The United Nations World Water Assessment Programme

Dialogue Paper

# Introduction to the IWRM Guidelines at River Basin Level

*International Hydrological Programme (IHP)*
*Network of Asian River Basin Organizations (NARBO)*

United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme of UNESCO

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The United Nations' flagship report on water, the WWDR offers a comprehensive review of the state of the world's freshwater resources and provides decision-makers with the tools to implement sustainable use of our water. The WWDR3 represents a mechanism for monitoring changes in the resource and its management and tracking progress towards achieving international development targets. Published every three years since 2003, it offers best practices as well as in-depth theoretical analyses to help stimulate ideas and actions for better stewardship in the water sector.

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*For more information about the* Integrated Water Resources Management (IWRM) Guidelines at River Basin Level, *please contact:*

*Toshihiro Sonoda*
*Programme Specialist*
*UNESCO- Division of Water Sciences*
*Email: t.sonoda@unesco.org*
*Website: www.unesco.org/water*


# Introduction to the IWRM Guidelines at River Basin Level

*The International Hydrological Programme of UNESCO and the Network of Asian River Basin Organizations*

## Overview

The *Integrated Water Resources Management (IWRM) Guidelines at River Basin Level* have been written as a contribution to the World Water Assessment Programme (WWAP), which launched the third United Nations *World Water Development Report* at the Fifth World Water Forum in March 2009 in Istanbul, Turkey. The purpose of developing these *Guidelines* is to raise awareness of the importance of an integrated approach to water resources management at the river basin level and to address the practical implementation of IWRM.

These *Guidelines* provide the necessary information to help practitioners implement IWRM in line with their own set of circumstances. They consist of the fundamental concepts of IWRM as well as provide insights into the perspectives of various stakeholders with regard to water issues, keys for success for overcoming problems, and good examples where such keys for success were applied. You should think of it as an instruction manual that synthesizes practical methodologies for IWRM to help implement IWRM at the river basin level. IWRM is essentially a user-friendly and cooperative approach that is an alternative to the activities previously carried out by individual water sectors acting in their own interests, with very little interaction with one another. The *Guidelines* invite each sector to fruitfully participate and cooperate in IWRM, with a practical road map so as to contribute to achieving both private and public benefits in a sustainable manner.

A river basin approach in the implementation of IWRM is being recognized as a comprehensive basis for managing water resources more sustainably and will thus lead to social, economic, and environmental benefits. However, actual progress towards implementing IWRM varies enormously and depends on the area, capacity, political will, and the understanding of IWRM concepts and their implementation. Hence, the *Guidelines* have been split up into separate stand-alone parts. They have been designed to enable readers to go to specific sections of the publications depending on their specific needs and circumstances without necessarily having to read the entire document.

The principles and concepts of IWRM have been widely recognized, but the implementation of IWRM is not satisfactorily progressing in many basins. This is perhaps because the practitioners responsible for water resources management at the basin level encounter difficulties in understanding where and how to begin, or the advantages of applying IWRM with respect to their actual situation may not be so apparent. On the other

hand, policymakers dedicated approaches for setting up enabling environments and political frameworks that strongly support sound and sustainable water resources management are necessary prerequisites for IWRM to function effectively. Therefore, it is desirable that practitioners and decision makers absorb the ideas and needs of IWRM while understanding the effectiveness of applying these within a basin-wide approach. UNESCO realized that there was a need for a mechanism to translate the IWRM principles into practical applications. *The IWRM Guidelines at River Basin Level* are intended for use as a tool to fill that 'gap'.

To get started with IWRM, practitioners and water managers need to identify the full spectrum of stakeholders involved in river basin management issues as well as have a good understanding of how other stakeholders relate to water, and how they relate to every activity through it. These *Guidelines* provide useful guidance on how to achieve this. They are meant to be a living document – users are therefore invited to use these materials interactively with the project team, and contribute to its improvement with suggestions on methodology as well as by introducing new case studies.

This publication serves as an introduction to the *Guidelines* and outlines the main points contained within them. For deeper analysis and explanations please refer to the *Guidelines* in question. Note that the *Guidelines* have been designed for use as separate documents and can be read separately. They mainly serve as training material for practitioners but can be used by other interested parties whether public entities or private users.

## The Structure of the *Guidelines*

The *Guidelines* comprise two parts:

**Part 1** deals with the overarching principles of IWRM at River Basin Level

**Part 2** deals with practical guide intended for use by practitioners of IWRM

### Part 1:

Part 1 provides basic principles of IWRM mainly targeting policy-makers, and explains the benefits of IWRM at river basin level and the need to promote it at the policy level. It also proposes a spiral model of IWRM, which illustrates the evolving and dynamic nature of the IWRM process.

### Part 2:

Part 2 comprises three sub-parts, which are presented as three separate publications:

- **'Part 2-1 The Guidelines for IWRM Coordination'** for those involved in IWRM coordination
- **'Part 2-2 The Guidelines for Flood Management'** for IWRM practitioners involved in flood management
- **'Part 2-3 Invitation to IWRM for Irrigation Practitioners'** for irrigation practitioners

Both Part 2-1 and Part 2-2 are intended for use either as introductory guidance for those tackling IWRM for the first time, or as training material for intermediary practitioners and trainers of IWRM. For IWRM experts, these parts can be used as a reference guide to tackle the various issues and problems they face in their IWRM activities.

'Part 2-3: Invitation to IWRM for Irrigation Practitioners' is prepared from the perspective of irrigation practitioners as representatives of water users. This document invites them to actively participate in IWRM.

***Two main features of the Guidelines are the 'Sector Perspectives' and the 'Key for Success'.***

The 'Sector Perspectives' sections provide insights on what individual sectors are typically thinking. What is described in these sections may not be complete, but they are invaluable in that they enable us to understand, at least to some extent, how other sectors perceive water management and how this relates to IWRM.

The core of Part 2 are the 'Keys for Success' sections, which can be used in practice to help IWRM succeed at the basin level. Some of the keys for success are extracted from good practice examples of IWRM implementation in several different river basins worldwide.

# Part 1. Principles

## Part 1 deals with the overarching principles of IWRM at the river basin level

Integrated water resources management is a step-by-step process of managing water resources in a harmonious and environmentally sustainable way by gradually uniting stakeholders and involving them in planning and decision-making processes while accounting for evolving social demands due to such changes as population growth, rising demand for environmental conservation, changes in perspectives of the cultural and economic value of water, and climate change. It can be seen as an open-ended process that evolves in a spiral manner over time as one moves towards more coordinated water resources management. The principles and concepts of IWRM have been widely recognized, but the implementation of IWRM has not always progressed satisfactorily in many basins perhaps partly because of the disparate perspectives held by the various water sectors concerned, all working with their interests in mind and failing to recognize the need for greater interaction and cooperation. Hence, the need for a more integrated approach to water management involving all stakeholders at every level became increasingly central to successful planning.

### The emerging concept of IWRM at the river basin level

An integrated approach to river management began in the 1930s in the US and, through its acceptance by the UN and other international organizations, the IWRM concept has consequently evolved over the decades leading to Integrated Water Resources Management (IWRM), which emerged around the 1980s in response to increasing pressures on water resources from competition amongst various users. IWRM has remained an important concept for water management since the Agenda 21 process of the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. The UN-Water Status Report revealed the different processes of IWRM planning and implementation among countries due to the diverse interpretation of IWRM and their various conditions.

Water is fundamental for sustainable development. It affects *inter alia* sanitation, health, poverty alleviation, disaster reduction, and ecosystem conservation, and cuts across all eight Millennium Development Goals. Implementing IWRM at the river basin level is therefore an essential element in managing water resources more sustainably leading to long-term social, economic and environmental benefits. The recognition of ecosystem requirements, pollution, and the risk of declining water availability due to climate change in order to achieve water security is a central goal of IWRM along with managing risks while responding to, and mitigating, disasters. The path towards water security requires resolving trade-offs to maintain a proper balance between meeting various sectors' needs, and establishing adaptable governance mechanisms to cope with evolving environmental, economical and social circumstances. IWRM strives for effective and reliable delivery of water services by coordinating and balancing the various water-using sectors – this is an important part of sustainable water management.

The term 'Integrated River Basin Management', as used in the *Guidelines*, is referred to in the context of implementing IWRM for the provision of water services at the river basin level. IWRM is defined by the Global Water Partnership (GWP) as 'a process that promotes the coordinated development and the management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems'. The river basin approach seeks to focus on implementing IWRM principles on the basis of better coordination amongst operating and water management entities within a river basin, with a focus on allocating and delivering reliable water-dependent services in an equitable manner. It is an holistic approach that seeks to integrate the management of the physical environment within that of the broader socio-economic and political framework.

## Benefits of integrated water resources management at the river basin level

A basin-level perspective enables integration of downstream and upstream issues, quantity and quality, surface water and groundwater, and land use and water resources in a practical manner. IWRM is a step-by-step process and takes time. By responding to changing social, economic and environmental needs or impacts, one can gradually achieve better and sustainable water resources management as if moving up a spiral, through such means as progressively developing water resources in the basin, building a more integrated institutional framework, or improving environmental sustainability. The *Guidelines* illustrate the dynamic and evolving process of IWRM in a river basin using a conceptual 'IWRM Spiral' model, as shown in Figure 1.

'Part 2-1: The Guidelines for IWRM Coordination' provides information on how individual water-related sectors tend to think and act, how the sector relates to water management and IWRM, and what the sector wants to convey to other sectors and the organization or persons responsible for coordinating IWRM efforts. It is important to know the perspectives of other sectors when implementing IWRM. The same $1m^3$ of water is valued differently depending on the sector because each sector treats and uses water in different ways. Water is also valued differently depending on when and where it can be obtained, and at what quality.

The first step on the path to integration requires that each sector have access to all the compiled basin data and updated information as well as the ability to avoid unexpected risks caused by uncoordinated internal and/or external sector activities. Moreover, the processes inherent in achieving basin sustainability need to be undertaken through a series of urgent actions, coupled with flexible measures and mutual coordination, along with stakeholder participation.

The management of water-related disasters such as floods and droughts, including appropriate risk management, should not be considered in isolation but should comprise an essential part of IWRM. 'Part 2-2: The Guidelines for Flood Management' is therefore a useful tool for practitioners of flood management. They present the keys for success in implementing the IWRM process as well as good examples for flood management. It should be noted that flood management projects impact various sectors. They can often have the differing perspectives or interests. Flood managers should keep these in mind when implementing flood control measures in order to ensure smooth coordination with relevant stakeholders. Inadequate coordination may lead to repeated revisions of plans or delays in implementation.

### The importance of water should be recognized at the highest level of decision-making as well as at the basin level.

Food security, gender, health, environment, industry and many other objectives are closely related to sound water resources management. Consultation with stakeholders on their needs and objectives is a necessary and continuous process. However, currently, not all nations devote the requisite attention to 'governance' of water related issues at national levels and link their national strategies to planning and management of water resources to the basin scale. Therefore, the importance of water resources for the development and management at the basin level should be recognized at the highest national, regional, and local levels. These *Guidelines* support the idea that the development of the IWRM process in terms of maintaining an ongoing public consultative process, which advocates that the ideal of a perfect IWRM system does not exist, is difficult to implement yet needs to be initiated with whatever resources are available and with whatever institutional framework exists. Sound water management improves imperfect policies and makes them work better in order to deliver vital services.

### A foundation for progress towards adaptation to climate change

Climate change may not always be perceived as the fundamental water challenge in every region, but such change may include increases in the number and severity of floods and droughts over current seasonal patterns and ultimately determine when, where, and how much water is available. Climate change impacts are realized through the response of the hydrological cycle, in terms of quality and quantity, with direct impacts on the basin. Therefore, IWRM at the river basin level is the foundation upon which the implementation of adaptation strategies, based on a sequence of climate change projections and impact assessments, can be realized. The *Guidelines* can therefore provide useful insights into the interaction of various sectors on climate change processes.

## An evolutionary process at the river basin level

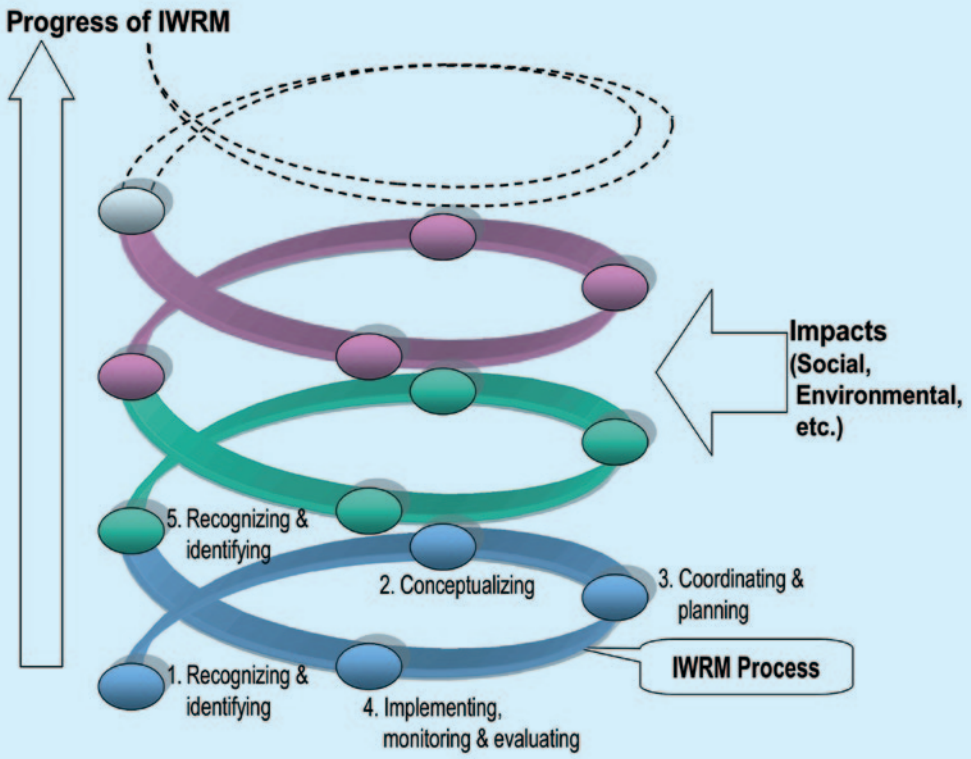
### The conceptual spiral model of IWRM planning

The evolutionary and adaptive implementation of the IWRM process presented in these *Guidelines* is illustrated by the 'spiral model'. In this model, water resources development in a basin, along with management principles and objectives, evolves over time as new demands and needs emerge, and innovative solutions are added at each stage. The 'spiral model' (Figure 1) is a convenient graphical conceptualization of the iterative, evolutionary, and adaptive management process, adjusting to new needs, circumstances, and societal goals. The spiral evolutionary model reflects progressive positive changes in historical water resources development and management and offers the following advantages:

- It allows IWRM actions to be started at any point of the evolutionary process.
- It builds capacity over time.
- It promotes cooperation and integration.
- It promotes the pursuit of better solutions that adapt to changing circumstances and values.
- It facilitates consensus building and stakeholder ownership at each 'turn of the spiral'.
- It illustrates IWRM as an incremental, step-by-step process, and therefore provides a practical framework for looking ahead and planning for successive 'turns of the spiral'.

