering stakeholder input

In the development of the Andhra Pradesh Water Vision in India, stakeholder 'water messages' were collected from over 600 people in village meetings. A local non-government organisation that specialises in collecting 'local voices' gathered the opinions of people who normally have very little, if any, access to government decision makers. This made sure that the voices of groups in remote locations were heard. The material gathered in this way was a key input to the Andhra Pradesh Water Vision.

But the process was limited, in that it was a 'one way' process. The Government needs to put more effort into communicating what will happen once the Water Vision gets underway. This has not really happened, so the danger is that the people who participated may become frustrated and wonder about the value placed on their input.

But, stakeholder participation can be time-consuming and costly, and may not have clear outcomes. There has to be a balance between informing all and involving a few. To avert or minimise these problems, procedures for involving stakeholders need to be designed thoughtfully and implemented carefully. The GWP ToolBox indicates key points to consider when designing stakeholder involvement (Box 6.A).

Box 6.A. Key points to consider in designing stakeholder involvement

- Ensure all relevant groups of water users are represented.
- Avoid 'capture' of the process by minority or particularly articulate groups.
- Subsidise if necessary to ensure a 'balance' of public and private participation.
- Establish 'rules' to resolve disputes.

Source: GWP ToolBox

In addition to setting up ways to involve stakeholders there is also a need to be specific about the scope of any consultation, what decision processes each group of stakeholders are going to be involved in and how these decisions are to be made (Example 6.4, Box 6.B). 'Stakeholders' is a very general term and it would be wrong to give the impression that they 'make decisions'. Rather than 'making decisions' they are 'involved in decision-making processes'. Specifying who decides what helps identify any gaps in the basin-wide decision-making process. It is important to fill these gaps to ensure that decision making is adequately co-ordinated.

Example 6.4. Hungary: public participation

The first Public Participation (PP) strategy for river basin management in Hungary was developed in 2006 based on the Danube River Basin PP Strategy. The strategy stresses that river basin management plans must harmonise with all other development programmes that affect water resources management.

The strategy was piloted in the Upper Tisza during the first half of 2007 on the four major interest groups: central and local government organisations, NGOs, water users, professionals and academia. To ensure meaningful public involvement, the PP strategy recommended establishing the following bodies:

- twelve Sub-Committees of existing Regional Water Management Councils,
- four Sub-Catchment Water Management Councils,
- a National Water Management Council.

These bodies are charged with canvassing public opinion and input to develop the River Basin Management Plan. Each body supervises the PP process at their own level and, following review and amendment, endorses or returns the plans for further improvement. The National Water Management Council is responsible for advising the minister on adoption of the plan.

The core composition of the councils is: 40% representatives of governmental organisations, 20% representatives of NGOs, 20% representatives of water users and 20% representatives of professionals and academia.

Other members of the national and sub-catchment committees may be included to ensure bottom-up representation. Legislation is being modified to establish the councils.

Box 6.B. Local participation in basin management

- Agree on customary 'rules' rather than regulations (it is meaningless to set up regulations for water use when there are vast numbers of small-scale users who are not linked with public institutions).
- Make sure sub-basin management plans specify how local water resource management decisions are made (consensus, voting, for example).
- Spell out a 'quality assurance' procedure to ensure that local decisions harmonise with the overall basin management plan.
- Advise local government organisations to enact zoning mechanisms, control pollution, and use planning tools to manage local natural resources, consonant with overall basin management goals (by training, changing attitudes and through co-ordination mechanisms, such as statutory planning powers).

6.3 Stakeholder advisory groups

An independent group, such as a stakeholder advisory group that advises on key water issues, can make basin management more effective. Stakeholder advisory groups are government-private sector-community groups made up of representatives of basin landowners, relevant state government agencies, local government councils, local water supply authorities and other utilities, economic sectors such as agriculture and energy, and other groups with an interest in land and water management.

The role of the advisory group is to advise the basin organisation on major basin problems and possible solutions. The group can voice local concerns, provide local knowledge, help quantify and prioritise issues, as well as identify options to address these issues and provide a reality check on how options are likely to work in practice. Another important role is to advise on developing and implementing a monitoring system.

Workshops and field trips can help both stakeholders and basin organisations appreciate the array, size and extent of land and water resources issues in basin management, as well as how local actions impact other parts of the basin. The advisory group may be supported by a technical committee that advises on the engineering, ecological, economic and social aspects of management.

There are also many opportunities for the private sector to be involved in basin management, especially at the local level. Some ways of doing this are through joint ventures and projects, and cost-sharing arrangements. Private sector water utility providers are the obvious partner for these types of arrangements. However, such arrangements in emerging economies and low-income countries need to be sure of representation by the informal water sector and private sector groups, as well as local organisations and agencies (Example 6.5).

Example 6.5. Comitê do Itajaí, Santa Catarina, Brazil: public–private participation

The Comitê do Itajaí, established in 1996 in the Santa Catarina region of Brazil, is an example of a bottom up organisation for integrated water resources management. Local institutions, including municipalities, industrial and commercial organisations and universities, came together initially to solve flood problems. This led to the setting up of a Water Resources Management Committee for the basin.

The Committee is formally recognised by the state government as a partner of the State Water

Resources Council. It is charged with management of the water resources of the Itajaí basin, co-ordinating the actions of responsible agencies in the basin and supervising implementation to meet the planned goals. In addition, it has been given the authority to set charges for water use.

The Committee is a public–private partnership with 50 members: 10 representing federal and state agencies, 20 representing water users, 10 representing the municipalities, and 10 representing non-governmental organisations. A governance system has evolved with a General Assembly that appoints senior management and approves the water management and flood management plans. The Committee reports to and communicates with the general public through an annual Water Week. This includes events in each municipality in the basin.

Public participation has built support and co-operation from the population in the basin as well as developing consensus among those involved in the public and the private sectors. The main results obtained so far by the Committee include:

- study of water demand and availability in the basin and a survey of almost 9,000 water users;
- approved criteria for concessions;
- recovery of more than 600 hectares of forest;
- increase in the number of municipal councils with environmental activities and promotion of municipal sanitation;
- greater clarity about environmental questions and their relationship to water resources;
- greater public involvement and participation throughout the basin.

More information at: <http://www.comiteitajai.org.br>

Many decisions in basin management will involve trade-offs, with both winners and losers. The participation of stakeholders means that an optimum – rather than a perfect – solution is more likely to be reached. Stakeholder advisory groups can also encourage the design of mitigating measures for the few who may be disadvantaged for the benefit of the many.

7 Strategic long-term planning

KEY POINTS

- Strategic planning involves setting long-term goals for water management in a basin.
- In developing the strategy, key areas to cover are issues, priorities, management actions, costs and benefits, and risk assessment.
- Strategic basin planning links basin level actions to regional and national development goals, policies and planning processes.
- The strategic plan needs to be flexible enough to adjust to new information and changing circumstances as they emerge.

The **basin management strategy** sets out the long-term goals and aspirations for water resources management, and how these goals are to be realised. A strategy usually covers a ten to twenty-year period. The strategy determines the overall directions for basin management and is the basis for developing detailed three- to six-year **basin management plans** or action plans (see Chapter 8 *Basin action plans*). Sometimes plans can be derailed by unforeseen events or changes in political priorities or personalities. It is therefore advisable to build some resilience into the plan to cope with such external shocks or pressures.

The strategy should take into account the following baseline information at national level, or regional level in the case of transboundary basins:

- water management policies and institutional frameworks;
- context, type, scale and severity of water and land resources management problems;
- general and water-related development goals;
- level of economic development of the basin;
- capacity of water managers and institutions to manage natural resource problems; and
- financial resources available during the strategic period.

Although strategies are a management tool, they are best developed with the involvement of the full range of stakeholders (see Chapter 6 *Involving stakeholders*). Box 7.A gives guidelines for building a successful basin management strategy.

In some countries, a legal framework for basin long-term planning has been established. In the European Union, the Water Framework Directive requires the 27 member states to develop a basin management plan for each European international and national basin before 2009.

Box 7.A. Building a successful basin management strategy

- Have a clear view of the actual situation of water resources in the basin.
- Agree on goals and targets.
- Propose scenarios to be discussed with stakeholders.
- Co-ordinate priorities and actions of all stakeholders.
- Lay down a framework for making decisions.

- Link the basin strategy to broader development goals, and national and regional development planning processes.
- Anticipate the need to strengthen capacity and fund capacity building.
- Involve and gain the support of stakeholders, including women and the poor.
- Allocate human and financial resources to the strategic planning process.
- Set a timetable with milestones and targets.
- Make sure the strategy includes funding requirements and funding sources.
- Put in place monitoring and evaluation systems that feed back into the planning process.

Adapted from GWP TEC 2004

There are five main elements in developing a basin strategy. These may or may not be taken in sequence depending on circumstances:

1. identifying the issues;
2. setting priorities;
3. identifying management options;
4. analysing costs and benefits; and
5. assessing risks.

For each element, it is necessary and good practice to organise dialogue between stakeholders and consult with interested parties and/or the general public.

The outcome of the strategic planning process should be a clear statement of the 'vision' of a basin organisation or basin initiative setting out unambiguous goals and explaining how, when and where the goals will be achieved (Example 7.1).

Example 7.1. Niger Basin Authority: a shared vision

In 2003, the nine member states of the Niger Basin Authority (NBA), Benin, Burkina Faso, Cameroon, Chad, Ivory Coast, Guinea, Mali, Niger and Nigeria, formulated a "clear and shared Vision" for the Niger Basin. The vision is to create an enabling environment for co-operation based on a Sustainable Development Action Plan (SDAP).

The Declaration of Paris on the "*principles of management and good governance for sustainable and shared development of the Niger Basin*" was signed in April 2004 by the nine Heads of State and Government.

The EU Water Facility provided funds to NBA to:

- draft a Water Charter;
- make the Sustainable Development Action Plan consistent with national and regional integrated water resources management processes; and
- prepare investment programmes and methods for implementing projects.

With the formulation of the SDAP, the development of the investment programme at the end of 2007, and the Summit of the Heads of State and Government and Roundtable of Donors held in 2008, the NBA will be able to achieve practical and lasting outcomes for Niger Basin users and citizens.

More on the NBA at: <http://www.abn.ne>

The strategy document should preferably take the form of a formally approved official management plan indicating how the initiatives of all stakeholders involved (public and private) will be co-ordinated and specifying the rules and regulations that will be implemented in the basin. The statement should be made easily accessible to all stakeholders in a format that can be understood by all.

7.1 Identifying issues

The first step in developing a strategic plan is to get a clear idea of the water and land resource management issues and ongoing activities in a basin. One useful method for identifying issues is scoping, but other methods, such as initial impact assessment, can also be used. The objective is to gain an overview of the issues, how critical they are, who they affect and the chances of being able to achieve results in the short term. Example 7.2 describes how countries sharing the Aral Sea Basin are working out a basin strategy.

Example 7.2. Aral Sea Basin: strategic long-term planning

During the Soviet period, the Aral Sea Basin was managed as an integrated economic unit. With independence the integrated economic system broke down. As countries began to define their own economic priorities they became acutely aware that their respective goals conflicted. These conflicting goals set the scene for intense competition for water.

In February 1992, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan signed an agreement on *Co-operation in the Joint Use and Protection of Water Resources of Interstate Significance*, recognising that they had a common interest in the Aral Sea and forming an Interstate Commission for Water Co-ordination (ICWC). This subsumed the two existing basin water organisations (Amudarya and Syrdarya). The ICWC formulated the strategy for water developments:

Regional approach to ownership and sustainability

- Ensure the stability and the security of the countries of the region.
- Promote closer regional co-operation within Central Asia.
- Build upon achievements already made in the countries.
- Make donor assistance conditional upon regional co-operation.
- Encourage regional political and financial commitment.
- Allow strong leadership of regional institutions by locals, not donors.

Creative approaches to negotiation

- Apply issue-linked strategies, for example, water for energy, water for the environment.
- Offer incentives to constituencies who may lose from co-operation.
- Carry out basic dispute resolution functions: information flow, fair treatment and sustainable processes.
- Allow local solutions to transboundary activities.
- Encourage publication of water management costs – as a step towards setting new financial mechanisms.

Network and authority for managing programmes

- Commit to co-ordination and knowledge sharing.
- Make conflict prevention measures integral to programmes and projects.
- Support existing institutions in cross-sectoral activities.
- Encourage co-operation with global knowledge networks.

More information at: <http://www.cawater-info.net>

Scoping is a way of making sure all aspects of an issue are considered. Basin managers can do this in many ways, through stakeholder workshops, surveys, or by asking for reports from different groups, for example. Putting the results of the scoping exercise together will define the scale and extent of the problem, the range of issues to be addressed, the environmental policies and regulations that affect the issue and will probably indicate possible management solutions. Defining problems in this way helps basin managers and stakeholders map out the boundaries of the problem in terms of what is within the power of basin management to change and what is outside their authority. When done upfront, scoping is useful both for making strategic long-term plans and for developing short-term action plans.

The matrix method is another way of assessing and prioritising the importance, scope and the context of water management issues with respect to the overall basin. Derived from the screening and ranking methods used in rapid impact assessments for environmental assessments, it helps in ranking different issues against each other (Box 7.B).

Box 7.B. Setting priorities, evaluating and ranking water resources issues

- Specify and prioritise natural resources management issues clearly and within national planning and development goals.
- Specify how each issue will be addressed in the planning process.
- Check each priority issue against the constraints and opportunities of the basin's hydrology.
- Relate priorities to financial resources.
- Do what is most pressing first!

7.2 Setting priorities

Once the issues have been identified the next step is to set priorities. Often it is better to tackle the more feasible development and resource management problems first, rather than to attempt to resolve more complex problems or address all problems simultaneously. Models and decision-support tools can be helpful in setting priorities (see Section 7.3 *Models and decision-support tools* below).

Importantly, local priorities must be integrated with regional and national priorities for water management, linking them to overall integrated water resource management strategies and plans.

These priorities will also reflect the financial resources available to address the issues. By picking the 'low hanging fruits' first a basin organisation can quickly achieve substantial gains and credibility with the basin's stakeholders.

7.3 Models and decision-support tools

Advances in computer technology, particularly geographic information systems (GIS) and decision-support systems (DSS), have significantly improved the basis for decision making in river basin management in many countries. These tools are particularly useful for setting priorities and developing management options. However, it is important to recognise that such tools are a means to an end and complement, rather than replace, skilled well-trained managers and consultation processes.

Models and decision-support tools draw on data sets in basin information management systems (see Chapter 9 *Basin information systems and monitoring*). GIS integrate and

analyse data sets, for example ecological and environmental data, and present the results spatially. DSS look at different scenarios and show what happens when parameters are changed. These tools can be used by groups or individuals in offices, workshops or, when they can be accessed on the Internet, even in the home. Another advantage of these tools is that they promote transparency.

7.3.1 Geographic information systems

Geographic information systems are widely used in developed countries to organise geographically-referenced data about the basin – electronic atlases in other words. Most systems allow users to search, for example, by land type, land use, management options, settlement patterns, land ownership or planning zones. Many are user-friendly, available on the Internet and include different kinds of visualisation technologies that display the results of decision-support models.

7.3.2 Decision-support tools

Decision-support tools are useful in predicting the outcomes of alternative plans and programmes. They are usually, but not necessarily, computerised systems. They assist in day-to-day operational and long-range strategic decision making. Where more complex decision models are required, expert systems can play an important role in predicting outcomes. Expert systems are commonly used for on-going management problems. But, they can also be used to develop different scenarios for policies and management plans, for example for irrigation districts with rising water tables, strategies for tree planting and land-use options for highland river basins.

7.3.3 Models

Modelling tools are useful for integrating social, economic and biophysical data – usually in a geographic information system – and displaying management options. Groups of users – basin managers, industrialists, farmers, agri-business managers, water user associations, government agency policy makers, local committees, government planners – can interrogate models to see what the impacts of different water management practices would be. Users can often just point-and-click on a map.

Models can illustrate important concepts, for example that aquifers or lakes take a long time to recover from pollution or degradation and that prevention is much more effective than trying to restore them. Models are also useful for indicating solutions. For example, models of water quality management options might show that water quality is more important in some parts of a basin than in others. Based on these models, basin managers might decide that, where water quality is important, people might be more willing to pay for water quality management – or change the way they manage water – than where water quality is not so important.

Optimisation and simulation models are other ways of examining certain problems. Optimisation simplifies problems, for example, by aggregating spatial descriptions of a particular problem. Simulation models can then be used to generate, for example, dynamic scenarios (Example 7.3). Such models are only tools to facilitate, and not to replace, dialogues between decision makers.

Example 7.3. Mekong River Commission: models and decision-support tools

A Decision-Support Framework has been developed by the Mekong River Commission (MRC) as an analytical tool for assessing the magnitude of changes and impacts caused by natural and man-made interventions. This tool helps to build trust among member countries. It shows the behaviour of the river system under a range of interventions. The model can be used for a number of years (hydrological data is available since 1985 in the Lower Mekong Basin) or a single year or season. Simulations enable planners to look at what might happen to a range of socioeconomic and environmental indicators.

The choice of socioeconomic issues that are assessed will depend on how the planners structure their analyses. This in turn depends on the data that is available. Environmental indicators have been identified in relation to the transboundary issues identified by the four basin member states.

More information at: <http://www.mrcmekong.org>

7.4 Identifying management options

Once priorities for basin management have been agreed, the next step is to determine what management action is necessary to address these priorities. In this step, identifying and targeting action needs to take place at several levels:

- at the **local** level, for specific farms, properties or neighbourhoods, municipalities and industries, tourism areas, or fragile ecosystems, such as site management plans;
- at the **sub-basin** level, where there are cross-cutting issues which require a broader scale of management, such as storm water management plans, pollution control;
- at the **whole basin** level, where government and other institutions need to take action, on for example cost-sharing, tax incentives, laws to abate pollution, poverty reduction, building the capacity of water user groups.

At the local level, the best management options will be targeted at farmers, producer organisations, local government planners, provincial government resource managers, extractive industries and manufacturing industries, nature conservation managers and recreation managers. The options need to complement sub-basin management plans and the overall basin management plan. Co-ordination mechanisms, such as national planning legislation, are needed to link bottom-up and top-down action.

Importantly, the strategy should show how basin action plans will be financed (see Chapter 5 *Finance*). Weighing up costs and benefits is a critical part of developing the basin strategy and deciding on the best options. This also means identifying who will benefit and who will be disadvantaged.

7.4.1 Using economic analysis tools

Once water management options have been identified, the next steps are:

- to select the most cost-efficient set of options regarding selected priorities, that is the set of actions that will address the priorities (objectives) at the lowest cost;
- to assess the costs and benefits of the selected set of options (and how these costs will be divided between different sectors).

To do this, economic analysis tools, such as cost-effectiveness analysis and cost–benefit analysis, can be used.

7.4.1.1 Tools to analyse cost effectiveness

To achieve the objectives set as priorities, there may be several alternatives (options). Cost-effectiveness analysis examines the costs (i.e. investment, operating costs) and benefits of each alternative. This gives basin managers a ranking of the options according to the ratio of cost to effectiveness (Example 7.4).

Example 7.4. Malta: analysing the cost effectiveness of ways to protect groundwater

The Malta Resources Authority (MRA) developed an inventory of measures likely to help protect groundwater through reducing abstractions. The MRA considered a wide range of options (including the reverse osmosis of sea water) and ranked each option according to a cost-effective ratio that compared the cost of implementing the option (capital, operation and administrative costs) with the expected volume saved or created, as shown below. This cost-effectiveness analysis helped to decide which measures should be included in the programme to implement the European Water Framework Directive (WFD). The analysis helped the Maltese water authorities to decide on measures with a high potential for saving water versus the development of reverse osmosis (with high and increasing energy costs).

It also generated a strong economic argument that could be put forward in dialogues with water stakeholders and the public consultations required by the European WFD.

Ratio of cost to volume of water expected to be saved

Distribute water saving devices to households:	- 2.50 MTL/m ³
Develop water saving practices for the agriculture sector:	+ 0.01 MTL/m ³
Abstraction taxes for industry:	+ 0.10 MTL/mv
Abstraction taxes for households:	+ 2.50 MTL/m ³
Abstraction taxes for agriculture:	+ 4.80 MTL/m ³
Increase rainwater harvesting livestock farms:	+ 5.00 MTL/m ³
Increase rainwater harvesting in industry:	+ 6.50 MTL/m ³
Increase rainwater harvesting for 3 star hotels:	+ 22.00 MTL/m ³

MTL: Maltese Lira, approx. €2.3

More information at: <http://www.mra.org.mt>

7.4.1.2 Sharing costs and benefits

Benefit sharing focuses on the value derived from water use and ecosystems. It takes into account water quality and risks, rather than the more contentious and less useful allocation of specific amounts of water to different parties (Box 7.C).

Box 7.C. Guidelines for sharing costs and benefits

- Quantify the benefits and costs of water management.
- Address equity.
- Link the size of water allocations to the benefits derived.
- Work out multiple benefits step-by-step before making agreements on water sharing and who pays.
- Define benefit shares initially at a sub-basin level then aggregate them up to the whole basin (including across international borders).
- Use a third party to promote sharing arrangements, such as funding agencies (World Bank) or environmental organisations.