Water resource systems are directly and indirectly affected by the interaction of numerous human related drivers of economic, social, and demographic functions, including climate change as an uncertain driver. Water managers should understand how different drivers of change affect the hydrology and therefore affect the related water demands and functions by the inhabitants in the basin. Setting up a viable IWRM framework is necessary as a platform for adapting to changes where the adaptation responses to those changes can be prioritized. Reassessment of basin hydrology improves understanding of a changing water cycle and can be an opportunity to consider and address special drivers such as climate, land-use changes, and the agricultural footprint in the evolving step-by-step IWRM process.

Figure 1 **IWRM spiral and process**




## The implementation process

Within a country or a river basin, different areas have diverse water problems and challenges. Each country and river basin must chart its own vision and plans based on its unique situation. A fully integrated approach to managing water in a basin may not be immediately possible. However, this does not prevent embarking on IWRM at the basin level whether the process is well developed or not.

Although their existence is not essential to begin with the IWRM process at the river basin level, river basin organizations provide a good institutional mechanism to facilitate implementation. The application of IWRM by basin organizations varies according to each river basin's specific conditions and requirements. Many river basins have set up coordinating bodies to facilitate river basin management. These may take the form of informal committees or authorities with important mandates and authorization.

In the case of transboundary river basins, a more flexible approach towards national policies and legislation is required. Nevertheless, the overall water management process at the basin level does not greatly differ. Top-down basin-wide approaches based on constructive ambiguity principles are often essential to foster trust and trigger action for cooperation due to the political nature of allocation of transboundary water resources.

The conditions listed in Table 1 are important but are not a set of prerequisites for implementing IWRM. IWRM aims to create sustainable water security within the present constraints and by improving conditions incrementally in each basin. For more detailed analysis of the steps required in the IWRM implementation process: recognition of benefits, identification of problems and needs, conceptualization, coordination and detailed planning, please refer to 'Part 2-1: Guidelines for IWRM Coordination'.

## Enhancing performance and accountability

In order to assess the resources and health of a river basin, water managers should establish evaluation indicators, which serve as useful tools to monitor developments, implementation, and results as well as to identify challenges. Water managers also have a responsibility to inform the public and other stakeholders of their findings in line with transparency objectives as well as to conduct self-assessments. Basin organizations have the responsibility to report on the status of planning and management, basin inventory,

and any changes in the basin's water resources to local governments, private sectors, NGOs, and other stakeholders. A framework for regular self-assessment should be established.

Enhancing performance and accountability through regular assessments using performance indicators and benchmarking, reporting and knowledge networks are key to moving up the spiral towards better IWRM at the river basin level. Performance benchmarking systems and peer review programmes provide pragmatic perspectives for assessment and improvement of basin management performance while at the same time instilling a climate of trust among the water users and sectors, which is key to improving IWRM coordination and implementation.

Table 1 **Important conditions for implementing IWRM**

| Important condition | Contents |
|---|---|
| Political will and commitment | Political will at all levels can help unite all stakeholders and move the process forward. It is especially needed if the resulting plan or arrangement would create or require changes in legal and institutional structures, or if controversies and conflicts among stakeholders exist. Access to actors outside the water box is essential to move political will, gain sectoral support and ease public pressure for IWRM implementation. |
| Basin management plan and clear vision | Water resources development coordinated among various sectors and users is facilitated by the preparation of a master plan that reflects the individual sector plans and offers the most effective and efficient utilization of the resource. |
| Participation and coordination mechanisms, fostering information-sharing and exchange | The identification of key stakeholders can be facilitated through interviews and meetings. Stakeholder involvement can be defined appropriately for local conditions and improved gradually. Initial sharing of general basin-wide data and information, and further sharing of more specific information, will assist the self-sustaining system. |
| Capacity development | Capacity development and training priorities should be expressed at all levels, including that of decentralized local government. Participants who may be adversely impacted and/or socially marginalized may be stimulated to participate within a consensus-building strategy. |
| Well-defined flexible and enforceable legal frameworks and regulation | It is necessary to assemble and review the full range of existing laws and regulations that apply to water-related activities and determine how existing legislation adapts or can be better adapted to accommodate sustainability and integration with regard to water resources management. |
| Water allocation plans | As water is a shared resource, water rights should be flexible in terms of allocation in order to accommodate changes. Preparing a master plan that reflects individual sector plans facilitates the coordination among various sectors and advocates the most appropriate utilization of a basin's resource. |
| Adequate investment, financial stability and sustainable cost recovery | Coordination for IWRM implementation needs financial sustainability – such as the promotion of cost recovery – and must consider long-term management. Various combinations and roles of international financing and donors such as government grants, public resources, user charges and taxes, donor funds, basin environmental trust funds can be considered as funding options. |
| Good knowledge of the natural resources present in the basin | Adequate knowledge and information on the water resources inventory and human resources of the basin is desirable. Including scientists as water resource managers can help maintain and accrue sound knowledge of the natural resources. |
| Comprehensive monitoring and evaluation | Monitoring and evaluation are essential for ensuring that the current management of water resources is properly implemented, and to identify the needs for adjusting management strategies. Upgrading new technologies is vital for effective performance both of local and central water management. |

# Part 2. Implementation

Part 2 of the *Guidelines* is intended for practitioners involved in IWRM coordination and implementation and consists of three sub-parts:

- Part 2-1: The Guidelines for IWRM Coordination
- Part 2-2: The Guidelines for Flood Management
- Part 2-3: Invitation to IWRM for Irrigation Practitioners

Part 2-1 and Part 2-2 are compiled from the viewpoint of comprehensive coordination of IWRM at the basin level. Part 2-3 is prepared from the perspective of irrigation practitioners as representatives of water users, and invites them to actively participate in IWRM.

The modular approach ensures that users do not have to read the entire *Guidelines*. Users can consult the topics relevant to their individual needs and easily navigate through the *Guidelines* to move directly to the most relevant section.

## Structure of Part 2-1 and Part 2-2

Both 'Part 2-1: The Guidelines for IWRM Coordination', and 'Part 2-2: The Guidelines for Flood Management', have six distinct chapters. These are common to both documents yet can be referred to individually. These chapters are linked by reference indices, which allow the user to jump from one chapter to another in the way most convenient to them. They are briefly described below. For more detailed analysis please refer to the *Guidelines* in question.

### 1. Features and structure

This introductory chapter provides an overview of the Part and outlines the following five chapters.

### 2. Sectoral perspectives in IWRM

This chapter provides information on how individual water-related sectors tend to think and act, how the sector relates to water management and IWRM, and what the sector wants to convey to other sectors as well as the organization or persons responsible for coordinating IWRM efforts. It illustrates the principles of the actions and interests of water-related sectors in water management and IWRM because each sector values water and interacts with water differently.

### 3. Keys for success

A 'Key for Success' is a key that can be used to help make IWRM succeed in practice. It is a key to establishing breakthroughs in challenging situations that may arise or for opening the door to better IWRM. Many of the keys have been proven in practice. Some are generic, i.e. they apply to all successful examples of IWRM others may apply only to specific situations, while some may not be in place as yet. It helps to find the key appropriate for the given circumstances in the IWRM process in the basin.

### 4. IWRM process

The 'IWRM Process' describes a typical process of IWRM implementation. It first details the conceptual model of the 'IWRM Spiral', introduced in this part as an evolving process. This is then followed by a schematic description of the 'IWRM Process' and its phases, each linked to a 'Key for Success'. It helps the reader orientate through the process and serves as a map for finding directions or locating the 'key' to enhance water resources management.

### 5. Good examples

Good Examples includes best practice examples of IWRM at the river basin level in the form of: 1) case stories illustrating actual IWRM efforts, and 2) 'Extracted Key for Success' highlighting elements of success instrumental in enhancing IWRM based on interviews with local resource persons conducted at the sites.

### 6. Useful tools

Useful Tools provides useful ideas/information that can be used in the application of keys for success. Good utilization of these tools will allow for the effective and efficient implementation of IWRM.

## The importance of sectoral perspectives

Implementation of IWRM means proposing a plan to individual sectors, which is as close to their ideal plans as possible while taking other sector's perspectives on board. It is in essence a balancing act of advantages and compromises. It is also important that as many sectors as possible are satisfied with the plan before consensus is reached. For this, managers in charge of coordination should not force their story on the sectors but should take a horizontal approach to obtaining the perspectives of the coordinated sectors so as to deepen their level of understanding. The coordinators must understand the goals of the activities undertaken by the sectors or stakeholders, and how they relate to water resources and the basin in order to appropriately implement IWRM. Furthermore, good understanding and communication by the coordinators on the benefits of IWRM to the individual sectors will facilitate efficient, appropriate, and socially justifiable consensus building. Thus, it is important to establish a good understanding of 'sectoral perspectives' in implementing IWRM.

Table 2 provides an overview of the general concerns faced by the sectors in question as well as their possible interaction, and benefits, with other sectors. For more detailed analysis of 'sectoral perspectives' please refer directly to the *Guidelines* in question.

Table 2 **Water sectors and their related interests and advantages**

| Sector | Interests | Relation and advantages of IWRM |
|---|---|---|
| **Agricultural Sector**<br><br>*– primary concern is food production, water is just an instrument* | • Water for agricultural production<br>Water, together with land, is only an instrument for agricultural production. The production outputs are food and ultimately revenues for the farmers. For farmers, water is a means of ensuring their livelihood on their land.<br>• Sense of entitlement as a precedence user<br>Agricultural sector has a history of investing and acquiring water before the concept of 'water management' even existed. Thus, there is a strong sense of entitlement that they can use their water exclusively.<br>• From close water sources to far water sources<br>Agricultural water supplies used to acquire water from close-by water sources; however, sectors eventually began to search for other water sources further from the farmland, which led to water resources development through dam-building. In the monsoon regions of Asia, the amount of rainfall varies greatly during the wet season. Thus, in order to prepare for sudden droughts, they utilize groundwater, reservoirs or nearby rivers, and if they need more water they build dams upstream of the river. In arid and semi-arid regions, there is always a need for more water, but the search always begins with nearby water sources before seeking further away as water demand increases. Thus, nearby water sources are utilized in most developing countries, but as development proceeds in the basin, larger infrastructures such as wide-area water transfers become necessary for obtaining adequate agricultural water.<br>• Agriculture as the fundamental industry of the country<br>The agricultural sector contributes to national security through food production. The agricultural managers of the country and the region consider providing a stable supply of food for the region's most important objective. In developing countries, some consider that agriculture should be promoted in order to secure jobs and revenues in rural regions and prevent population concentration in urban cities. This cannot be realized without securing the water necessary for agriculture. The agricultural sector is also strongly influenced by national policies. Thus, it must be kept in mind that local coordination is sometimes not enough. | • If the agricultural sector wishes to conduct a large infrastructure development, there is the possibility of significant cost reduction if the venture is jointly implemented with other sectors. Furthermore, the agricultural sector may gain forms of compensation if it reaches compromise with other sectors regarding the securing of water resources.<br>• By compromising on making decisions as regards to water resources the agricultural sector may be able to receive compensation in another form, with the possibility of covering potential losses. Thus, it is important to issue proposals regarding agricultural production from a comprehensive standpoint.<br>• By uniting specific organizations or individuals in the agriculture sector, the sector can represent a significant amount of water resources. It can, therefore, facilitate the consensus-building process for IWRM implementation and enhance the benefits achieved by the entire agricultural sector. |
| **Domestic Water Supply Sector**<br><br>*– requires water quality on top of water quantity* | • Sanitation and domestic water supply<br>Domestic water supply provides clean water to people in a stable manner and is highly public in its nature. Provision of safe drinking water may be normal in developed countries or cities but it is still a fundamental demand for sustaining the lives of people in developing counties and rural areas. Furthermore, water supply in these areas will lead to improvements in the social environment, such as less time fetching water, etc. Provision of water supply in cities was originally developed from the viewpoint of crisis management in order to prevent water-related diseases. Supplied water may be 'drinkable' or 'not appropriate for drinking'. It is rare that water is 'drinkable' but in order to meet the needs of improving the sanitary environment, the provision of water that is not necessarily drinkable can be sufficient.<br>• No alternative for domestic water supply utility<br>Current domestic water supply in cities does not provide an opportunity for users to choose their service. People have to use the available water supply in the area. There is probably no region where multiple water supply utilities compete (or a user can choose the water service). Water pricing to collect initial investment and operation and maintenance costs depends on the area or utility; however, the water source available is often limited and regional differences in water pricing are inevitable and of little interest to the water supply sector. This issue is a primary concern for most water users.<br>• Privatization and water supply<br>In the past there were movements to privatize water utilities to enhance profits. However, such movements have been revised to balance the public aspect of water utilities in meeting the social needs together with the business aspect of operation effectiveness and cost reduction.<br>• Water treatment technology and water source/water quality<br>Before water treatment technology was developed to its current level, an important consideration for water sources for domestic water use was not only 'quantity' but 'quality'. Thus, groundwater was often utilized. River water was used if groundwater alone could not meet the demand. Before treatment technology was developed to its current level, the sector sought better quality water upstream of rivers. This often induced conflicts with existing water users downstream, but for the water sector it was important that good quality water was obtained as a water source. Furthermore, conventional water treatment by rapid filtration cannot treat dissolved substances. In recent years - however - with advances in treatment technologies, water quality is no longer a major issue. It has now become possible to create drinking water from treated wastewater. | • When demands for water supply increase due to the development of a new city, population growth or a change in social situation, the domestic water supply sector will have to locate new water sources, and be faced with the need to implement IWRM.<br>• When introducing IWRM, conformity with plans by other municipalities or water use sectors can be ensured by accounting for upstream and downstream, right and left banks, and coordination among municipalities or water utilities. Furthermore, infrastructure such as dams, intake weirs and treatment plants can be jointly developed and a joint management framework can be established. These can present substantial advantages to the domestic water supply sector.<br>• If there is shortage of water due to population growth or rapid urbanization, water transfers from other uses, particularly the agriculture sector, can become an option, together with the development of new water resources infrastructure such as dams. |