- Recognise the link between water policies and transboundary water issues.
- Monitor, evaluate and report to all riparian parties to promote learning and build consensus.

Source: Qaddumi 2008

Benefit sharing in the Senegal Basin is an example of how the costs and benefits of major water infrastructure projects can be shared (Example 7.5). The concept of value derived from water use is applicable in a wide range of economic, social, political and environmental uses, between recreation or biodiversity and commercial fishing for example.

Example 7.5. Organisation for the Development of the Senegal River: benefit sharing

The Organisation for the Development of the Senegal River (OMVS) has had strong political support for more than thirty years at the highest level (the supreme governing body of the organisation is the Conference of Heads of State and Government). This political support is based on a benefit sharing system between riparian states and the implementation of concrete activities in favour of regional development.

Two major hydraulic infrastructure projects (the Manantali dam in Mali and the Diama dam on the Senegal-Mauritania border) and an energy distribution network will stimulate regional development.

In the early 1980s the OMVS received loans and grants from various funding agencies to finance this major infrastructure programme. The contribution it would make to irrigation, energy production and navigation was calculated as well as the overall benefits to each member country.

Benefit	Mali	Mauritania	Senegal
Irrigation	11%	31%	58%
Energy production	52%	15%	33%
Navigation	82%	12%	6%
Overall	35%	23%	42%

The debt repayment is shared pro rata among the three countries according to the benefits that will accrue to each.

More information at: <http://www.omvs.org>

7.5 Assessing risks

One of the key issues in developing long-term basin management strategic plans is to assess risks, such as those posed by floods, droughts or other natural disasters, and to devise measures to alleviate these risks. For example, it is becoming increasingly important to plan for the risks posed by changes in climate (Box 7.D).

Box 7.D. Assessing the risks posed by climate change

- Develop water footprints under different climate change scenarios.
- Develop procedures to rapidly update water management strategies and plans with the latest hydrological data and changes in water use, and present these as water footprint scenarios.
- Use risk assessment to evaluate water resources management options under different climate change scenarios.

Because more and more data is becoming available and models of climate change are constantly being updated, basin organisations need to make sure that their strategic plans are not set in stone, but can take this new information on board and 'auto-adapt'. Planning systems need to be set up so that new data and information can be fed in immediately as it becomes available. In this way, basin management strategies can be rapidly adapted to new predictions. There are usually no simple technical fixes for some of the scenarios and basin managers will usually need to mix hard and soft strategies in their plans to minimise these risks (Box 7.E).

Box 7.E. Strategies to minimise risk

Hard strategies – infrastructure and technology:

- traditional water storage systems;
- flood proofing;
- storage management;
- early warning systems;
- integrated water systems and supply security;
- water reuse and desalinisation.

Soft strategies – institutions, technologies and management systems:

- demand management;
- efficient technologies;
- establishing a culture of conservation;
- managing water scarcity through trade;
- integrated flood management;
- land use planning;
- education and communications.

8 Basin action plans

KEY POINTS

The basin action plan:

- Sets out the goals, objectives and actions to be taken in the short term (3 to 6 years) to implement the long-term strategy.
- Details the resources needed to implement the plan and the sources of financing.
- Spells out how actions will be co-ordinated.
- States how regulations will be enforced under current legislation.
- Specifies cost-sharing arrangements.
- Spells out how management outcomes will be reported to stakeholders.

One of the critical tasks in basin management is to develop (and then implement) the basin action plan. This involves setting up procedures to identify options for water resources management and decide which options to use, and then implementing those options. It also involves 'adaptive learning' or making sure that, as the plan is implemented, the lessons learned are fed back into the planning process (see Section 2.2 *Basin management as an iterative process*, Box 2.A *The learning-by-doing management cycle of planning and implementation*). All this must be done with the participation of the basin's water stakeholders.

This Chapter outlines procedures for developing a basin action plan and harnessing ownership through involvement of stakeholders. Chapter 9 *Basin information systems and monitoring* should be read in conjunction with this Chapter as it discusses the role of information in formulating and implementing basin action plans.

8.1 Developing basin action plans

The basin action plan sets out the goals, objectives and programmes for managing water resources for a specific period, usually between three and six years. This plan is brokered by decision makers in the basin – government agencies, local authorities, municipalities, private firms, farmers, individuals and community organisations – and 'signed off' by the basin organisation. The agreed plan will specify responsibilities for action, how costs will be shared, lines of accountability and channels for exchanging and distributing information. The plan will most likely contain a mix of infrastructure, maintenance and non-structural tasks such as changes to laws and procedures, regulations, pricing, institutional development, training and other 'soft' interventions – it is not a wish list of projects.

The action plan is the basin organisation's blueprint for water management across the basin (Box 8.A). The GWP Toolbox provides useful principles for developing a basin management plan. The plan should clearly identify who does what but it is important to understand that the basin organisation itself will not undertake all the tasks in the plan (see Section 4.1 *Roles of basin organisations*). The role of the basin organisation is to co-ordinate the various tasks carried out by others. For example, a plan to reduce pollution in a basin might require a combination of actions by local councils, waste disposal industries, farmers, local

government planners, government resource managers, extractive and manufacturing industries, nature conservation managers and recreation managers. In this case, the task of the basin organisation would be to co-ordinate action and get agreement on who will be responsible for doing what, and where and when they will do it.

Box 8.A. Design principles and main components of a basin management plan

Design principles

- Define the boundaries of the basin (river basins or sub-basins, aquifers, lake basins; national or transboundary).
- Establish operational rules which reflect the technical and biophysical characteristics of water ecosystems.
- Ensure collective-choice arrangements that engage village and district stakeholders as well as neutral government water policy people in decision making.
- Monitor the outcomes of planning and policies through water audits.
- Employ graduated sanctions.
- Build in conflict resolution mechanisms.
- Develop clearly defined property rights.
- Separate the role of water provider from that of the regulator, to avoid conflicts.
- Develop both demand management and supply management options, and encourage water-use efficiency through non-regulatory and regulatory mechanisms, particularly to increase efficiency in irrigated and dryland areas.

Main components of an action plan

- *Description* of the state of basin natural resources, trends, and how changes will be monitored.
- *Inventories* of land use, ecosystems, current water availability and demands, pollution sources.
- *Assessments* of aquatic and terrestrial ecosystem needs, vulnerability to floods, droughts or extreme meteorological events, implications of changing land use.
- Analyses of *stakeholders*, stakeholder needs and mechanisms for participation.
- Analyses of *priority* issues.
- Basin and sub-basin *goals*, both short- and long-term.
- Water allocation and water quality *objectives*.
- Benefit *shares*.
- Water-related development *scenarios*, assessments of future water demand, risk assessments.
- Strategy, measures and action *plans* for the achievement of goals, including sub-basin management plans and implementation guidelines.
- *Financing* arrangements for water use and management, including details of cost-sharing programmes for projects and other actions.
- *Responsibilities* and schedules for implementation.
- Details of the *monitoring* programme.
- *Appendices* describing particular basin management issues, areas and management techniques, and specific studies such as of areas of environmental significance.

The basin management plan should be developed in such a way that it cannot be put on the shelf and ignored. To ensure this doesn't happen a reporting and accounting system should be built into the plan. For example, national and transboundary basin management plans should stipulate what should be reported to national governments and how often these reports will be made. The basin organisation should also be audited by an independent authority. The audit should examine the outcomes of the basin management plan and, if warranted, recommend changes to improve outcomes in the future.

A practical way of making basin management plans dynamic documents is to ensure they are updated as new information emerges (audits, new scientific discoveries, stakeholder inputs) so that they respond to changing circumstances. A basin management plan must be a living document which managers use, update and adapt as they put the plan into practice. For the plan to be successful, stakeholders and the general public must become involved. Lessons learned as projects and programmes get underway must be fed back into the plan so that successes can be repeated and mistakes avoided.

Example 8.1 describes a basin action plan to restore water courses in the highly developed Ruhr basin. The GWP Toolbox has many examples of other basin action plans: the Mountain-River-Lake integrated development programme, Jianxi, China (#118), the Tsurumi River Basin Water Master Plan, Japan (#302), the River Basin Plan for Midden-Holland, the Netherlands (#165) and the Danube River Basin (#219). The European Water Framework Directive Common Implementation Strategy also provides guidance documents for developing basin action plans. These are available on the Water Information System for Europe website⁶.

Example 8.1. Ruhr: a basin action plan to restore water courses

The basin action plan of a fully developed river basin, such as the Ruhr basin, will be fundamentally different from the basin action plan for a basin that is just starting to develop or is less developed.

The Ruhr Association Water Quality division manages 77 wastewater treatment plants, 540 storm water storage facilities, 5 reservoirs, 107 pumping stations and 3 hydropower plants. The Water Quantity division manages 8 dams and reservoirs with an overall storage capacity of 464 million m³, 7 re-pumping stations and 13 hydropower plants. No major new infrastructure needs to be built. The action plan is, therefore, oriented towards operation, preventive maintenance and repair, and restoring water courses to their natural condition.

The action plan for repairing the negative effects of existing infrastructure and restoring water courses means taking measures to allow fish to migrate. This means dealing with about 1,200 structures that prevent fish migration, such as dams, weirs and sills, along 1,870 km of the basin's watercourses.

The plan for the next 5 to 10 years concentrates on clearing migration routes along the main river and its larger tributaries, as well as in smaller watercourses in certain sub-basins, to allow fish to bypass weirs and sills. An example of a specific project in the plan is the construction of a fish pass to bypass a hydropower plant at the Harkortsee reservoir near Dortmund.

More information at: http://www.ruhrverband.de/ruhrverband_en/html/index.html

8.1.1 Co-ordinate action

To implement the basin plan, a basin organisation must co-ordinate the actions of many parties with different roles and responsibilities. Take irrigation for example: for irrigation water to get to the farmer, the actions of the reservoir manager, the water distribution manager, the farmers themselves and perhaps the environmental regulator, if there is one, need to be co-ordinated. But the responsibilities for these actions often lie with different government departments or, especially in developing countries, even outside government jurisdiction. Frequently, the links in the 'action' chain may not communicate with each other. In large basins, some links in the chain may not even be aware of the existence of the others, let alone co-ordinate with them. What happens then is that agencies develop discrete local solutions that do not take into account impacts and improvements across the basin. To avoid

⁶<http://water.europa.eu>

this fragmentation, basin managers need to build co-ordination into the basin plan (Box 8.B). They also need to ensure that the people assigned to carry out tasks have the capacity to work in teams, and plan across sectors and disciplines. This may mean working to strengthen skills and capabilities (Example 8.2).

Where basin councils or committees exist they can play a strategic role in co-ordinating basin action plans. This role is stronger where such councils or committees have been set up by law.

Box 8.B. Guidelines for co-ordinating basin management

- Encourage a 'learn by doing' approach and create ways of learning from past experiences.
- Establish 'rules' for co-ordination (who is involved), whether it is binding or permissive (what can be done) and the basis for involvement (law, policy, informal agreement).
- Establish integrated action across all natural resource issues in the basin.
- Ensure basin-wide planning procedures balance all user needs, enhance water quality, provide protection from water related hazards, ensure agreement on commitments within the basin, and monitor agreements.

Example 8.2. Mancomunidad de la Cuenca del Río Jubones, Ecuador: a co-ordination agency in the Jubones basin

The Mancomunidad de la Cuenca del Río Jubones is a basin agency, created by local governments, provinces and municipalities, to co-ordinate and manage the water resources of the Jubones basin. The agency aims to evolve and take on more activities. These include identifying common development strategies for the basin with an emphasis on integrated water resources management and aligning provincial and municipal development plans with basin plans. The agency encourages community management of natural resources, the protection of water sources and ensuring food security.

A key task of the basin agency is to educate and train municipal staff and members of Sub-basin Committees in development and water basin management. The agency will also introduce environmental education in schools, again with the emphasis on an integrated approach.

The measures to boost information and knowledge will strengthen the capacity of municipal staff in municipalities that are members of the Mancomunidad to make decisions about environmental protection and develop appropriate measures.

More information at: <http://www.cuencadeljubones.gov.ec>

Many basin managers struggle to find the best way to co-ordinate the actions of government agencies and other stakeholders. Box 8.C gives examples of some useful co-ordination tools. Basin managers need to select those that they believe will get political and administrative support and can be readily used. A good route is to try what appears to be a viable option and evaluate its effectiveness through trial and error. But basin managers can also learn from experiences in other basin organisations. Twinning arrangements between similar basin organisations encourage learning and sharing of what works and what doesn't (Example 8.3).

Box 8.C. Co-ordination tools for basin organisations

Tools for joint planning and management	Tools for resolving conflict	Tools for communicating
Joint forecasting or scenarios.	Additional research or analysis.	Information and data sharing procedures.
Joint models or jointly used geographic information systems.	Interpersonal or inter-group communication.	Common database or data gathering.
Co-location of personnel or creation of common jurisdictional boundaries.	Appeal to higher authority, outside party, third party (facilitation, mediation).	Regular communication (newsletters, e-mail).
Joint review of plans or environmental impact statements.	Special meetings of committees or other groups such as Basin Councils or Committees.	Scheduled meetings.
Formal review of clearance procedures.	Negotiation/bargaining within the group.	Intranet for joint development of plans, papers.
Supervisory oversight.	Community advisory committees.	Informal communication, social occasions, word of mouth networks.
Joint budgeting process.	Transboundary water agreements.	
Co-ordination committees.	Village meetings and tribal customary law.	
Joint staffing or joint staff work groups.		
Joint reviews of permits or common standards for review.		
Joint planning process (including environmental impact assessments).		
Cost-sharing arrangements for financing basin management works.		
Joint plans of action (projects, programmes, policies).		

Source: Hooper 2005, p.52, adapted from Margerum and Born 2000, Margerum and Whittall 2004

Example 8.3. The TwinBasin™ project: Congo-Amazon twinning agreement

The TwinBasin™ project brings together the two largest river basins in the world, the Amazon Basin and the Congo Basin, to share their experiences under a twinning arrangement. The water resources of each basin are shared by several countries. Each basin has an established inter-governmental organisation responsible for promoting integrated water resources management.

The International Commission for the Congo-Oubangui-Sangha Basin (CICOS) was recently created by four riparian countries to manage a basin which has not been studied or managed

for the last forty years. The Amazon Co-operation Treaty Organisation (OTCA) on the other hand was established by the eight Amazonian countries to promote the sustainable development of the basin, following establishment of the Amazon Co-operation Treaty in 1978. Both CICOS and OTCA are working towards regional integration.

The politicians of the countries in these two basins are aware of the importance of reconciling conservation and use of natural resources with development objectives. The two organisations are aware of the threats of human interventions on fragile ecosystems and how these could adversely affect renewable water resources and the poor in the two basins.

Through the TwinBasin™ project, supported by the European Commission and coordinated by INBO and IOWater, OTCA and CICOS are jointly addressing the institutional, technical, economic, financial and social issues related to the use, management and protection of water resources. Institutional organisation, monitoring, sharing water resources between various uses, planning, mechanisms for users' participation, prevention and mitigation of extreme events, public awareness and ecotourism are all covered under the twinning arrangement.

More information at: <http://www.twinbasin.org>

8.1.2 Co-ordinate at grass roots

In many countries, both in developing and developed economies, there is both formal and informal jurisdiction over the water sector. In the informal sector, the way forward may be to start at the grass roots, for example by getting stakeholders together to seek solutions and agree on 'rules' for water resources management (Example 8.4). These rules, or ways of doing business, don't have to be laws but can be community practices or other accepted norms. In countries where local and regional planning capacity is well-developed, local planning laws may be the way to co-ordinate local, sub-basin water management.

Example 8.4. Lagartero river basin, Chiapas, Mexico: social participation

The Lagartero sub-basin lies on the coastal plain of Chiapas State, Mexico. Social participation in the integrated basin management programme involved dialogues, community-based workshops with water users, and governmental and non-governmental institutions to seek solutions for sustainable management and development of the basin's natural resources and reduce threats to water availability.

To formalise participation the Lagartero River Basin Committee was created in 2003 with support from the National Water Commission (CONAGUA). The Basin Committee is an auxiliary body of the Chiapas Coast Basin Council, created under the Mexican National Water Law. Social participation facilitated the co-ordination of activities. The participative planning process developed nine plans for the Conservation of micro-valleys, an Ecological Plan for the Region and a Citizens' Action Plan for Natural Disasters.

More information at: <http://www.conagua.gob.mx>

8.1.3 Use decision-support tools

In developing an action plan various tools can be used to evaluate options. This is discussed further in Section 7.3 *Models and decision-support tools*.

8.1.4 Finance implementation of the plan

Financing a basin action plan is critical to its implementation and long-term sustainability. The plan should be fully costed and the financing strategy should identify sources of finance (see Section 5.2 *Sources of revenues*). Annual work plans and budgets should also be developed to accompany the plan so that implementation begins immediately after the plan is approved.

8.2 Implementing basin action plans

8.2.1 Share information

Water is everybody's business. It's vital that information about the basin management plan and how it is being implemented is shared with stakeholders. In countries with good access to the Internet, websites (see Section 10.3.1 *Websites*) linked to the basin information system allow stakeholders to keep up to date on successes and failures as and when they wish. These kinds of systems not only encourage a two-way flow of information, but also expand the array and formats of information in the basin information bank. For example, resource managers, as well as uploading conventional reports, can post video or audio anecdotes. Often, users can access detailed data and information on trends and the results of environmental audits just by clicking on interactive maps. In most countries access to the Internet is very limited and more traditional techniques have to be used. In many rural areas, or where there is a high level of illiteracy, radio and local meetings are important sources of information and these should be used by basin organisations to share information and inform the public.

8.2.2 Get feedback

In implementing plans it is important to provide a feedback loop to ensure lessons learned are taken on board by the basin organisation and used to improve management. This encourages a continuous cycle of renewal and improvement in basin management (see Section 10.4 *Feedback and learning*).

9 Basin information systems and monitoring

KEY POINTS

- Make sure there is an interactive, accessible, affordable, appropriate and equitable basin information system.
- Collect and organise a comprehensive set of physical, biological, social and economic data and information on the basin.
- Make sure data and information relate to the basin management strategy and action plan.
- Ensure stakeholders can access and use the data and information in ways which suit their needs.
- Use geographic information systems and other user-friendly means to present the status of basin resources and monitor changes.
- Set up a basin monitoring programme that co-ordinates information from regional, state, national and local levels, and public, private and non-government organisations.

Easy access to information on the status of water resources and ecosystems and the trends in water use and pollution underpins successful water management. Water resources managers need to be able to get hold of reliable, up-to-date and relevant information when they need it and in a form that they can use.

Data and information is often dispersed, heterogeneous and incomplete, and is rarely comparable or suited to objective decision making. Many public, parastatal and even private organisations produce and manage data but lack the means and guidelines to exchange, assemble, standardise, summarise and capitalise on the data they and others have.

So, basin water information systems must enhance existing data and information systems. They must benefit all stakeholders and support water resources management. Setting up a basin water information system means working on two fronts: first on institutional and organisational issues, and then on the technical issues associated with building an information system.

Ideally, basin water information systems and monitoring programmes should be set up in parallel. The basin information system can then be organised to generate data and indicators on water resources and water use that will allow effective assessment of water management (Box 9.A).

Box 9.A. Good practices in basin information systems and monitoring

- Recognise that basin information systems are an important tool for water resources management.
- Identify information needs.
- Make sure that information is freely accessible to all stakeholders (open shop policy).
- Develop a network of partners and working groups to facilitate the collaboration of institutions in basin water data management.

- Make an inventory of existing data and information sources. Find out how they are produced and whether or not they are accessible.
- Define a strategy, responsibilities and rules for producing and managing data, processing and disseminating information, and respecting confidentiality.
- Adopt common rules, standards and nomenclatures, so that data is comparable and interoperable.
- Develop human capacities and infrastructure to collect, manage and process data, produce and disseminate information. Use the technical infrastructure of partners where possible.
- Produce and disseminate information for decision making, water management and public information/participation.
- Set up basin monitoring programmes for water resources and water use, and develop indicators (process indicators, outcome indicators, impact indicators) to assess water management.

9.1 Organising collaborative basin information systems

9.1.1 Establishing basin information systems for good governance

In order to manage water resources at the basin level, it is important for decision makers to have easy access to comprehensive, representative and reliable information, at all relevant levels, on:

- the quality and quantity of both surface and groundwater resources, as well as seasonal and yearly fluctuations;
- biotopes and aquatic environments, and their degrees of sensitivity;
- water use (withdrawals), particularly for irrigation, industry and drinking water, and pollution sources (discharges), whether point or non-point;
- the risks of recurrent extreme phenomena, such as floods, droughts and accidental pollution; and
- social and economic indicators, for example costs, prices, taxes.

Basin organisations need to create a basin information system that will meet their own particular needs, both for managing the data they collect and for delivering information to different groups of users in formats they can understand and make use of.

In order to develop such information systems it is important to have strong support from decision makers. Sound governance of water depends on effective information systems. It is therefore very important to make decision makers aware that a basin information system is a priority tool for water resources governance.