Table 2 **Water sectors and their related interests and advantages (cont.)**

| Sector | Interests | Relation and advantages of IWRM |
|---|---|---|
| **Industrial Water Sector**<br><br>*– primary deciding factor is cost* | • Low-cost water and industrial water<br>The primary concern of the industrial water sector is how to obtain and provide low-cost water and discharge the wastewater in the least expensive way. Cost is the primary deciding factor. Compared to the domestic water supply sector, which does not provide alternative option for users, the industrial water sector is much more sensitive to the demand for cost-effectiveness. The industries themselves are influenced greatly by aspects other than water (logistics, employment, environment, etc.), thus, it is difficult to develop long-term demand projections compared to domestic water supply.<br>• Groundwater utilization and industrial water<br>Industrial water in earlier days was abstracted mostly from groundwater. This is because groundwater was a cheap and stable water source with high water quality. Drawing water from rivers requires water use rights, infrastructure development and water quality adjustment (treatment), thus, the use of river water for industrial use is discouraged whenever possible. Excessive abstraction of groundwater in alluvial plains may induce ground subsidence or groundwater salination, resulting in deterioration of groundwater quality. Users of industrial water are mostly private entities and thus such problems are likely to occur if there is no adequate regulation.<br>• Water quantity, water quality and industrial water<br>Industries that use large amounts of water such as steel, oil, chemical or paper industries select locations with easy access to water. Industrial water, unlike domestic water, demands varying levels of water quantity or quality depending on the usage. For example, advanced IT related companies purify water themselves and thus the industrial water supplier may only need to provide raw water. Discharging used industrial water directly into the river may cause severe contamination downstream. Industrial water users generally understand and consider this. | • If the industrial water sector wishes to conduct a large infrastructure development there could be a possibility of significant cost reduction if it is jointly implemented with other sectors. |
| **Hydropower Sector**<br><br>*– how to generate the maximum amount of energy from water* | • Characteristics of electricity<br>– Electricity cannot be stored, thus facility capacity generally exceeds demand peak.<br>– The same can be said for instant supply and demand, and lack of flexibility in supply often leads to inefficient operation.<br>– There is often no alternative service for power supply and thus the price of power has a public utility cost.<br>– Infrastructure investment and cost collection plans are long-term.<br>– It can be distributed over a wider area, compared to water (and is possible to transmit long-distance).<br>Generally, hydropower generation in its early stages was used to provide power for local consumption, such as factories. Although usually commencing in the form of private projects, it soon expanded to general implementation in combination with other electricity sources to provide economic and efficient electricity supply nationwide. In many countries hydropower development began before irrigation water development. Hydropower generation often has lower running costs than thermal power generation, thus generating more electricity through hydropower and less through thermal power is ideal. Hydropower generation does not consume water as compared to other water-use sectors. However, hydropower generation upstream of a river harnesses the potential energy of water to its maximum extent. The hydropower sector plans to exploit this potential energy by utilizing as much water as possible and building multiple power-generation facilities. Its priority is efficient power generation; if that causes rivers to run dry, that is considered an inevitable cost. Hydropower generation using dams to generate power depending on demand, and thus the discharged water quantity fluctuates. This also influences water temperature. Thus, consideration for other sectors and environment would be necessary. The hydropower sector may take measures to reduce its influence downstream by controlling discharges, but the sector is not proactive in this regard without the effect of investment. Thus, the hydropower sector considers investment and the efficiency of power generation among its priorities, and river flow and the environment are only considered when required, through environmental assessments, etc. | • When demands for water supply increase due In developed countries where public awareness on environmental conservation is high and there is a high level of public participation, it is difficult to plan new hydropower projects without overall coordination. If the hydropower sector actively participates in IWRM and facilitates consensus-building with relevant stakeholders with a special focus on environmental conservation, this will facilitate project planning and implementation, and will become an advantage for the sector. |
| **Sewerage (Sanitation)/ Drainage Sector**<br><br>*– how to collect wastewater efficiently and where to discharge it* | • Maintaining sanitary environment and crisis management<br>Providing access to sanitation is as important as a safe water supply in maintaining public hygiene and providing a sanitary environment. For example, the sewerage system must account for storm-water otherwise urban areas can flood due to lack of stormwater discharge capacity and lead to backflow of sewage or wastewater, causing extremely unsanitary conditions. This could cause the spreading of water-related diseases. If wastewater is discharged upstream of a river due to an underdeveloped sewerage system, the downstream river becomes inappropriate as a water source for domestic water supply. In many regions of the world, large cities are often situated downstream of large rivers. Wastewater disposal upstream can bring about a crisis situation in such cities. For a city, the development of a sewerage system in the upstream region of a river that flows down through a city is a crisis management issue.<br>• Recycling of wastewater<br>Wastewater, if treated to an appropriate level, can be effectively reused for water-use purposes. A sewerage system is thus very important in order to recycle wastewater and to utilize it as a water resource.<br>• Urban drainage<br>Drainage facilities in urban cities are sometimes not developed fast enough and heavy rains can cause inundations in the lowlands of cities resulting in severe damage to underground spaces. Garbage thrown into drainage channels often prevents drainage and intensifies the damage caused by inundations.<br>• Public nature<br>Sewerage and drainage systems are highly public in nature. The efficient collection of wastewater, treated to the level requested by society, then discharged downstream as quickly as possible are of paramount importance. | • The drainage location and drainage water quality are important aspects that need coordination and consensus building with other sectors. Furthermore, participating in IWRM from the aspect of securing water quantity will enhance interaction with stakeholders. By improving drainage water quality, one may be able to set a closer drainage location. It can lead to overall economic benefits, ensuring adequate river flow and recycling of wastewater, etc |

Table 2 **Water sectors and their related interests and advantages (cont.)**

| Sector | Interests | Relation and advantages of IWRM |
|---|---|---|
| **Environmental Sector**<br><br>*– ensuring ecological diversity and social consensus* | • Maintenance of sustainable environment<br>The principal interest of environmental managers is to ensure a sustainable environment over a long-term perspective. They prevent excessive, shortsighted development and call for the restoration of the natural environment. They demand and display requests to other water-related sectors. If these demands are social demands the coordinator will have to determine if social consensus can be attained for such demands including its cost allocation.<br>• Maintaining the natural ecological state<br>The environmental sector pursues the maintenance of the environment in its natural ecological state, striving for the preservation of forests or rivers without human influence. From their perspective, over-extraction of water or drainage from and to rivers causing insufficient water for the environment, or dams or weirs changing flow-variability in rivers, are considered to be problems.<br>• Environmental conservation in harmony with human activities<br>In areas where communities developed slowly around irrigation agriculture, environmental ecology has established within the interaction between nature and human activities. Such an environment is not without human influence but harmony or balance exists between human activities and nature. There are opinions that such environments with some level of human influences should be conserved in their present state. For example, shallow riparian waters, tributaries and streams, or networks of irrigation channels and the surrounding agricultural land can be considered as forms of ecological habitats for fauna and flora. | • IWRM cannot exist without the introduction of environmental perspectives, thus the implementation of IWRM is a definite advantage for the environmental sector. However, the economic perspective is also important in gaining the consensus of relevant sectors, thus the importance of the environment has to be prioritized in social demands. |
| **Flood Management Sector**<br><br>*– protecting the lives and properties of residents living in the river basin* | • Minimizing flood damage<br>The primary concern for flood managers is to protect people and their properties in the river basin from floods, and to minimize damage in a basin-wide manner. Promptly realizing the benefits of flood control measures is the priority of flood managers. In this regard, flood managers consider it necessary to collaborate closely with managers responsible for IWRM in order to ensure complete coordination with other sectors and stakeholders as efficiently as possible. | • The management of flood risks needs to be implemented through the involvement of various basin stakeholders, including development sectors, municipalities as well as residents. Flood managers are generally found on the coordination end of IWRM with the relevant stakeholders and managers responsible for overall IWRM coordination.<br>• Flood risk management contributes to meeting overall IWRM objectives in the basin by preventing disastrous damage caused by floods, and hence enhancing the social and economic welfare of the basin. Its existing framework for negotiating with basin stakeholders can also be utilized for overall IWRM coordination, allowing for efficient stakeholder participation and coordination.<br>• Flood control not only mitigates flood disasters but also provides benefits for water-use sectors. Temporarily stored floodwater in facilities/ reservoirs can be allocated for later water use. This can lead to cost-effective multi-sector collaboration, where flood managers as well as water-use sectors can all benefit from working together.<br>• Firmly positioning flood risk management as part of IWRM objectives ensures enhancement of prevention and preparedness capacities of the basin against future flood risks.<br>• Flood managers can also benefit from the overall IWRM arrangement in implementing flood risk management projects by utilizing the overall participatory/ coordination framework. This facilitates the gaining of consensus from relevant stakeholders and enables project objectives to be achieved in an efficient manner.<br>• Floods may bring benefits to the basin in terms of fertile soil suitable for cultivation or by supporting the ecological functions of floodplains or wetlands. |

## Part 2-1: The Guidelines for IWRM Coordination

In Part 2-1, the IWRM process is conceptualized using the IWRM spiral model. As IWRM implementation progresses it is represented by a turn of the spiral, which is linked to a 'Key for Success' and 'Good Examples'. In the main publications, diagrams of the spiral and their related steps illustrate the IWRM process. This can provide ideas on how actual IWRM practices progress in a spiral manner.

### The IWRM spiral

IWRM at the river basin level seeks better water resources management through such means as progressively developing water resources in the basin, building a more integrated institutional framework, and improving environmental sustainability. This goal must always be kept in mind wherever positioned in the IWRM spiral. However, it should be noted that the process cannot proceed at once in a short period of time; IWRM is an evolving, step-by-step process. (Figure 1) One turn of the spiral includes such phases as:

1. recognizing/identifying pressing issues or needs;
2. conceptualizing the problem itself and locating possible solutions;
3. coordinating and planning among stakeholders to reach an agreement; and
4. implementing/monitoring/evaluating the plan and its outcome.

This creates a new IWRM framework or scheme in the basin, which also forms the beginning of the next stage of the spiral. One turn of the spiral may take a long time. In the case of a large water resources development project, such as the construction of a dam, it may take more than ten years to complete one turn. Creating a new institution or organization would also require several years.

### Key for success

Many of the keys for success have been proven in practice and are linked to 'Good Examples'. Some are generic, in other words, they apply to every successful example of IWRM, others may only apply to specific situations, and some may not be in place as yet. Not all of them have to be applied. Work with them to see how they can assist the practitioner to move ahead with IWRM implementation in the basin.

Each 'Key for Success' in the *Guidelines* is explained using the following format.

- **Key**: The essence of the 'Key for Success' is indicated in bold in the box.
- **Why**: The reason why the 'Key for Success' is important or useful is indicated in the box.
- **How**: The ways of implementing the 'Key for Success' are indicated outside the box.

### Links to good examples and useful tools

Both Part 2-1 and Part 2-2 include a chapter on 'Good Examples'. These chapters are compiled with best-practice examples of IWRM at the river basin level, in the forms of: 1) case stories illustrating actual IWRM efforts and 2) an 'Extracted Key for Success' highlighting elements of success in enhancing IWRM, based on interviews with local resource persons conducted at the basin sites (See Tables 3 and 4 for a list of the case studies).

Links between 'Key for Success', 'Useful Tools' and 'Good Examples' are also provided for easy reference.

### How to use the *Guidelines*

**The flowchart on pages 12–13 illustrates the IWRM process as described fully in the *Guidelines*, from the initial stages of recognition and identification of problems and needs through to IWRM planning, capacity building and implementation.**

**Good examples of IWRM implementation are referred to, as well as some useful tools for IWRM managers.**

***See pages 12–13***

**Sample pages from the *Guidelines* are given on page 14. These describe how the chapters work together to explain the IWRM implementation process, with the different chapters providing useful tools and examples to illustrate important aspects of IWRM.**

***See page 14***

### Process of IWRM coordination

**Figure 4 on pages 15–19 provides a schematic overview of the process steps.**

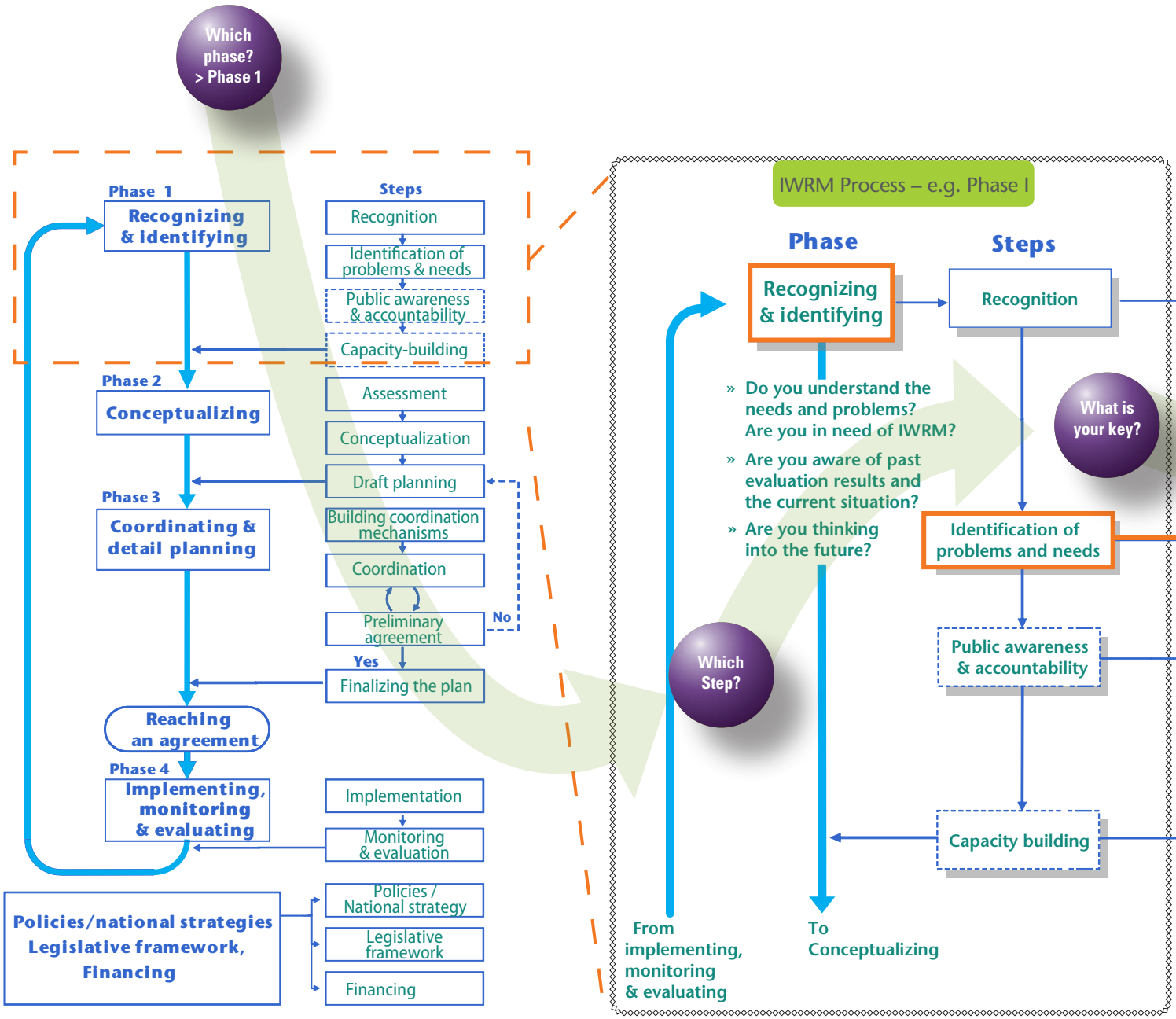
***See pages 15–19***

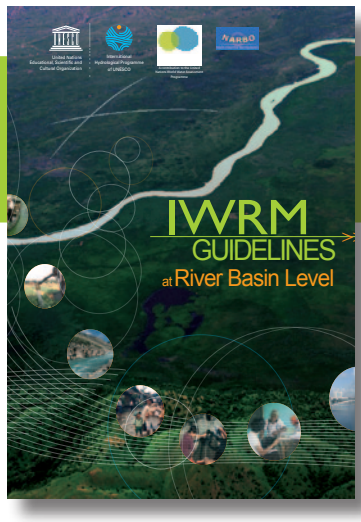
**Table 3 provides a list of case studies of examples of IWRM coordination and their associated links to 'Keys for Success'. For more detailed analysis and explanations please refer to 'Part 2-1: The Guidelines for IWRM Coordination'.**

***See page 20***

Figure 2

# How to use the Guidelines






Any useful tool for your Key?

## Keys for Success in Implementing IWRM

The Keys for Success can be used in practice to help IWRM succeed at the basin level.

- [1.1.1] Be aware of IWRM efforts in your river basin, region or country.
- [1.1.2] Consider a significant change in the basin as a chance to move IWRM forward, and recognize and understand such changes as early as possible.
- [1.1.3] Ensure broad and long-term perspectives when identifying changes occurring in the river basin.
- [1.2.1] Identify potential priority areas (critical locations and key issues) for IWRM implementation in the basin.
- [1.2.2] Make good use of existing information in the basin.
- [1.3.1] Proactive disclosure of information is a fundamental activity in IWRM.
- [1.3.2] Facilitate awarenessraising through utilization of topics, materials and processes familiar to the public, including those usually outside the water sector.
- [1.3.3] Introduce educational activities on water and IWRM, focusing particularly on women and children.
- [1.4.1] Develop the capacity of a leader who can recognize problems, find necessary solutions, and implement them.
- [1.4.2] Integrate capacity building and incentives.

## Good Examples

- [1.1.1] Davao River (1)
- [1.1.2] Lake Biwa (2)
  Sacramento–San Joaq
  Yoshino River (3)
- [1.2.1] Murray Darling River (3)
  Yoshino River (1), (4)
- [1.3.1] Negro River (3)
  Tama River (2)
  Yoshino River (1)
- [1.3.2] Murray Darling River (2)
- [1.3.3] Murray Darling River (2)
  Negro River (3)
  Volta River (2)

How can your Key overcome issues at other basin?

## Useful Tools for Implementing IWRM

The pentagram is a tool for comparing alternative plans

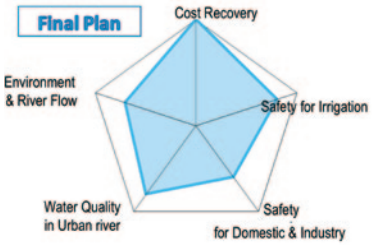




Figure 3 **Sample pages of the main publications: the IWRM coordination process**

## Chapter 3

### Key for Success in Implementing IWRM

2.2.2

**It is advisable to start considering mechanisms and courses of action for stakeholder participation during the conceptualization phase.**

- The mechanisms and courses of action for progressively involving various stakeholders in the basin need to be thoroughly considered, otherwise the later process of consensus building could involve many revisions making it time-consuming. Moreover, the agreement reached may become ineffective or may, in the worst case, be overturned.

- Mechanisms for participation may include setting up a committee, public hearings, and workshops. Appropriate forms of participation should be chosen based on local conditions and the relationships among the stakeholders.
  - o Planning here does not only mean preparing plans for water-related projects, but also includes planning for the establishment of a coordinating organization like a river basin organization, or new rules, or planning for environmental conservation measures, etc.
  - o Involving all stakeholders fairly an… may not always be ideal. Gradually … ter forms of participation over the …

of coordination in a step-by-step and locally appropriate manner. For example, priority stakeholder groups most closely related to the issue/problem can be identified at the beginning, and the involvement of stakeholders can be progressively expanded from therein.

- o It is desirable that the coordinator is at least aware of the relationships among stakeholders. Complete knowledge is not necessary, but familiarity with the existing relationships is …eful for future coordination. Neglecting this …ect, means that future coordination may …ke longer.

Reference guide

**Good Examples**

>> Extracted Key for Success from Davao River (1), 'Integrating the fragmented sectors', p.88

>> Extracted Key for Success from Davao River (2), 'Integrating the fragmented sub-basins', p.89

>> …tracted Key for Success from Tama River (… 'Rules for coordination and consensus-bu…ding in developing the River Improvement Plan', p.136

**Useful Tools**

>> Grasping the Positioning of Stakeholders and their Mutual Relationships, p.173

## Chapter 5 Good Examples

**5.3.2 Extracted Key for Success**

**(1) Extracted Key for Success from Davao River** Reference to 5.3.1 Case Story (Davao River)

**[ Title ]**
**Integrating the fragmented sectors**

**[ Situation ]**
**A number of local initiatives started building awareness and capacities in the different river basins in the Davao City**

Major efforts in the development of integrated water resource management (IWRM) had been the focus in the Talomo-Lipadas Rivers, the source of major aquifers that provide 96 per cent of the Davao City Water District's (DCWD) regulated drinking water supply. However, as DCWD only serves 56 per cent of the total population of the city, large populations across the watersheds continue to be unregulated for water supply. Being the largest river basin, the Davao River plays a key role in ensuring water for much of the remaining 44 per cent of the population and is critical for other factors including food production and other ecological services.

**[ Problem ]**
**The local initiatives were fragmented in the different river basin even though each group is working on limited resources**

Fragmented initiatives only created water quantity and quality problems. Contradictions and conflicts in rules and roles are inevitable as local initiatives evolved their policies and strategies in …

## Chapter 6 Useful Tools

### 6.4 GRASPING THE POSITIONING OF STAKEHOLDERS AND THEIR MUTUAL RELATIONSHIPS

Understanding the positioning and relationships of and among stakeholders is useful in laying out strategies for stakeholder involvement effectively and efficiently. Such efficiency is improved further if a key person is identified and involved.

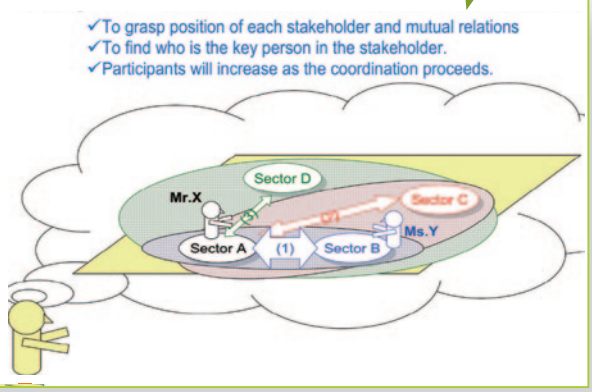
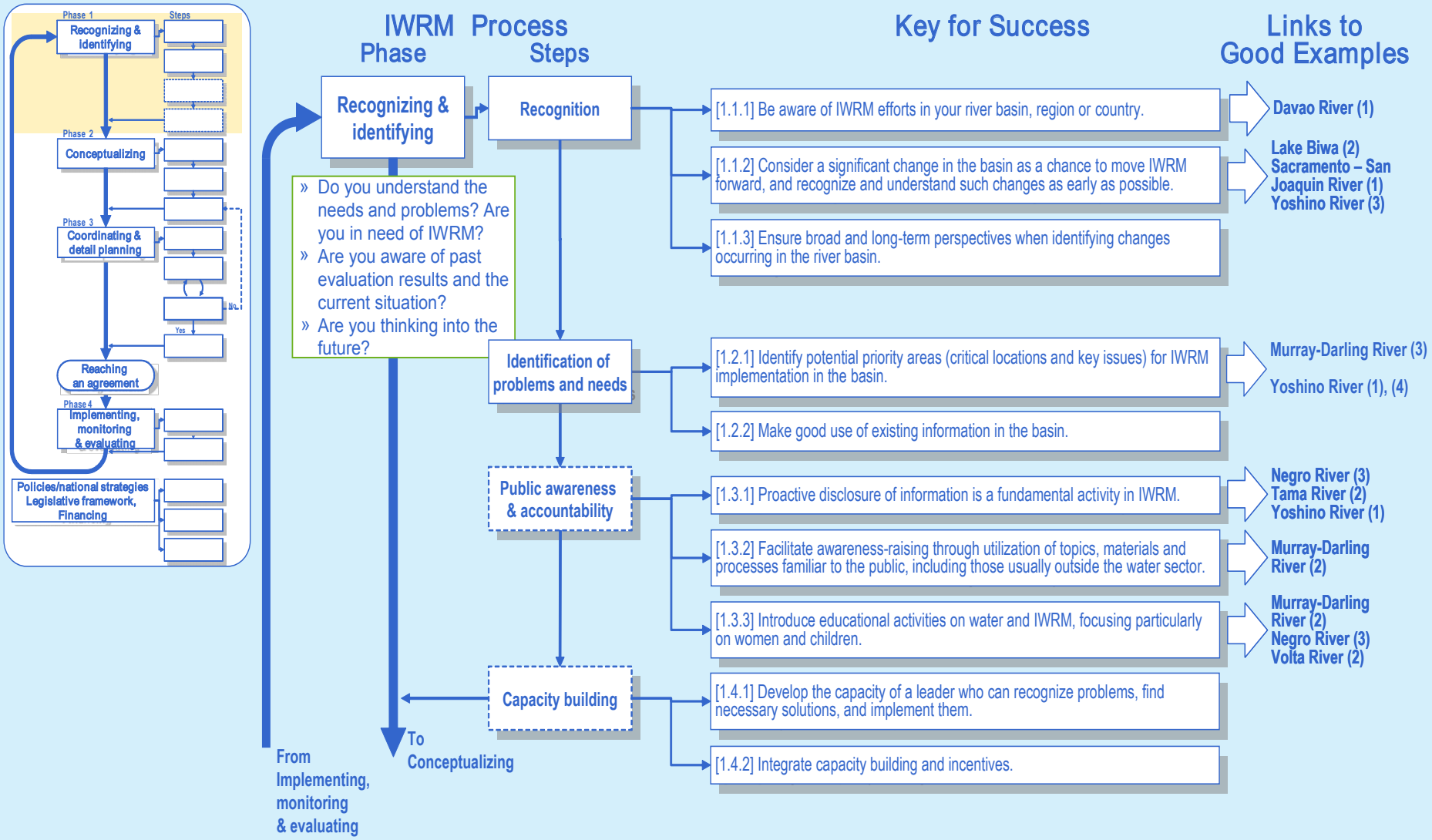


Figure 4 **Process of IWRM coordination: (1) Phase 1: recognizing and identifying**




## Steps in Phase 1: Recognizing & identifying

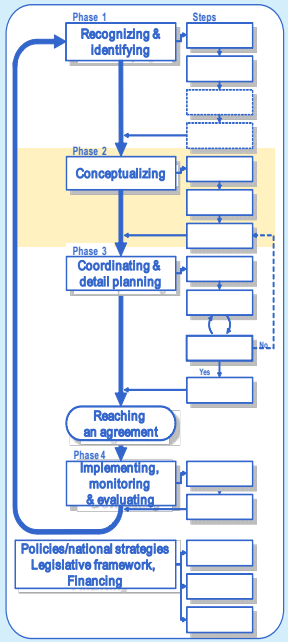
**Recognition**：A good understanding of needs becomes a driving force for identifying the issues to be addressed by implementing IWRM. Your understanding can be measured by how well you can make others understand.