Basin information systems are also important for participatory management of the river basin. They provide stakeholders with easy access to relevant information (Box 9.B) and a way for water users and resource managers to interact. A basin information system allows information on basin management to be shared clearly and transparently, on progress made (or the lack of it) for example.

Box 9.B. Characteristics of a basin information system

- Describes condition and trend of the basin's natural resources.
- Highlights critical water management issues and where they occur.
- Gives access to community information and knowledge about resource management.
- Informs the basin community about the management process.

- Exchanges information to help specify best management options.
- Shares information between basin management practitioners.

Basin information systems do not have to be sophisticated. In developing countries, an information system may be quite simple. What is important is that it should be affordable and work for the basin in question. What a basin information system should not be, though, is a database housed in a government department and inaccessible to basin stakeholders. The information system needs to be interactive, accessible, affordable, appropriate and equitable.

Information needs to be **appropriate** to the task in hand, proven through research and development, tested in the field and pitched to the capacity of institutions, practitioners and stakeholders to understand and use it. Information needs to be **affordable**, preferably free, so that there is no discrimination between information providers and users because of lack of funds. Information needs to be **accessible** to all practitioners through the channels they normally use, not dependent on major upgrades of technical infrastructure. And, information processes should be **equitable**. This means that information systems should respect cultural needs, gender issues and embrace stakeholders distanced from decision making because of their location, or economic or social status.

The information system should be designed to fit the financial and human resources available to the basin organisation. Too often large initial investments are made, often with external financial support, to establish sophisticated systems that are then not sustainable due to a lack of funds or lack of human resources. Therefore, before deciding what type of system should be used, it is advisable to estimate the running costs and clearly indicate the size of budget available to ensure the initial investment will not be wasted.

9.1.2 Developing an appropriate framework for collaboration

Addressing water issues generally involves collaboration at various levels (local, regional, national and international). This means using data produced by many different institutions. Given the many actors who produce, manage and use data, it is best if they work collaboratively, as in the Joint Danube Survey for example (Example 9.1).

Example 9.1. Joint Danube Survey: a collaborative international water information system

The Joint Danube Survey (JDS) was launched under the auspices of the Convention on Cooperation for the Protection and Sustainable Use of the River Danube (Danube River Protection Convention).

The JDS investigates pollution in the Danube basin. Collaborating countries collect data on water, sediments, river flora and fauna, as well as polluting substances. The data set, collected by the best laboratories in the Danube River Basin, is helping to identify and confirm specific pollution sources and pollution pathways. Participation of all countries sharing the Danube River means that there are excellent opportunities to exchange experiences, harmonise sampling and monitoring procedures and, to a certain extent, harmonise analytical methodologies.

JDS data is used to develop the Joint Danube Action Programme and Integrated River Basin Management Plans, and to prepare the European Water Framework Directive (WFD) Roof

Report. The JDS is also the basis for planning International Commission for the Protection of the Danube River (ICPDR) activities, especially:

- measures to decrease nutrient input from agriculture;
- building wastewater treatment plants to remove nitrogen and phosphorus;
- introducing phosphate-free detergents;
- measures to decrease heavy metal pollution from mining and metallurgy;
- stepping up co-operation with the Danube Navigation Commission to reduce oil pollution from shipping;
- establishing sediment quality targets; and
- improving the Danube Trans-National Monitoring Network.

More information at: <http://www.icpdr.org>

In many cases the need for collaboration leads, in the first instance, to the creation of an inter-institutional network of partners willing to work together on data management. The next stage is the creation of thematic working groups to implement an action plan for the development of the basin information system.

9.1.3 Establishing a strategy and action plan for the information system

The basin information system is a tool for information users. Their needs for information – to solve the priority issues of water resources management in the basin – must therefore guide the development of the system. Users' information needs determine the overall strategy for organising and setting up the information system (Example 9.2).

Example 9.2. Sabarmati River Basin, Gujarat State, India: development of an information system

In many Indian regions there is a risk that scarce water will limit economic and social development in the near future. The main problems are not technological but institutional and financial.

The Sabarmati River Basin (Gujarat State) was chosen by local and federal Indian authorities as a 'pilot basin' to test new processes for integrated water resource management from 1999 to 2001. The goals were to:

- organise an information system for the Sabarmati River Basin, based on existing databases and collaborating closely with other projects;
- prepare a long-term development scheme for the Sabarmati River Basin, taking into account the State's socioeconomic development plan;
- define a priority action programme.

The information system for the Sabarmati River Basin was developed and includes:

- structuring the river basin information system,
- organising data collection,
- identifying existing data sources and databases,
- modalities for data exchange,
- assessing the situation,
- identifying the main challenges.

Based on the information needs assessment and on an analysis of the existing situation (legislation, actors, dataflow, existing information systems), the organisational and technical aspects of the water information system can be specified. The next step is to develop a multi-year action and financial plan which indicates what will be done, how much it will cost and where the money will come from.

9.1.4 Adopting rules that allow data to be shared

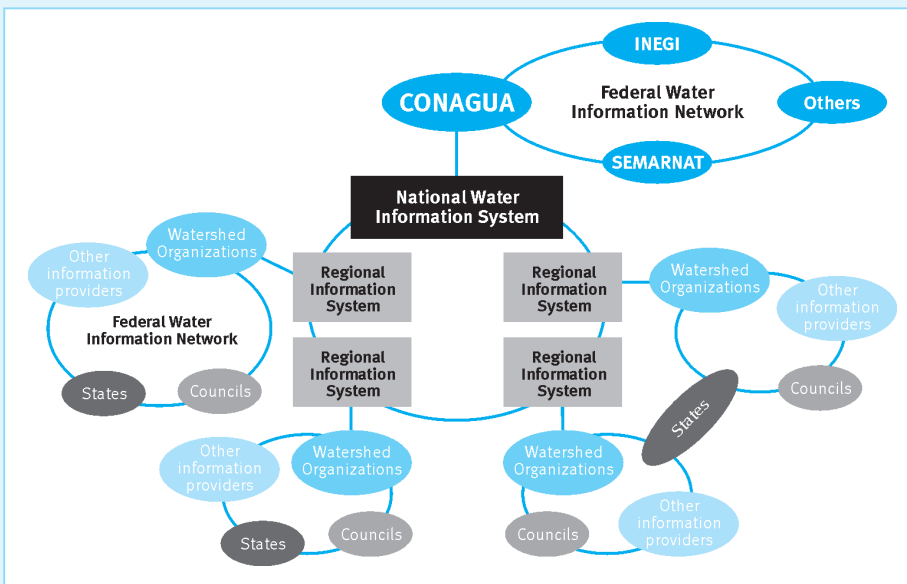
The problems related to availability, accessibility and sharing of water data and information are widespread and occur at all levels (regional, national, local).

Solving these problems means that those involved in water resources management need to adopt rules for sharing, accessing and using data and data services (Example 9.3). Common measures and rules specifically concern:

- **Sharing responsibility** for producing, gathering, processing and disseminating data and information (who does what and access rules) in order to avoid duplication and create synergies.
- **Sharing data.** Public authorities should have easy access to data and data services related to water resources management. This access can be hindered when it depends on ad hoc negotiations between public authorities each time data is required. Partners should remove practical obstacles to data sharing by setting up, for example, agreements between public authorities.
- **Interoperability** of information systems and the organisation of network services to facilitate, for example, data identification, consultation and downloading.

Example 9.3. Mexico: links between national and regional basin information systems

The legal and institutional context in Mexico (i.e. water law, laws on statistical, geographical and environmental statistics, as well as role of various institutions) influences the links between the Mexican National Water Information System and the regional water information systems.



The system was set up by:

- identifying synergies and creating a federal Water Topical Group;
- setting up and training sub-groups in the common data exchange language in Mexico;
- defining the work programme for the National Water Information System; and
- specifying, for example, the document information system, tools, multi-lingual research engine.

More information at www.conagua.gob.mx

9.2 Technical aspects and practical implementation

9.2.1 Inventory and characterisation of data

The first task in setting up a basin data and information system is usually to take an inventory of available data at basin level. This inventory should cover various types of data (Box 9.C). The time wasted and expense involved in searching for water data, and then establishing how useful it is, are major obstacles to using what data there is fully. Thus, making an inventory of existing data series and information is essential to:

- identify existing data and information and whether or not it is accessible;
- determine the rules for producing and accessing data; and
- check that the quality of available data meets users' needs.

Box 9.C. Types of data in a basin information inventory

Basin information inventories include data and information relevant to basin management, for example:

- biophysical characteristics
 - soils
 - topography
 - water yield
 - wetlands;
- basin hydrology and hydrogeology;
- land use;
- anticipated changes in land use;
- best management practices;
- water quantity and quality data;
- ecosystems;
- nutrients;
- point and non point sources of pollution;
- resource use, withdrawals and discharges;
- demography;
- population;
- social and economic indicators.

Making an inventory should be a collaborative activity. When inventories are organised in an online metadata catalogue, users benefit from immediate access to data. These metadata catalogues mean that partners can input the data they manage directly. They can also specify the access rights to metadata and data series for specific user groups. Users can:

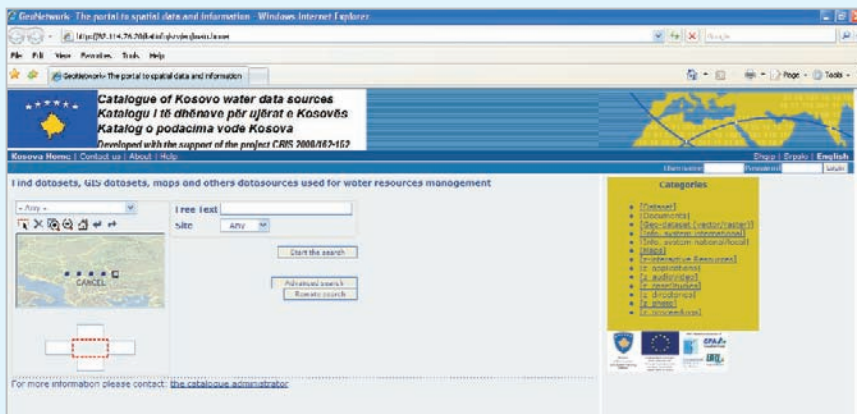
- search and identify data through simple multi-lingual interfaces by keyword and/or through a geographical interface; and
- download data, or access interactive maps, according to the access rights they have been granted by data producers.

Thus, instead of producing a series of reports, data producers can put their data on line, and authorised partners can immediately consult, update metadata and download the information they need (Example 9.4).