**Identification of problems and needs**：Identifying problems and needs by evaluating the existing water resources assessment results and exploring new problems or needs existing in the basin due to social changes.

**Public awareness & accountability and Capacity building**：These are powerful agents for promoting IWRM and can be at times set as objectives. Thus these should be considered from the beginning of the IWRM process. However, it takes time and efforts. They need to be implemented in the later phases as well.

Figure 4. Process of IWRM coordination: (1) Phase 1: recognizing and identifying

Figure 4 **Process of IWRM coordination: (2) Phase 2: conceptualizing**







## Steps in Phase 2: Conceptualizing

**Assessment :** Grasp the overall structure of the problem such as 1) problems and needs, 2) natural conditions, and 3) human factors. Interactions with stakeholders have already began at this stage.

**Conceptualization :** Consider the course of action and the relevant stakeholders and their relationships for tackling the problem based on the assessment conducted above. Conceptualize possible solutions.

**Draft planning :** Prepare draft plans based on the concepts outlined above. It is most important that multiple alternative solutions are prepared. In cases where coordination in phase 3 does not reach an agreement you may have to come back to this phase again. Carefully drafting proposed plans will avoid such impediment.

Figure 4. Process of IWRM coordination: (2) Phase 2: conceptualizing

Figure 4 **Process of IWRM coordination: (3) Phase 3: coordinating and detail planning**

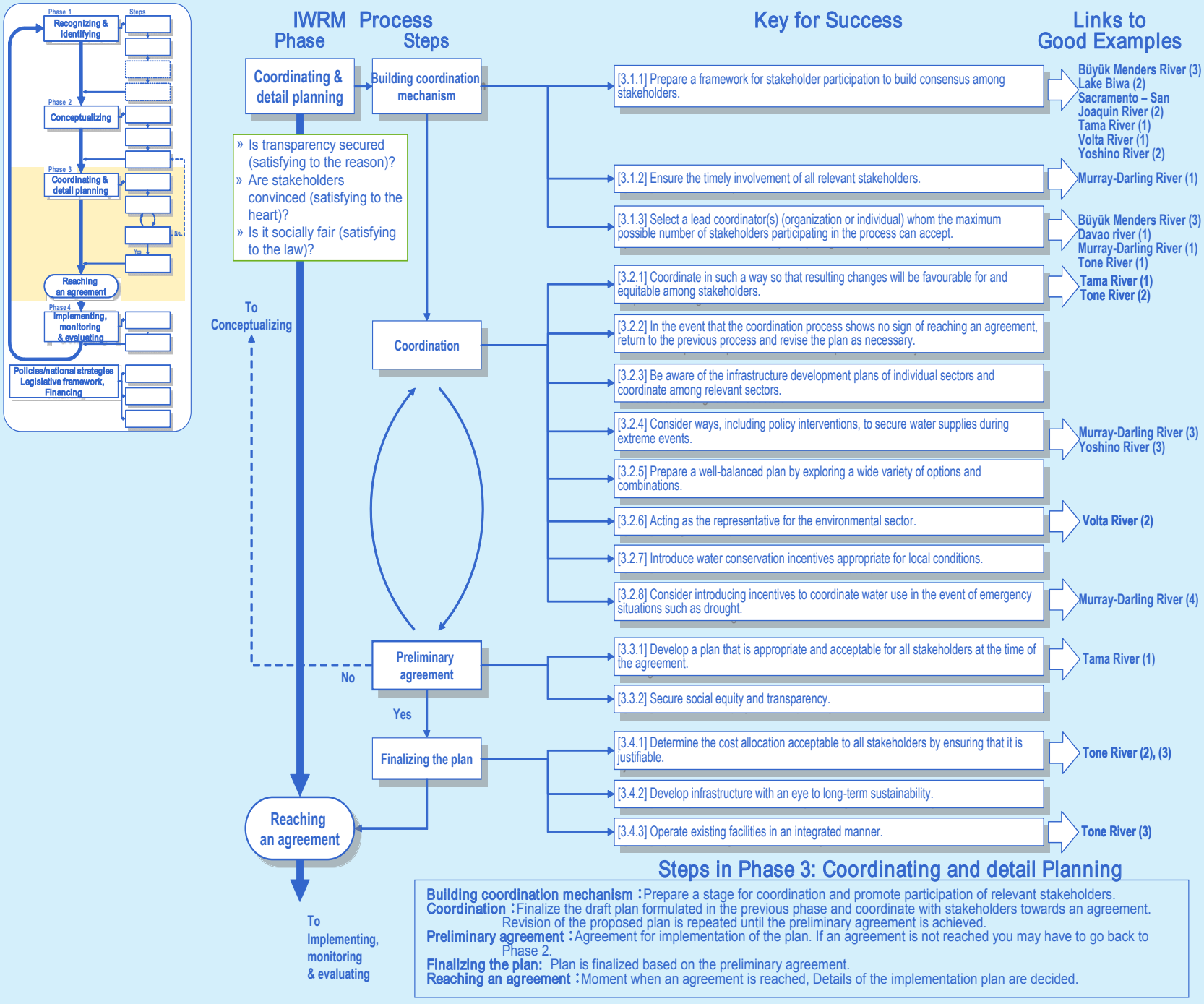
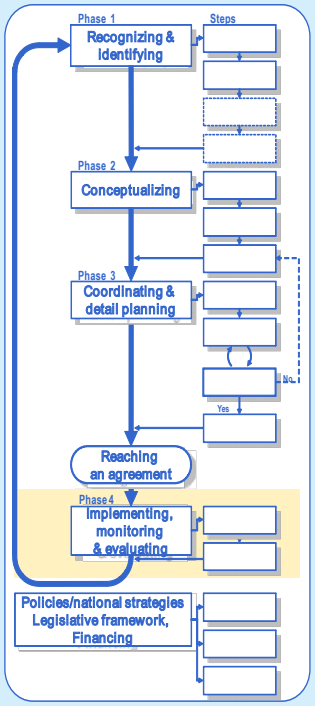
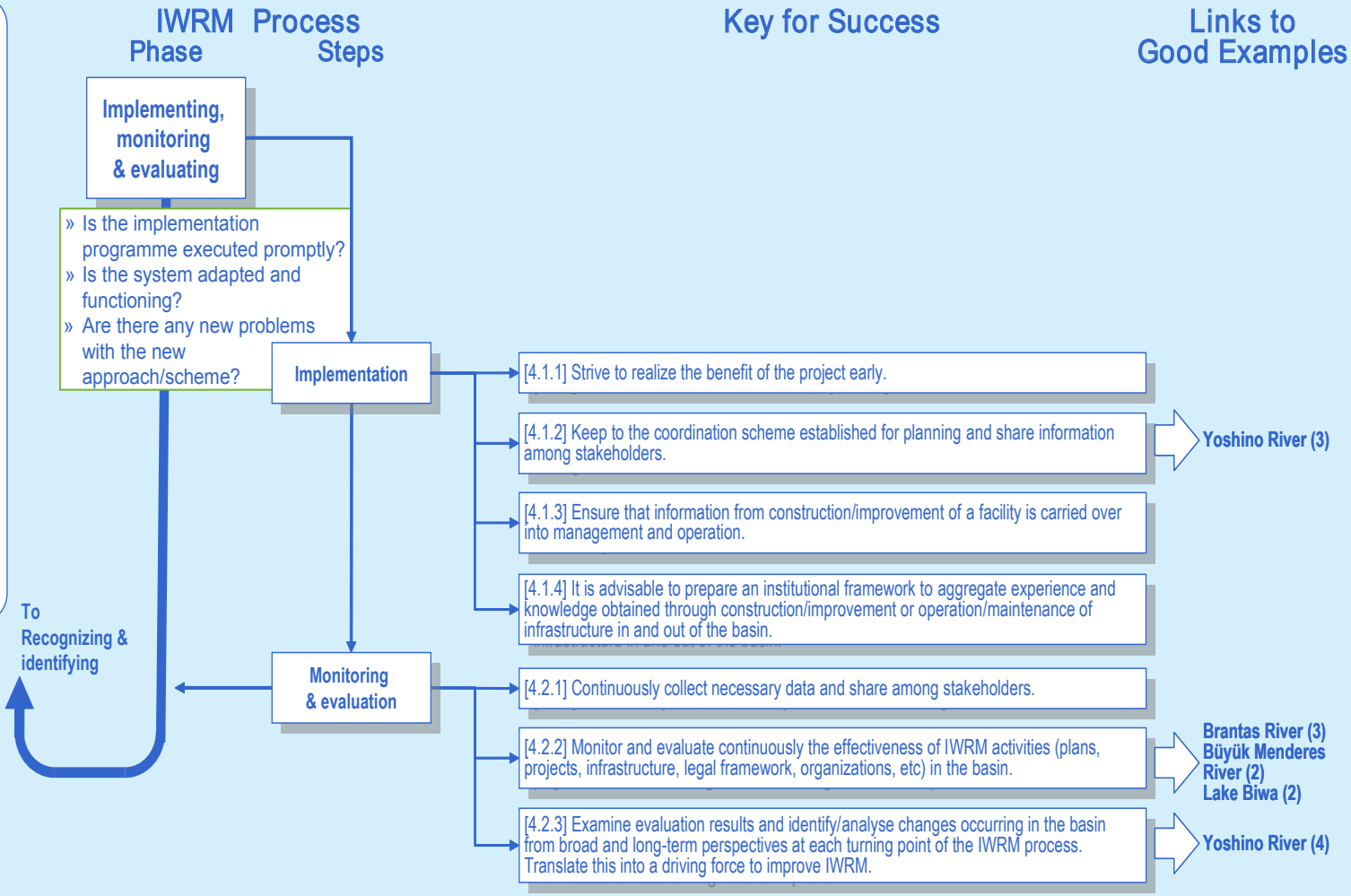



Figure 4. Process of IWRM coordination: (3) Phase 3: coordinating and detail planning

Figure 4 **Process of IWRM coordination: (4) Phase 4: implementing, monitoring & evaluating**




## Steps in Phase 4: Implementing, monitoring & evaluating

**Implementation:** Execute the implementation program and develop a new IWRM approach/scheme. For details of implementation procedures for infrastructure development projects refer to existing manuals for study, design and construction, etc. For establishment of institutional frameworks and organizations refer to existing IWRM manuals.

**Monitoring & evaluation:** Monitor and evaluate if the newly developed approach or scheme is functioning and watch out for any new problems.

Figure 4. Process of IWRM coordination: (4) Phase 4: implementing, monitoring & evaluating

Figure 4 **Process of IWRM coordination: (5) Important aspects of IWRM: policies/national strategies, legislative**

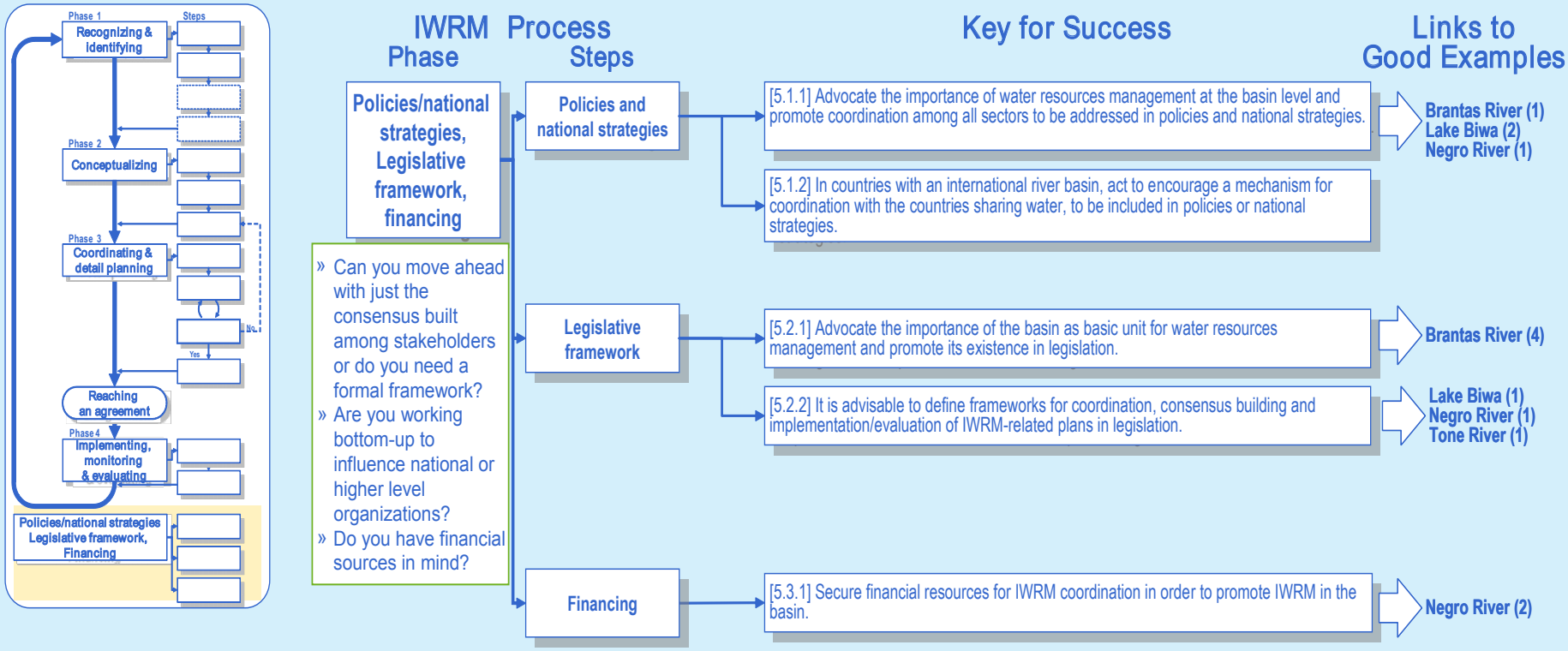



Figure 4. Process of IWRM coordination: (5) Important aspects of IWRM: policies/national strategies, legislative

Table 3 **Summary of examples of IWRM coordination**

| No. | River, Country | Title | Links to KFS |
|---|---|---|---|
| 1 | Indonesia: Brantas River | (1) Applying integrated river basin development and management concept<br>(2) The comprehensive plan must be positioned as a national priority and as a regional (river basin wide) priority<br>(3) Managing water resources and infrastructures in the basin<br>(4) Coordination among sectors and all stakeholders | 5.1.1<br>2.3.1<br>4.2.2<br>5.2.1 |
| 2 | Turkey: Buyuk Menderes River | (1) Estimation of water demand and analysis of hydrology in the river basin for project planning<br>(2) Continuous project monitoring in order to improve next steps<br>(3) Framework for stakeholder participation in the new scheme | 2.1.1<br>4.2.2<br>2.2.3,3.1.1,3.1.3 |
| 3 | Philippines: Davao River | (1) Integrating the fragmented sectors<br>(2) Integrating the fragmented sub-basins<br>(3) Awareness of importance of technology for water management | 1.1.1,2.2.2,3.1.3<br>2.2.2<br>2.1.1,2.3.4 |
| 4 | Japan: Lake Biwa | (1) Legislative framework for conflict resolution between upstream area – the Lake Biwa basin – and downstream area<br>(2) Formulation of comprehensive conservation plan with the participation of all stakeholders in the basin | 5.2.2<br>1.1.2,3.1.1,4.2.2,5.1.1 |
| 5 | Australia: Murray-Darling River | (1) Community consultation and participation in decision-making<br>(2) Enhancing public awareness<br>(3) Contingency measures to secure critical water demands<br>(4) Reducing the economic impacts of severe water shortages | 3.1.2,3.1.3<br>1.3.2,1.3.3<br>1.2.1,3.2.4<br>3.2.8 |
| 6 | Argentina: Negro River | (1) National policy and needs are important to promote an integrated approach<br>(2) Securing permanent finance for coordination activities<br>(3) Share information broadly with the public | 5.1.1,5.2.2<br>5.3.1<br>1.3.1,1.3.3 |
| 7 | USA: Sacramento – San Joaquin River | (1) Achievement of efficient IWRM for complex multiple-purpose water users<br>(2) Effectively coordinating and integrating water management of different levels of government | 1.1.2<br>3.1.1 |
| 8 | Japan: Tama River | (1) Rules for coordination and consensus-building in developing the River Improvement Plan<br>(2) Ensuring complete accountability by disclosing all information | 2.2.2,3.1.1,3.2.1,3.3.1<br>1.3.1 |
| 9 | Japan: Tone River | (1) Foundation of the coordination and implementation body<br>(2) Project planning, coordinating multiple sectors, and conflict resolution<br>(3) Improvement of water budget in the basin without the construction of new facilities(such as dams) | 3.1.3,5.2.2<br>3.2.1,3.4.1<br>2.2.4,3.4.3,3.4.1 |
| 10 | Benin, Burkina Faso, Cote d'Ivoire | (1) Mobilizing stakeholders from the community, national and transboundary levels for joint water management<br>(2) Causing motivation for ecosystem conservation | 3.1.1<br>3.2.6,1.3.3 |
| 11 | Japan: Yoshino River | (1) Formulating the water budget for an integrated plan<br>(2) Practical coordination mechanism by working group<br>(3) Creating a mechanism for drought conciliation<br>(4) Securing flow for the environment so as to improve IWRM in the next stage | 1.2.1,1.3.1<br>3.1.1<br>1.1.2,3.2.4,4.1.2<br>1.2.1,4.2.3 |

## Part 2-2: Guidelines for Flood Management

'Part 2-2: The Guidelines for Flood Management' is intended for IWRM practitioners of flood management. It provides introductory guidance for those tackling IWRM for the first time, or it can be used as training material for intermediary practitioners and trainers of IWRM.

For IWRM experts, it can be used as a reference guide to tackle the various issues and problems they face in their IWRM activities.

### The IWBM flood management process

Chapter 4 of Part 2-2 describes the IWRM process for flood management in terms of four phases. The elements of the process that are related to all phases (such as policies, legal frameworks and financing) are indicated outside of the process flow. Each phase is further explained through the steps it involves. (Figure 5.)

### Keys for success

Chapter 3 of Part 2-2 illustrates keys for success relevant to each phase or step of the process. These help practitioners to orient themselves through the process and serve as a map for finding directions or the correct 'key' for enhancing water resources management (Table 4).

### Good examples for flood management

Chapter 5 of Part 2-2 includes best practice examples of IWRM at the river basin level in the form of:

1) case examples illustrating actual IWRM efforts, and;

2) 'Extracted Key for Success' highlighting elements of success in enhancing IWRM.

*Action-oriented guidelines*

Good examples included in the *Guidelines* are collected through actions, by visiting sites and conducting interviews with local resource people.

## Part 2-3: Invitation to IWRM for Irrigation Practitioners

'Part 2-3: Invitation to IWRM for Irrigation Practitioners' is intended for IWRM practitioners tackling irrigation planning.

### Why should irrigation practitioners be interested in IWRM?

When irrigation practitioners prepare an irrigation plan for a water basin, they are required to think about the other water users in the basin. Moreover, considering other water users helps to improve the irrigation plan, and can bring enormous benefits.

Through these efforts, the resultant irrigation plans will be more successful, not only for irrigation practitioners, but for all the stakeholders that share the water basin.

### The IWRM process for irrigation practitioners

Chapter 4 of Part 2-3 describes a typical process for IWRM implementation and illustrates keys for success relevant to each phase or step of the process for irrigation practitioners.

This chapter illustrates the points affecting water resources in the basin that practitioners must consider in preparing their irrigation plans.

Those responsible for planning, designing and implementing irrigation plans can start by using Part 2-3 to make their own keys. If so required, these irrigation practitioners may later explore other parts of the guidelines such as 'Part 1: Principles', 'Part 2-1: The Guidelines for IWRM Coordination', and 'Part 2-2: The Guidelines for Flood Management'.

### The IWRM process of flood management

**Figure 5 on pages 22–26 provide a schematic overview of the IWRM flood management process.**

**For more detailed analysis and explanations, please refer to 'Part 2-2: Guidelines for Flood Management'.**

***See pages 22–26***

**Table 4 provides a list of case studies of examples of flood management and their associated links to 'Keys for Success'.**

***See page 27***

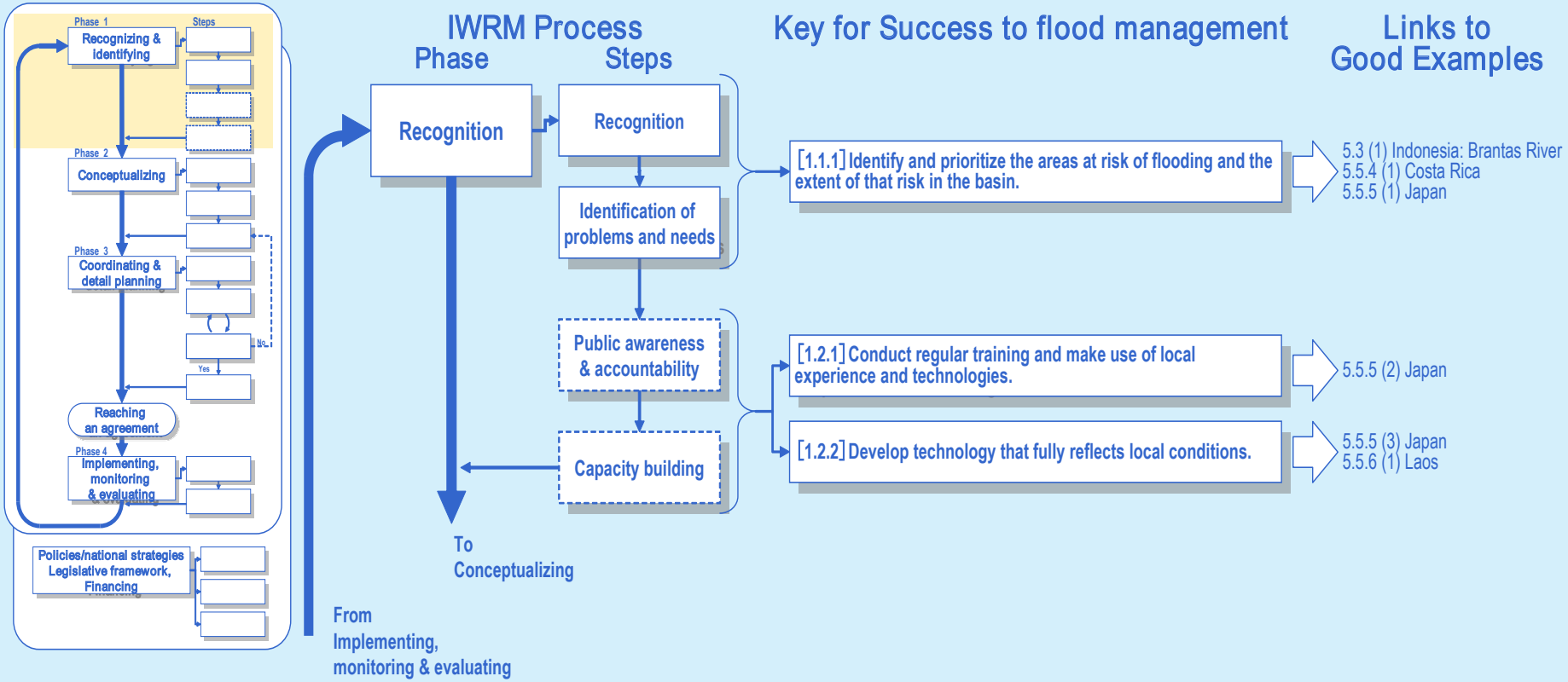
### The IWRM process for irrigation practitioners

**Figure 6 on pages xxxx provide a schematic overview of the IWRM process as it relates to irrigation practioners.**

**For more detailed analysis and explanations, please refer to 'Part 2-3: Invitation to IWRM for Irrigation Practitioners'.**

***See pages 28–29***

Figure 5 **The IWRM process of flood management: (1) Phase 1: recognizing and identifying**



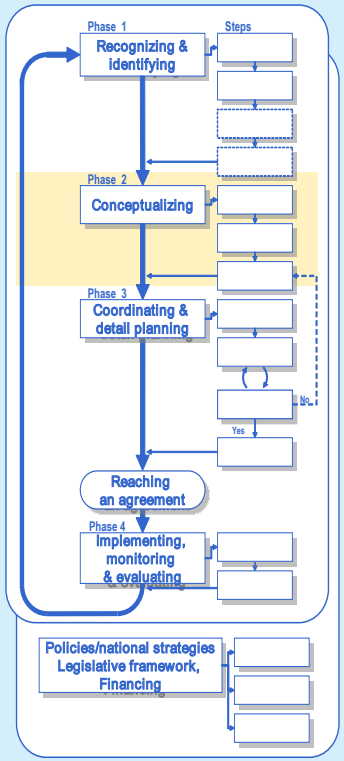

**Recognition**：A good understanding of needs becomes a driving force for identifying the issues to be addressed by implementing IWRM. Your understanding can be measured by how well you can make others understand.