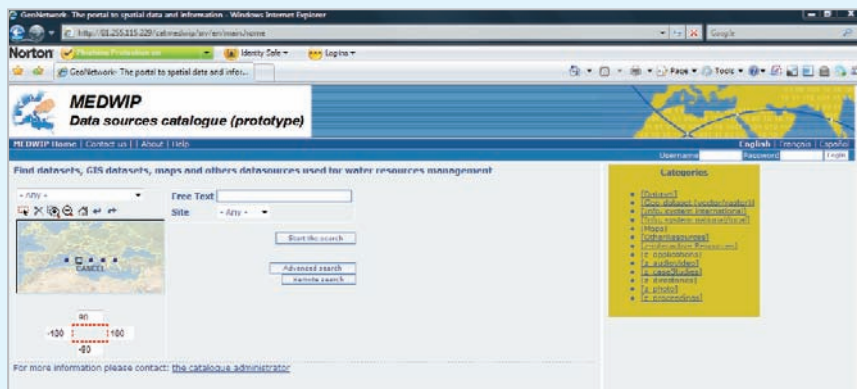
Example 9.4. On line catalogues of data sources for transboundary, national and local basin level management

On line catalogues of data sources help partners collaborate, respect the confidentiality of data and help users find existing data:

- Catalogue of water data sources in Kosovo
(<http://www.ks-gov.net/mmph/> in folder 'Departments', chapter 'Water department')



- Catalogue of data sources for the feasibility study of the 'Mediterranean water data network'
(<http://www.semide.net/medwip/tools/metadata-catalogue/catalogue>)



9.2.2 Developing infrastructure to manage information

The basin information system must be structured so that it can generate information from data provided by the various data producers. Developing such a system means acquiring or reinforcing the basin water information system platform (servers, software) to manage data effectively. To make collaboration between partners easier this platform should, as far as possible, build on the existing information infrastructure of each partner. The basin information system platform should reinforce their capacities to produce, manage and provide information for water resources management.

The platform should be capable of managing all types of information: geographic, alphanumeric, text and multimedia. The main components are usually:

- a database and geographic information system (GIS): these are vital tools for managing data and translating them into, for example maps, graphs, indicators and performance charts;
- tools to manage a catalogue of data sources on line;
- decision-support and modelling tools; and
- a web portal for sharing and disseminating information (Example 9.5, see Chapter 10 *Communication*).

Example 9.5. Euro-Mediterranean Information System on know-how in the Water Sector

The Euro-Mediterranean Information System on know-how in the Water Sector (EMWIS) is a tool for exchanging water information and establishing co-operation programmes in the water sector, for Mediterranean countries.

EMWIS helps Mediterranean Partner Countries to develop their own integrated water information systems (for example intranets) and allows for more coherent water planning.

EMWIS collects information and promotes information exchange and dissemination. Its task is to make an inventory, gather all available information and provide easy access to information for all, as well as to work collectively on common products and co-operation programmes.

The main tool is a website in English, French and Arabic that facilitates information exchange and discussion.

More information at: <http://www.emwis.net>

Apart from the platform itself, the basin information system may also include:

- the development of master datasets and procedures allowing technical interoperability between partners;
- definition of models and global data dictionaries of the water sector or on specific topics (e.g. surface water quality);
- production of common reference frames (administrative and hydrological reference frames, GIS layers of river basins, water bodies, aquifers, coding of parameters) (Example 9.6);
- the development and networking of services on the Internet for data and information identification, consultation and sharing according to the rights granted to the various users; and
- the development of toolboxes, guides and tools (software, application software).

Example 9.6. Irtysh River Basin Information System, Russia–Kazakhstan: transboundary water information system

The Irtysh basin stretches from the Altai Mountains in the People's Republic of China to Russia. In 2000, Russia and Kazakhstan signed an agreement protocol for the transboundary management of the Irtysh River basin. The main objective was to set up a framework for better international water management by:

- collecting data and monitoring,
- developing the Irtysh River Basin Information System (IRBIS),
- modelling water quantity according to water use, and
- setting up the Irtysh International Commission.

The IRBIS system allows each country to integrate their data, while using common frames of reference based on:

- an alphanumeric database,
- a geographic information system to enhance data mapping, and
- a web server (developed in French and Russian) to disseminate information.

More information at: <http://www.ecomsk.ru>

9.2.3 Developing human expertise

A basin information system needs trained people to run it. Training should be based on a needs analysis, should focus on data administration methods and tools, and be very hands-on (Example 9.7). A training programme might include:

- general training on environmental data administration (for example data production, dashboard concepts, indicators, data quality);
- technical training on software or techniques non-specific to the water and environment sector, for example managing databases, geographic information systems, exchange formats, web services; and
- training on methods and tools specific to water data administration at the national and regional level.

Example 9.7. Pan-African web portal

It is not easy to access information in Africa and there is no organised, common information management system. The African Water Documentation and Information System (AWIS), created by partners from developed and developing countries, was launched in April 2007 to promote and facilitate the provision of information and knowledge on water in Africa via a Pan-African web portal.

AWIS is led by the Organisation for the Development of the Senegal River (OMVS). It is taking a two-step approach:

- (i) Developing and providing a mechanism for knowledge and information exchange, and
- (ii) Building stakeholder capacity through the creation of an African network gathering together organisations that produce information (basin organisations, resource management centres, documentation centres, non-governmental organisations, etc.).

AWIS intends to facilitate:

- Experience sharing and access to information on know-how in the African water sector.
- Translation of key documents from French-, English- and Portuguese-speaking countries.
- Dissemination of research results to end-users. Better dialogue between stakeholders and researchers will be organised, as well as better integration of research results to meet the needs and requests from people in the field.

AWIS is designed to link to existing information systems and facilitate wider access to the information they manage.

More information at: <http://www.sadieau.org>

9.2.4 Data processing and information management

If the water information system is to be useful, it must allow all categories of users to retrieve data in a form they can easily understand.

As far as possible, the information system should be structured to allow users to retrieve information and accomplish routine tasks easily. For example, users may want to study strategies, master plans for water management and development, action programmes, budget simulations or the basis for setting water taxes. They may want to issue authorisations, regulate public works, set up warning systems, evaluate the results of policies or inform the general public.

9.2.5 Research

There are often significant knowledge gaps in our understanding of biophysical processes and natural resources management in basins. This means that basin organisations may need to commission research to fill these gaps.

Areas where research often needs to be done are in analysing processes and links within and between ecosystems, and in developing models to predict ecological and hydrological changes, such as under different climate change scenarios. Basin managers then need to use the research findings to develop practical options for resource use.

The IWRM-Net project⁷ (2006-2010) is a European project which aims to improve the transfer of research results on IWRM towards decision makers, elected representatives, managers, professionals and local authorities, through a network of scientists involved in IWRM. Comprising 20 programme managers from 14 EU member states, the project also allows the setting up of joint activities at transnational and transregional level.

9.3 Monitoring and evaluation

Many people associate monitoring with collecting data. Although collecting data and information are important, what is just as important is to understand how the information gathered is going to be used in making decisions. This means setting out plainly how it will be analysed, communicated and used by basin managers, stakeholders, governments, funding agencies and society at large (Box 9.D). Monitoring systems need to generate information showing the degree and extent to which basin management plans, strategies and

⁷<http://www.iwrm-net.eu>

programmes are changing the state of water resources, and economic, social and ecological conditions in the basin.

Box 9.D. Key questions to ask when setting up a monitoring system

What do we need or have to monitor?
 How will we gather and organise information?
 How will we make use of the information gathered?
 How and to whom do we need to communicate about what is happening?
 What do we need to do to make sure the monitoring system works (for example, do we need to train people in information gathering, organising data)?
 What funds do we have available for the monitoring system?

There are two main types of monitoring programmes at basin level. The first produces data to assess the status of water resources, and the current and potential driving forces and pressures on the resource in terms of water intake and pollution. The second monitors and assesses basin management to assess progress to meet strategy aims and to learn lessons for improving the effectiveness of the basin organisation.

9.3.1 Monitoring water resources

The key issues in designing a programme to monitor the status of water resources and water use are to determine what to monitor, where, when and how often. The answers to these questions depend on:

- the objective(s) of monitoring (e.g. to determine the chemical status of a water body, or to determine a trend);
- the precision and confidence required; and
- the types and magnitudes of variability exhibited by the water body or bodies to be monitored.

The objectives will determine the design of the monitoring programme and specify:

- the hypotheses to be tested;
- realistic and measurable goals/targets; and
- the acceptable level of risk, precision and confidence.

Monitoring programmes need to consider the types of basin – river, lake, groundwater – and parameters to be measured – quantitative or qualitative (e.g. biological, hydromorphological, physico-chemical, specific pollutants).

An understanding of the system is the basis for developing appropriate questions to be asked. These can be formalised using a conceptual process model linking the driving forces, pressures and current state of the system. The assumptions underlying the model can be reviewed and validated as more information becomes available.

Temporal and spatial heterogeneity, both natural and anthropogenic, will influence the location and number of water bodies monitored, the location and number of monitoring stations and the frequency of sample collection.

The levels of risk, precision and confidence that are set will determine the level of uncertainty (arising from natural and anthropogenic variability) that will be tolerated. Once acceptable levels of risk, precision and confidence have been defined, a monitoring programme can be developed using a range of statistical tools. These tools will ensure that the programme:

- meets the objectives;
- monitors a sufficient number of sites at a frequency that provides the required precision and confidence in the results; and
- is cost effective and scientifically robust.

When considering the cost of monitoring programmes, it should be remembered that, although the initial investment costs for obtaining appropriate information (stations, laboratories, teletransmission, automation, etc.) are high, training and operating costs are, by far, in the medium and long term, the most significant and recurring costs. Thus, it is unwise to invest in a monitoring programme without ensuring ongoing, appropriate financial resources.

A practical example of sound basin monitoring is the monitoring system implemented for the follow up of the European Water Framework Directive. Guidance documents have been produced by the European Strategic Coordination Group⁸.

9.3.2 Monitoring basin management

Monitoring and evaluating basin management activities is a key component of basin management. The goal of monitoring is to help basin managers and stakeholders learn together in order to improve planning and the implementation of plans. Monitoring is also important for upward and downward accountability on expenditures, activities, outcomes and impacts.

A system to monitor basin management will:

- set out what impact changes in management are expected to have;
- show how progress and impact will be measured;
- set out methods for gathering and analysing the information that will be necessary for tracking progress and impact; and
- set out how the information collected will be used to explain the reasons for success and failure, and how the understanding gained will be used to improve management in the future.

In other words, monitoring basin management is a way of finding out whether plans, programmes, strategies and projects are on track and, if not, pointing to where corrective action needs to be taken to get them back on course. Ideally, monitoring will relate to both water management goals in the basin, and to higher level national or transboundary goals.