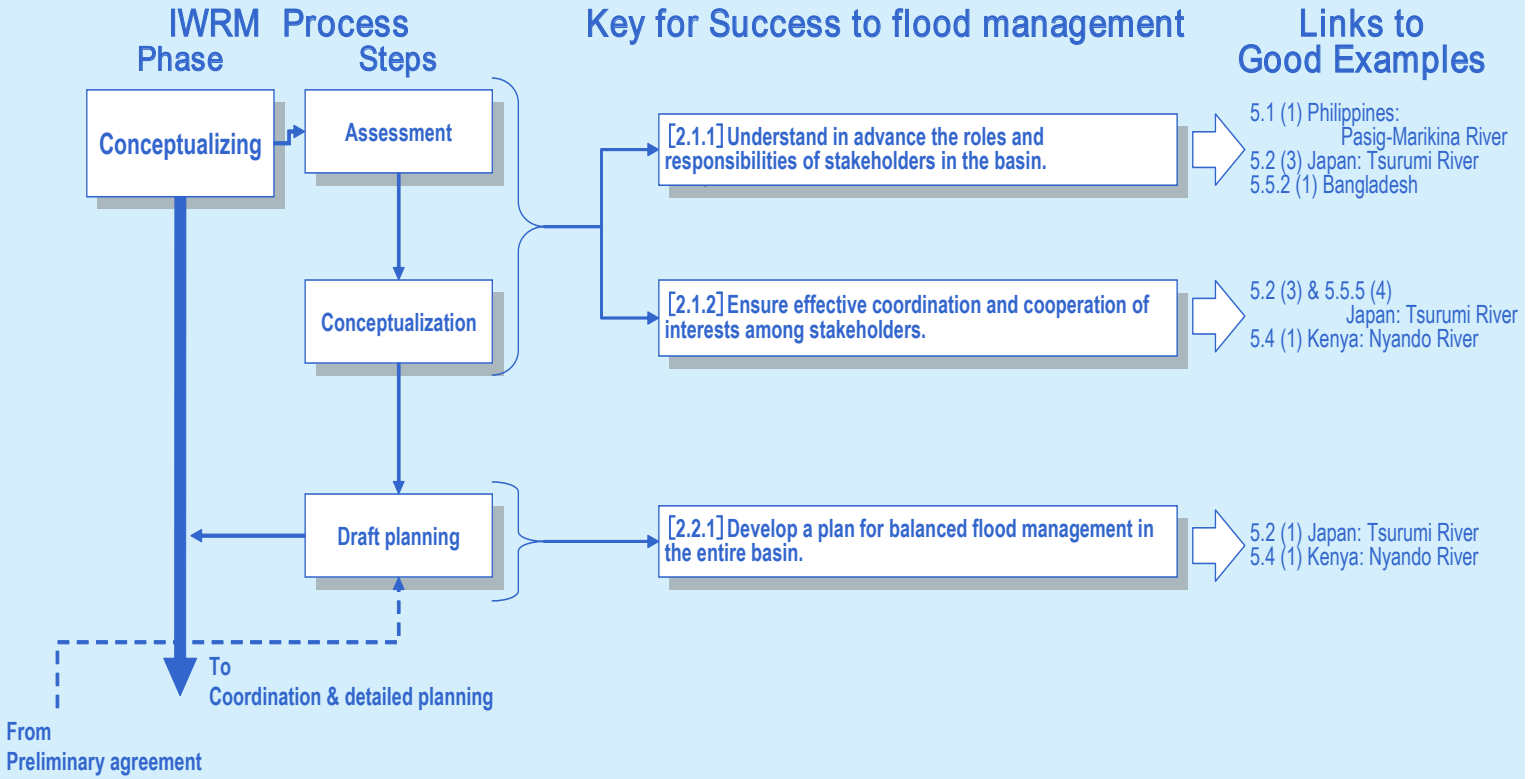
**Identification of problems and needs**：Identifying problems and needs by evaluating the existing water resources assessment results and exploring new problems or needs existing in the basin due to social changes.

**Public awareness & accountability and capacity building**：These are powerful agents for promoting IWRM and can be at times set as objectives. Thus these should be considered from the beginning of the IWRM process. However, it takes time and efforts. They need to be implemented in the later phases as well.

**Figure 5, The IWRM process of flood management: (1) Phase 1: recognizing and identifying**

Figure 5 **The IWRM process of flood management: (2) Phase 2: conceptualizing**




**Assessment** : Grasp the overall structure of the problem such as 1) problems and needs, 2) natural conditions, and 3) human factors. Interactions with stakeholders have already began at this stage.

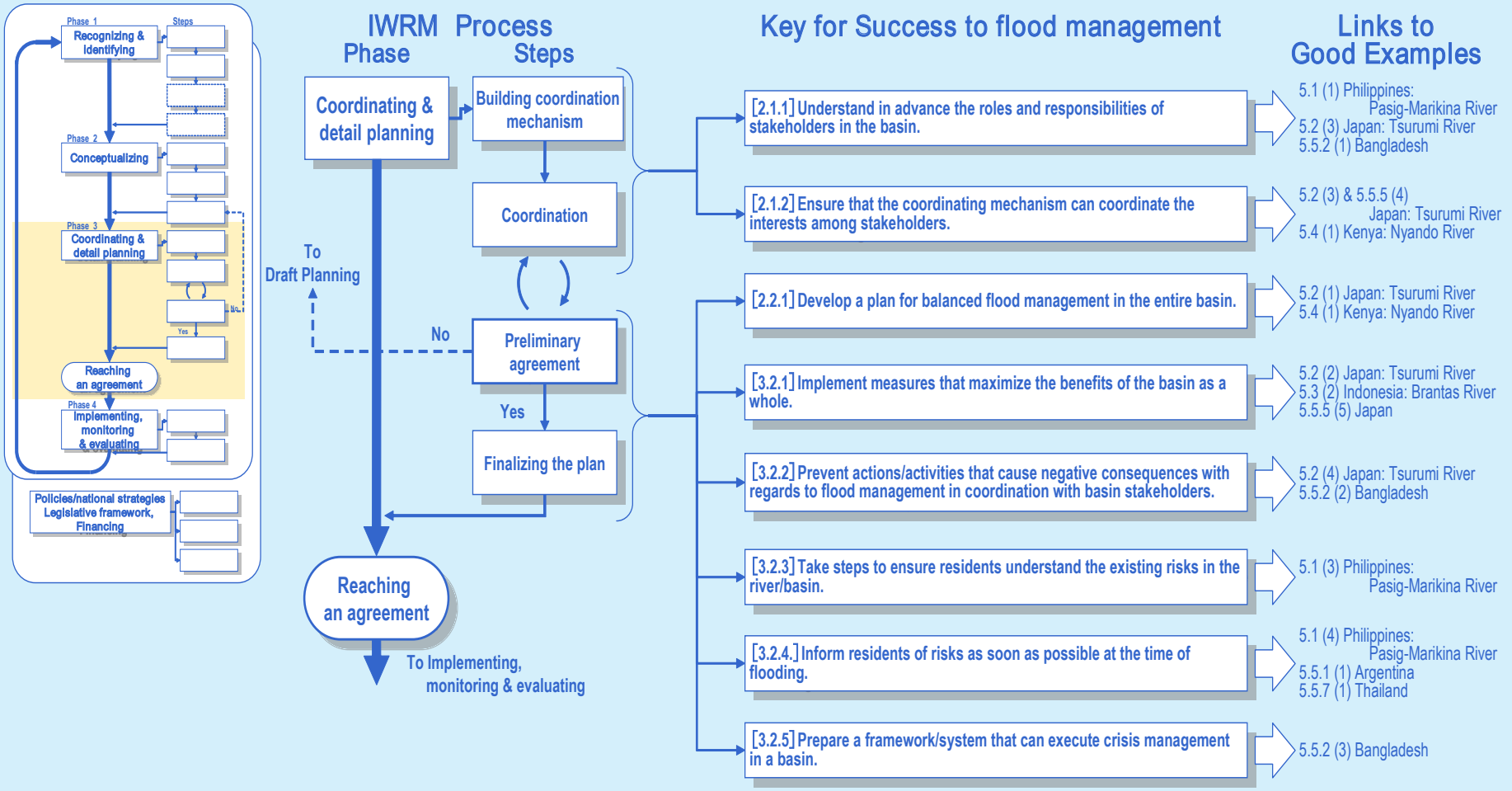
**Conceptualization** : Consider the course of action and the relevant stakeholders and their relationships for tackling the problem based on the assessment conducted above. Conceptualize possible solutions.

**Draft planning** : Prepare draft plans based on the concepts outlined above. It is most important that multiple alternative solutions are prepared. In cases where coordination in phase 3 does not reach an agreement you may have to come back to this phase again. Carefully drafting proposed plans will avoid such impediment.

**Public awareness & accountability and capacity building** : These are powerful agents for promoting IWRM and can be at times set as objectives. Thus these should be considered from the beginning of the IWRM process. However, it takes time and efforts. They need to be implemented in the later phases as well.

Figure 5. The IWRM process of flood management: (2) Phase 2: conceptualizing

Figure 5 **The IWRM process of flood management: (3) Phase 3: coordinating and detail planning**




**Building coordination mechanism** : Prepare a stage for coordination and promote participation of relevant stakeholders.

**Coordination** : Finalize the draft plan formulated in the previous phase and coordinate with stakeholders towards an agreement. Revision of the proposed plan is repeated until the preliminary agreement is achieved.

**Preliminary agreement** : Agreement for implementation of the plan. If an agreement is not reached you may have to go back to Phase 2.

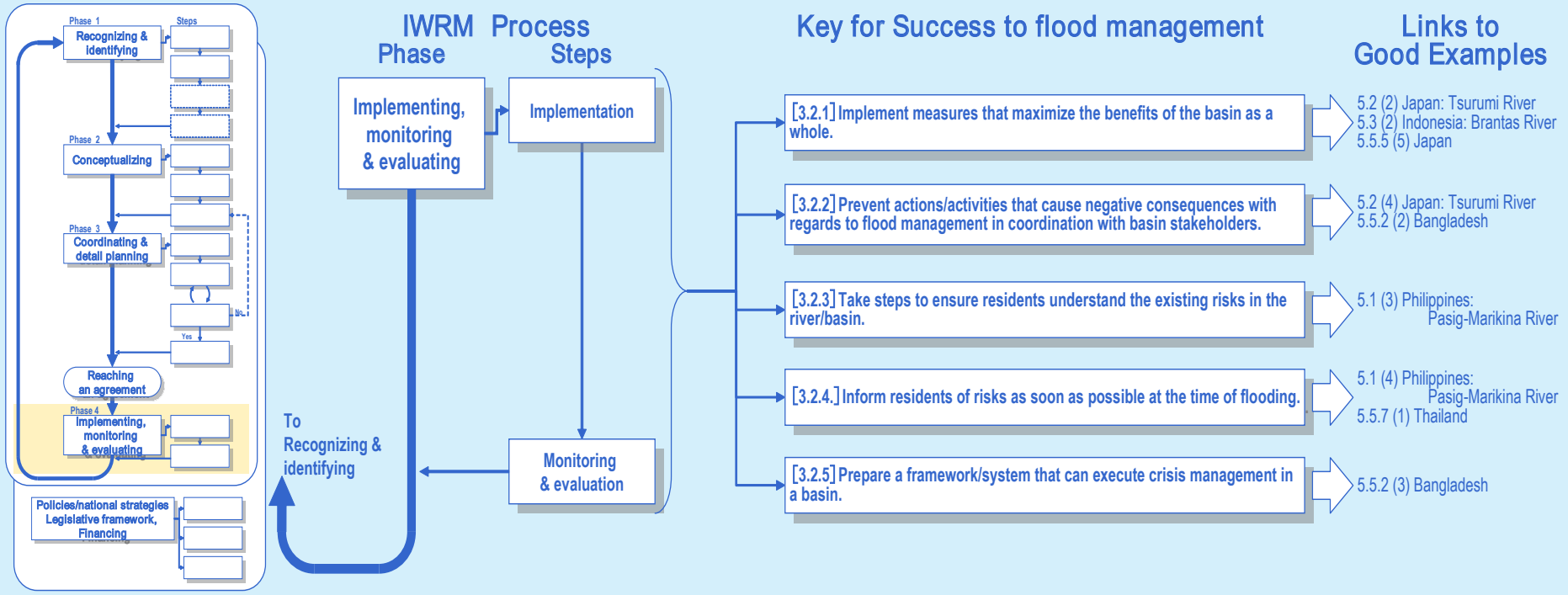
**Finalizing the plan:** Plan is finalized based on the preliminary agreement.

**Reaching an agreement** : Moment when an agreement is reached, Details of the implementation plan are decided.

**Public awareness & accountability and capacity building** : These are powerful agents for promoting IWRM and can be at times set as objectives. Thus these should be considered from the beginning of the IWRM process. However, it takes time and efforts. They need to be implemented in the later phases as well.

Figure 5. The IWRM process of flood management: (3) Phase 3: coordinating and detail planning

Figure 5 **The IWRM process of flood management: (4) Phase 4: implementing, monitoring & evaluating**




**Implementation:** Execute the implementation program and develop a new IWRM approach/scheme. For details of implementation procedures for infrastructure development projects refer to existing manuals for study, design and construction, etc. For establishment of institutional frameworks and organizations refer to existing IWRM manuals.

**Monitoring & evaluation:** Monitor and evaluate if the newly developed approach or scheme is functioning and watch out for any new problems.

**Public awareness & accountability and capacity building :** These are powerful agents for promoting IWRM and can be at times set as objectives. Thus these should be considered from the beginning of the IWRM process. However, it takes time and efforts. They need to be implemented in the later phases as well.