Whether at the local, national or transboundary scale, it is good practice to set up the management monitoring system at the outset so that state, federal, commercial, non-government and other stakeholders produce the information required as a routine activity, not as a separate exercise. A good monitoring system should generate useful information for managing basin resources, but, at the same time, be straightforward in practice.

Practical examples of systematic assessment of monitoring basin management are the 'Performance Benchmarking Program' of the Asian Development Bank jointly with the Network of Asian River Basin Organisations⁹ and the CapNet 'Performance and Capacity of River Basin Organizations' study¹⁰.

⁸<http://ec.europa.eu/environment/water>

⁹See www.adb.org/water/narbo/benchmarking.asp for more details.

¹⁰CapNet February 2008

9.3.3 Setting baselines and indicators

Baselines and indicators for monitoring both the state of water resources and basin management will be related to the goals and targets in the basin action plan. Indicators to report on, for example, progress in applying integrated water resources management, could be devised to show:

- changes in processes, for example completed documentation,
- reforms in integrated water resources management, for example that IWRM practices are being adopted,
- impacts/outcomes of integrated water resources management and better water management, and
- sustainability.

But care is needed in choosing and using indicators. Too many indicators or the wrong type of indicator make it difficult or impossible to track changes in resource status or measure management performance. In the case of water management, what should be remembered is that many things that affect water management in a basin are outside the mandate of the basin organisation, for example, the construction of highways, urban sprawl, or the emergence or decline of industries. This means that, as far as possible, indicators should be carefully chosen to relate to the context, goals and targets (Example 9.8). Moreover, monitoring can be costly and the level of monitoring possible with the budget available will usually mean that the ideal system is not feasible. Tough decisions have to be made to decide what is essential and affordable.

Geographic information systems can be useful tools for collecting and presenting data on indicators, for example for comparing the present situation in the basin to the baseline. Similarly, graphs charting the trends in the indicators compared with baselines and targets are another way of showing patterns of change. Models can illustrate how links and relationships are changing. And analyses of what helped and hindered progress towards targets can guide decisions on the priorities for the next period.

Example 9.8. Africa: performance indicators for transboundary basin organisations

In 2007, the International Network of Basin Organizations (INBO), through the African Network of Basin Organisations (ANBO), launched a project to develop, test and compare performance indicators that could be adapted to the particular context of transboundary African basins. The performance indicators must be:

- tools to assess, forecast and assist in decision making,
- in compliance with pre-defined objectives,
- quantitative to measure trends (easy to up-date), and
- complemented by qualitative information and comments.

Proposed indicators are in two categories:

- 'Governance' indicators, describe how the structures responsible for implementing a transboundary IWRM approach deal with the IWRM principles and functions.
- 'Technique' indicators, related to concrete outcomes, are observable in the field and result from an integrated basin management approach.

The list of indicators was tested in Niger, Congo, Senegal, Lake Victoria and Orange basins in 2007. Another test in 2009 in 10 transboundary basins will refine the indicators and come up with a final list.

More information at: <http://www.aquacoope.org/PITB>

10 Communication

KEY POINTS

- Good communication boosts ownership of basin management.
- Public awareness campaigns and education programmes encourage support for basin management.

Basin management using IWRM involves many different stakeholders. In Chapter 9 *Basin information systems and monitoring* we stressed the importance of a basin information system to share critical data and knowledge about water resources management between key stakeholders. In this Chapter we look at the broader range of stakeholders, including the general public.

Basin public awareness campaigns and education programmes keep those who live and work in a basin informed about basin issues and how the basin is being managed (Example 10.1). The target audiences are many and varied, and include those who live in the basin, businesses (including water utilities, industries, tourism resorts, fishermen and farmers), researchers, and government departments operating inside and outside the basin. These programmes support basin management by communicating clear messages about issues, actions and progress.

Example 10.1. Danube Day: raising awareness

Every year on Danube Day, 29 June, over 81 million people in 14 countries celebrate one of Europe's greatest river systems. The International Commission for the Protection of the Danube River co-ordinates this annual event to mark the international co-operation that has made the Danube a cleaner, safer river.

Huge festivals on the riverbanks, public meetings and fun educational events pay tribute to the Danube, its peoples and the progress that has been made. Danube Day strengthens 'Danube solidarity' and highlights that, in spite of different cultures and histories, all Danube basin citizens share the desire and responsibility to protect their precious resource.

International and basin-wide events for Danube Day 2008 included:

- a Danube Art Master schools competition;
- a Danube Photo Competition;
- collaboration with the International Vukovar Film Festival, Croatia, on the 'Danube Photo Exhibition: From Source to Delta';
- a 'Greet the Danube horn blast', uniting Danube workers throughout the basin as ships horns were sounded at 2 pm in tribute to the Danube rivers; and
- participation in World Water Expo in Zaragoza, Spain.

More information at: <http://www.danubeday.org/en/home>

Often, new basin organisations need to build their capacity to communicate and educate. At first, they may need to bring in communication specialists to make sure messages are clear. Likewise, they may need education specialists to tailor education programmes to meet the

specific needs of their particular basin. Basin organisations planning major public awareness and education campaigns may also need to engage specialists.

Public awareness and education programmes cost money. Advertising, organising events, setting up and operating public information services incur both one-off and ongoing costs. Basin management budgets need to include budget lines for capital, operating and staff costs for communication programmes. Strategies and plans for communication should be part of overall basin planning and management.

10.1 Raising awareness

Raising awareness of the complex and often contentious issues in basin management is vital. Over time, public awareness campaigns can bring about a change in thinking and encourage ownership of basin management plans to improve livelihoods, use water more efficiently and improve the environment.

10.1.1 Public awareness campaigns

Many basin organisations run public awareness campaigns in newspapers, on television and radio, and through the Internet to create interest in basin management, and change attitudes and behaviour. A good example is the campaign in the Brisbane River basin in Australia (Example 10.2).

Example 10.2. Queensland, Australia: Brisbane River Basin Healthy Waterways Programme

The Healthy Waterways Programme in the Brisbane River basin runs an ongoing public awareness campaign in the local media. Over the last ten years, this has led to a much greater awareness of the need to improve water quality. The campaign focuses on reducing sediment loads from agricultural and urban runoff, and upgrading sewage treatment plants to reduce nitrogen and phosphorus contamination of downstream estuaries and Moreton Bay.

The Healthy Waterways website (www.healthywaterways.org) and the awareness campaigns not only provide information about water quality management but also give practical suggestions for managing water quality and water use. These are backed up by programmes, such as Water by Design, and annual awards for best practice implementation and reducing litter.

More information at: <http://www.healthywaterways.org>

Printed materials are another tried and tested way of raising awareness, for example newsletters, state of the basin reports and basin scorecards. These can complement public awareness campaigns and, as well as informing the general public, can be particularly useful for targeting particular groups of stakeholders.

Strong working relationships with local media can also serve basin organisations well. Basin organisations that contact journalists regularly usually get good coverage and raise their profile significantly. One excellent example of the value of good media contacts is the coverage given to the Grand River Conservation Authority in Ontario, Canada, by local newspapers. These run multi-page thematic sections on, for example, pollution and basin management which inform and educate readers, and boost buy-in for action.

Television and radio are other effective communication channels. The Corporación Autónoma Regional in Cundinamarca, Bogota, Colombia, produces its own TV programmes. The Corporación has an agreement with the Colombian national TV channels to broadcast these programmes weekly.

10.1.2 Public consultation

Basin organisations also consult with the public to collect their views on water resource issues and to seek potential solutions (Example 10.3).

Example 10.3. France: public consultation

The European Water Framework Directive requires members of the European Union to consult stakeholders (see Example 6.2). In France, the minister in charge of the environment and the River Basin Committees arranged a national public consultation, 'Water is life – give us your opinion', to seek public opinions on the future of water resources in basins.

The public consultation in 2008 sought public opinions on the environmental objectives of the Water Development and Management Master Plans proposed by the basin committees, as well as on the actions that are planned to achieve those objectives.

A questionnaire was distributed to all households in each basin. Questions related to the environmental objectives and the major measures to achieve them. People could also make general comments about the Master Plans. Citizens could participate in the consultation through the Internet. The media (radio and regional media) encouraged people to take part in the consultation. Partner associations also organised events to encourage participation.

The average rate of participation was 1.3% (400,000 respondents), although participation varied from one basin to another (ranging from 0.7% to 4.3%). The responses addressed the main concerns of the basin committees. Overall, the public questioned the proposed objectives and expressed reluctance to pay more. The public's major concerns were the risks related to toxicity and health (discharges, and industrial and agricultural pollution) and the costs of water. Citizens reasserted their commitment to the polluter-pays principle, transparent decisions, to measures that protect water resources and to outcomes that safeguard the future of water resources.

More information at: <http://www.eaufrance.fr>

10.2 Education

Many basin organisations arrange education programmes and several, the International Commission for the Protection of the Danube (www.icpdr.org), Chesapeake Bay Program (www.chesapeakebay.net) and the Grand River Conservation Authority (www.grandriver.ca) for example, make them available on their websites.

Visual presentations are useful in helping people learn about basin management. The Great Lakes Information Network, 'a partnership that provides one place online for people to find information about the bi-national Great Lakes Region of North America', has synthesised a huge amount of information and put it on simple and visually appealing web pages (www.great-lakes.net).

Education works best of course when it is interactive. Workshops, meetings and websites encourage two-way communication and learning. Stakeholders learn, and exchange

information more freely, if they meet face-to-face, learn from each other, from mentors or champions, and discuss issues one-to-one or in interest groups. Such interactions are ideal for basin organisations, residents and stakeholders to gain new knowledge and skills and, at the same time, keep in touch with what is happening in the basin.

10.3 Communication tools

10.3.1 Websites

Open or restricted access websites are common tools for basin managers and stakeholders to share and access information. For those without Internet connections, the same sets of information can be shared on CD-ROMs.

Other tools, such as online discussions, encourage regular interaction and feedback among basin stakeholders. Discussion topics can be catalogued and searchable, generating an archive of comments for future reference.

Interactive websites can put a vast range of information in a variety of media, such as voice, graphics, movies, photos and data, as well as text, at stakeholders' fingertips. Many basin websites post information about best management practices, the research the practices are based on, and the contact details for people who can discuss the pros and cons of each. Some websites provide user-friendly decision-support and modelling tools.

Although the Internet is effective for information sharing it may not be the most suitable tool for information sharing in basins where rural and poor communities do not have access to such technology (see Section 9.1.1 *Establishing basin information systems for good governance*). Basin organisations thus need to consider different options including newsletters in local languages, radio programmes and face-to-face meetings.

10.3.2 Libraries

In developed countries, depositing basin information in public libraries makes it easily accessible to stakeholders. Often, libraries have special regional collections that are ideal for keeping reports, strategies and plans related to basin management. Many have climate-controlled storage facilities. Importantly too, librarians are experts in cataloguing and can organise basin management materials systematically.

University libraries in both developed and developing countries, as repositories of research, collect and preserve a wide range of material, from specialist international publications to anecdotal information. Because of this, university libraries are often valuable partners in basin information exchange programmes.

From the users' perspective, basin documents lodged in libraries are easy to consult and borrow in hard copy. Often, especially in the case of university libraries, individuals and basin management organisations can also sign up to access materials electronically – a very simple and quick way of getting information. Many basin organisations have developed their own documentation centres which are open to the general public, students and scientists.

10.3.3 Basin phone-in service

Basin phone-in services are common in developed countries and capitalise on the power of the spoken word for exchanging information. Phone-in services cater for people with limited reading and writing skills, limited access to the Internet, and to those who just prefer to give and receive information verbally. For example, business people are often in a hurry and want information quickly. They usually have little time for formal education or training.

programmes. What they want are quick answers to their questions about resource management from a reliable source.

Phone-in services provided by basin organisations give callers advice and information on, for example, developing and implementing land and water management plans, the state of natural resources in the basin, cost-sharing, best management options for farmers, basin management organisations and basin governance.

10.3.4 Community-based information service

A community-based information service typically holds collections of information on the basin and provides a range of other services. These centres may operate a phone-in service for water managers, maintain mailing lists for distribution of reports and updates by fax or email, develop and maintain websites, run community education programmes, and develop and implement conservation partnership agreements.

In general, such centres are located in the headquarters of the basin organisation. They are excellent 'shop fronts' for local stakeholders and, in large basins where there are good Internet connections, such as Chesapeake Bay, may be virtual (Example 10.4).

Example 10.4 Chesapeake Bay basin: virtual information shop front

The Chesapeake Bay Information Network developed a gateway to a vast array of Internet resources, such as descriptions of sub-catchments, information on federal and state government programmes, calendars of events, contact information for environmental networks and other organisations, and funding opportunities (www.chesapeakebay.net).

The website gives users access to a library of information on the basin, including report cards on the health of the Bay. When information is freely available like this, basin management is more transparent.

More information at: <http://www.chesapeakebay.net>

10.4 Feedback and learning

Basin management is a learning cycle (see Section 2.2 *Basin management as an iterative process*). Once a plan is put into action and monitoring begins, managers and stakeholders can start to see what is working and what isn't. They can then use what they learn to improve. Adaptive management, or learning by doing, works best when stakeholders are involved in an appropriate manner and when management is flexible and adaptive. But this learning must be fed back to relevant target groups in a suitable manner.

Basin organisations need to make sure that they report appropriately on progress, or lack of it, to stakeholders. A good way to think about reporting is as a 'three-way' system that covers outcomes, return on investment and stakeholder interests.

Reporting 'outcomes' means reporting to the basin public on the results of basin management activities and investments. This covers aspects such as the health of the basin ecosystem and the status of water resources. Reports must be simple, clear and to the point, published as 'basin reports', or 'basin state of health' cards for example.

Then again, reports for those who pay for basin management programmes and support the basin organisation, often national governments, must show how funds have been spent,

returns on investments, programme outcomes and achievements.

Reporting to other basin stakeholders such as local governments, private companies (water utilities), government departments, and non-government organisations must show how co-ordinated planning and management has worked and where there is room for improvement (Example 10.5). This may be a two-way process. The basin organisation, for example may provide water utilities with reports that enable them to improve water services in the basin while water utilities, for their part, can report to the basin organisation on improvements in water-use efficiency.

Example 10.5. Júcar River Basin, Valencia, Spain: information and monitoring

The Spanish General Directorate for Water elaborated a 'Public Participation Project' in 2006 in accordance with the EU Water Framework Directive. This guides activities related to public information and participation in the Spanish river basin districts. In the Júcar River Basin district, the public has been actively involved in river basin management. A Citizen Information Office has been set up to inform and to address any water related public concern. Information is also distributed through the basin website and the dissemination of brochures.

The Júcar River Basin Organisation has created an Information and Monitoring Committee (or Public Participation Committee), which evaluates technical aspects of River Basin Management Plans and projects. It is composed of 48 organisations from different sectors – local, regional and national government, business and trade unions, users, and NGOs. It has an advisory nature, and it generates proposals and co-ordinates the public participation process. This Committee is part of the Public Participation Forum, which represents over 300 organisations, all interested parties and stakeholders related to water. A consultation period of last six months allows review and contributions to documents and comments are included in the river basin management plan annexes.

More information at: <http://www.chj.es>

WEBSITES, REFERENCES AND FURTHER READING

Websites

African Network of Basin Organisations: <http://www.omvs-soe.org/raob.htm>

CapNet, an international network for capacity building in IWRM: www.cap-net.org

Central and Eastern Europe Network of Basin Organisations: <http://ceenbo.mobius.ro/>

Global Water Partnership: www.gwpforum.org

GWP ToolBox: www.gwptoolbox.org

International Network of Basin Organizations: www.inbo-news.org

International Office for Water: www.oieau.fr/anglais/index.htm

Latin American Network of Basin Organisations: www.ana.gov.br/relob/?lang=es and www.rebob.org.br

Mediterranean Network of Basin Organisations: www.remoc.org

Network of Asian River Basin Organisations: www.narbo.jp

Regional and national research programmes network on IWRM: <http://www.iwrm-net.org>

References

CapNet (February 2008). Performance and Capacity of River Basin Organizations. Cross-case Comparison of Four RBOs. UNDP/CapNet.

Gleick, P. H. (2002). Dirty Water: Estimated Deaths from Water-Related Diseases 2000-2020. Pacific Institute for Studies in Development, Environment, and Security.

GWP TAC (2000). Background Paper No. 4. Integrated Water Resources Management. Global Water Partnership, Stockholm, Sweden.

GWP TEC (2004). Catalyzing Change: a Handbook for Developing Integrated Water Resources Management (IWRM) and Water Efficiency Strategies. Global Water Partnership, Stockholm, Sweden.

Hooper, B. P. (1995). Adoption of Best Management Practices for Dryland Salinity. The Need for an Integrated Environmental Management Approach. Results of a Study in the Goran Catchment. Centre for Water Policy Research, N.S.W. University of England, Armidale, Australia.

Hooper, B. P. (2005). Integrated River Basin Governance: Learning from International Experience. IWA Publishing, London, United Kingdom.

Margerum, R. D. and Born, S. M. (2000). A Co-ordination Diagnostic for Improving Integrated Environmental Management. Journal of Environmental Planning and Management. 43[1], 5-21.

Margerum, R. D. and Whittall, D. (2004). The Challenges and Implications of Collaborative Management on a River Basin Scale. Journal of Environmental Planning and Management. 47[3], 407-427.

Comprehensive Assessment of Water Management in Agriculture (2008). Developing and Managing River Basins: the Need for Adaptive, Multilevel, Collaborative Institutional Arrangements. Water for Food, Water for Life. Issue Brief #12. Comprehensive Assessment of Water Management in Agriculture, Global Water Partnership and International Network of Basin Organizations.

Newson, M. (1992). Land, Water and Development. River Basin Systems and their Sustainable Management. Routledge, New York, USA.

OECD (2009). Strategic Financial Planning for Water and Sanitation. Paris, France.

Qaddumi, H. (2008). Practical Approaches to Transboundary Water Benefit Sharing. Working Paper 292. Overseas Development Institute, London, United Kingdom.

UN-Water (2008). Status Report on IWRM and Water Efficiency Plans for CSD16. United Nations, New York, USA.

Further reading

Bank-Netherlands Water Partnership Program (2002). Integrated River Basin Management: From Concepts to Good Practice. Briefing Note Series. The Bank-Netherlands Water Partnership Program.

CapNet (June 2008). Integrated Water Resources Management for River Basin Organizations: Training Manual. UNDP/CapNet.

CapNet (June 2008). Indicators: Implementing Integrated Water Resources Management at River Basin Level. UNDP/CapNet.

Dourojeanni, A. (2001). Water Management at the River Basin Level: Challenges in America. United Nations, Santiago, Chile.

GWP CEE (2007). Tool Box: Institutional Setting of Water Institutions in Development, Enforcement and Implementation of Future Water Management Plans. Global Water Partnership Central and Eastern Europe, Bratislava, Slovakia.

GWP TEC (2008). Background Paper 12. Water Financing and Governance. Global Water Partnership, Stockholm, Sweden.

INBO (2004). Participation of Users in Sustainable Water Resources Management. International Network of Basin Organizations. Paris, France.

INBO (2005). Financing of Sustainable Water Resources Management. International Network of Basin Organizations. Paris, France.

INBO (2006). Formulation of Water Plans for Water Development and Management. International Network of Basin Organizations. Paris, France.

INBO (2006). Information Necessary for Decision Making. International Network of Basin Organizations. Paris, France.

INBO (2006). Toward a New Integrated Management of Transboundary Basins: examples in Europe. International Network of Basin Organizations. Paris, France.

Lenton, R. and Muller, M., eds (2009). Integrated Water Resources Management in Practice: Better Water Management for Development. Earthscan, London, United Kingdom.

Molle, F., Wester, P., Hirsch, P. and others (2007). River Basin Development and Management, in Water for Food, Water for Life: a Comprehensive Assessment of Water Management in Agriculture (Chapter 16). International Water Management Institute. Earthscan, London, United Kingdom.



This handbook provides guidance for improving the governance of freshwater resources, in particular through **effective implementation of the integrated water resources management (IWRM) approach in lake, river and aquifer basins**. It articulates the links between challenges and IWRM responses; suggests ways of setting up or modernising basin organisations to facilitate the adoption of the IWRM approach; and is a practical and user-friendly guide with many examples of experiences in river, lake and aquifer management.

The handbook has been developed by the **Global Water Partnership** and the **International Network of Basin Organizations** as an outcome of the collaboration between the two networks to facilitate the adoption of better and more sustainable water resources management. The hope is that the handbook will help to catalyse positive change for sustainable development. The handbook will be a dynamic document, updated with best practices in water management for basins all over the globe.

The **Global Water Partnership** is an international network whose vision is for a water secure world. The GWP mission is to support the sustainable development and management of water resources at all levels. GWP was created in 1996 to foster integrated water resources management and to ensure the co-ordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital environmental systems.

The **International Network of Basin Organizations**, established in 1994, is an international network that supports the implementation of integrated water resources management in river and lake basins and aquifers. It links basin organisations and other government agencies responsible for basin management in order to promote the exchange of experiences and develop suitable tools for better basin management at transboundary, national and local levels.



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