Figure 5 **The IWRM process of flood management: (5) Important aspects of the IWRM process: policies/national strategies, legislative framework, financing**

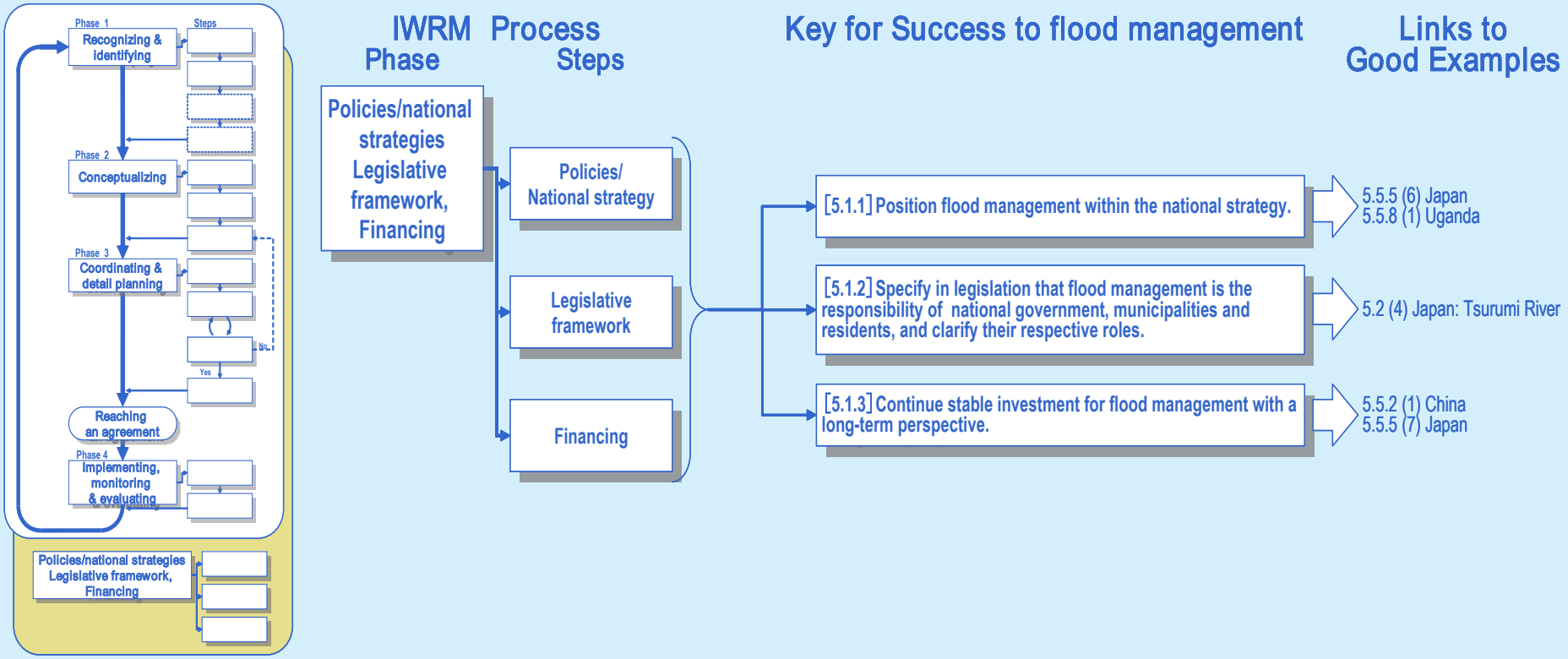
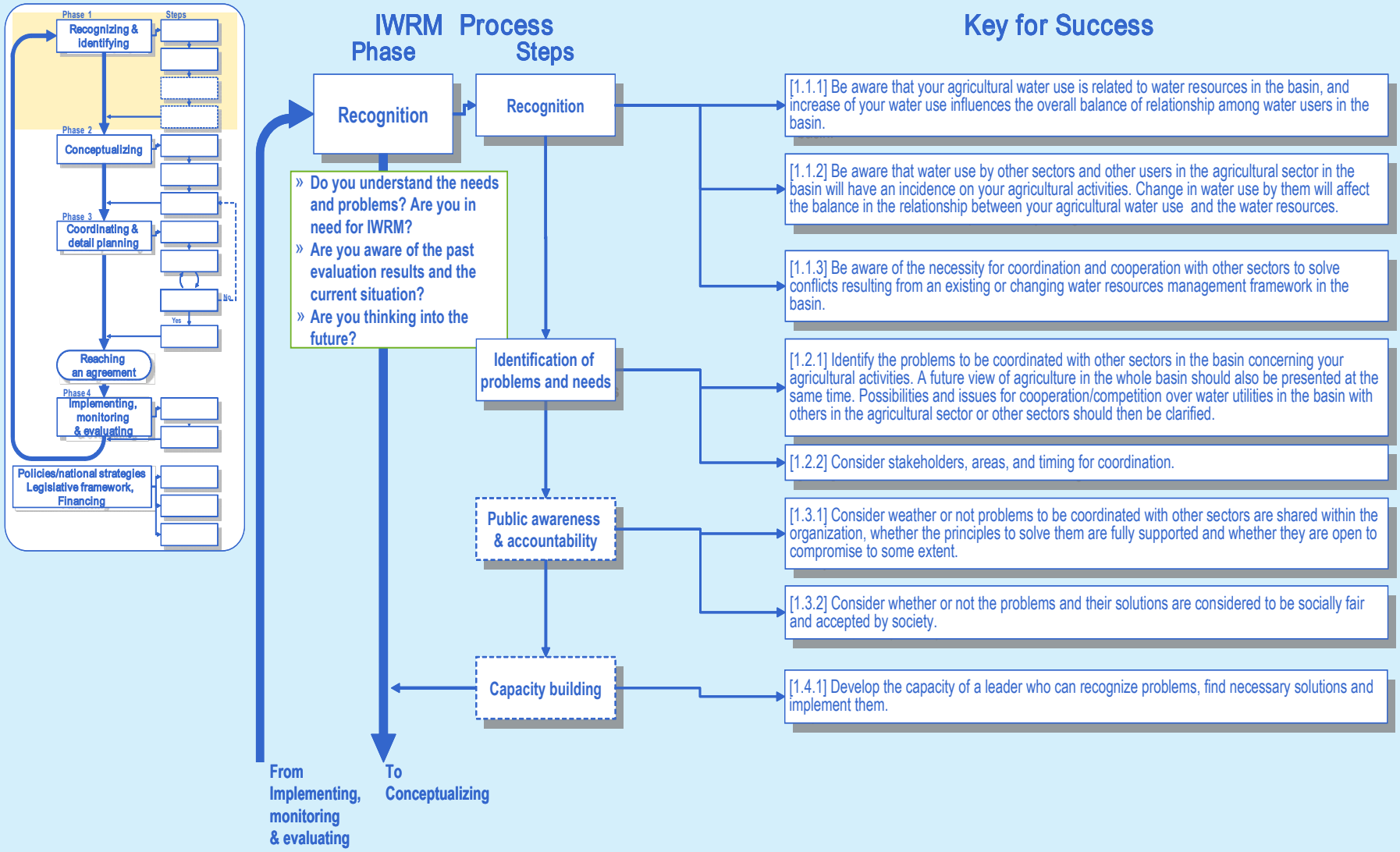



Figure 5. The IWRM process of flood management: (5) Important aspects of the IWRM process: policies/national strategies, legislative framework, financing

Table 4 **Summary of examples of IWRM flood management**

| No. | River, Country | Classification | Links to KFS |
|---|---|---|---|
| 1 | Philippines: Pasig-Marikina River Basin | (1) Stakeholder participation | 2.1.1,2.2.1 |
| | | (2) Regulation of activities | 3.2.2,3.2.3 |
| | | (3) Raising Awareness | 3.2.3 |
| | | (4) Information sharing | 3.2.4,3.2.5 |
| 2 | Japan: Tsurumi River Basin | (1) Planning | 2.2.1 |
| | | (2) Maximized benefit | 3.2.1 |
| | | (3) Stakeholder participation & Coordination | 2.1.1,2.1.2 |
| | | (4) Legislation & Regulation of activities | 5.1.2,3.2.2 |
| 3 | Indonesia: Brantas River Basin | (1) Risk assessment | 1.1.1 |
| | | (2) Coordination | 2.1.2 |
| 4 | Kenya: Nyando River Basin | (1) Coordination & Planning | 2.1.2,2.2.1 |
| 5 | **Other Examples** | | |
| 5.1 | Argentina | (1) Information sharing | 3.2.4 |
| 5.2 | Bangladesh | (1) Stakeholder participation | 2.1.1 |
| | | (2) Regulation of activities | 3.2.2 |
| | | (3) Crisis management | 3.2.5 |
| 5.3 | China | (1) Financing | 5.1.3 |
| 5.4 | Costa Rica | (1) Risk assessment | 1.1.1 |
| 5.5 | Japan | (1) Risk assessment | 1.1.1 |
| | | (2) Capacity building | 1.2.1 |
| | | (3) Technology development | 1.2.2 |
| | | (4) Stakeholder participation | 2.1.2 |
| | | (5) Maximized benefit | 3.2.1 |
| | | (6) National strategy | 5.1.1 |
| | | (7) Financing | 5.1.3 |
| 5.6 | Laos | (1) Technology development | 1.2.2 |
| 5.7 | Thailand | (1) Information sharing | 3.2.4 |
| 5.8 | Uganda | (1) National strategy | 5.1.1 |

Figure 6 **The IWRM Process for irrigation practitioners: (1) Phase 1: recognizing and identifying**




## Steps in Phase 1: Recognizing & Identifying

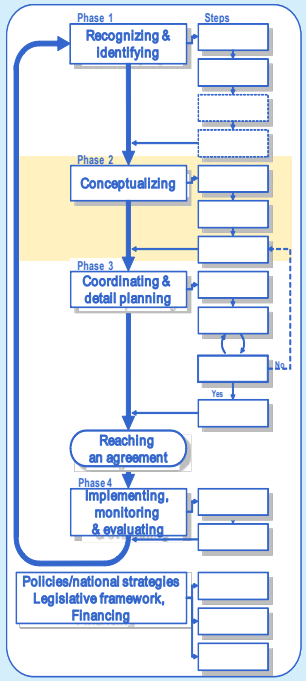
**Recognition :** A good understanding of needs becomes a driving force for identifying the issues to be addressed by implementing IWRM. Your understanding can be measured by how well you can make others understand.

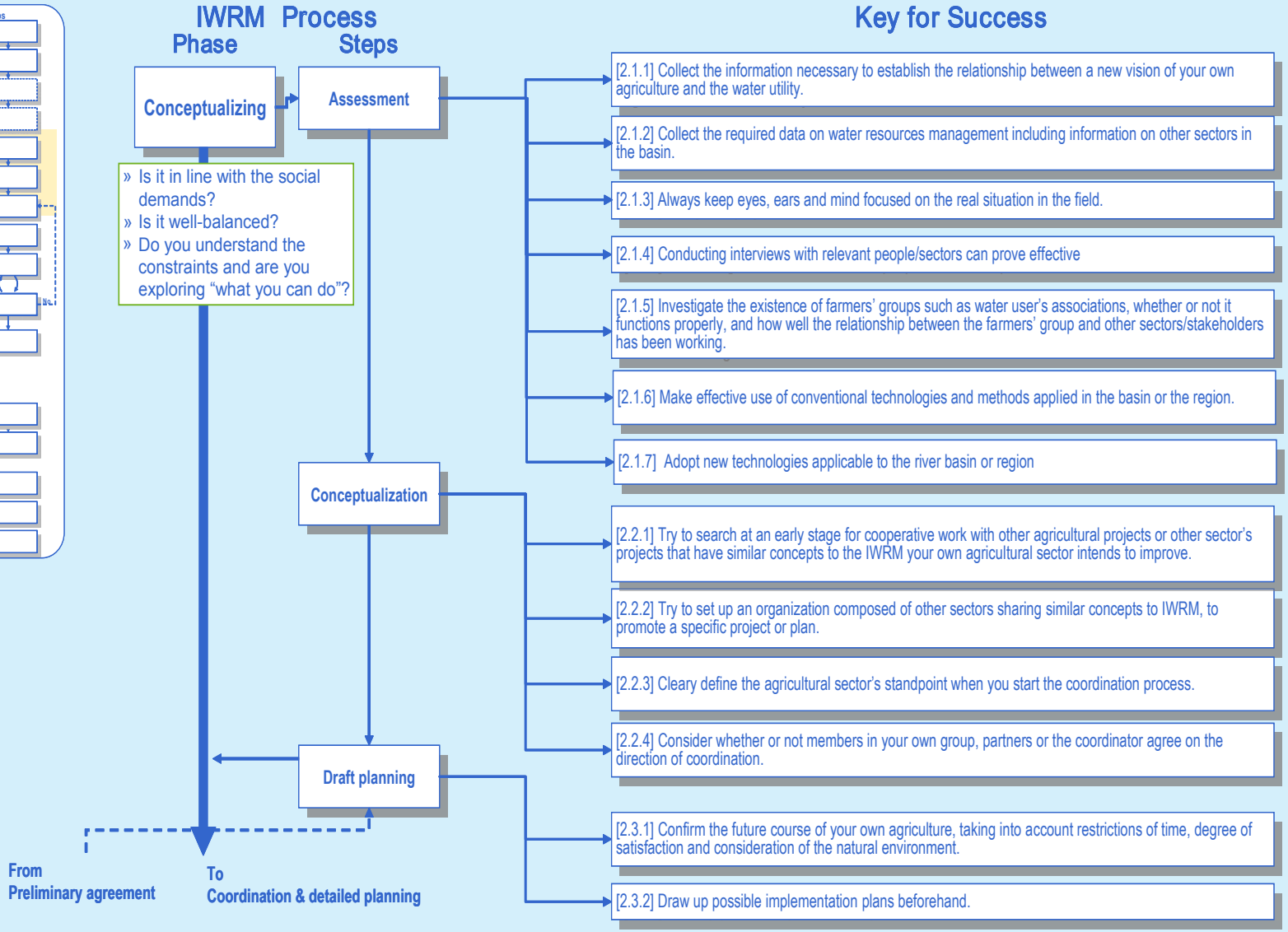
**Identification of problems and needs :** Identifying problems and needs by evaluating the existing water resources assessment results and exploring new problems or needs existing in the basin due to social changes.

**Public awareness, accountability and capacity building :** These are powerful agents for promoting IWRM and can be at times set as objectives. Thus these should be considered from the beginning of the IWRM process. However, it takes time and efforts. They need to be implemented in the later phases as well.

Figure 6. The IWRM process for irrigation practitioners: (1) Phase 1: recognizing and identifying

Figure 6 **The IWRM process for irrigation practitioners: (2) Phase 2: conceptualizing**




## Steps in Phase 2: Conceptualizing

**Assessment :** Grasp the overall structure of the problem such as 1) problems and needs, 2) natural conditions, and 3) human factors. Interactions with stakeholders have already began at this stage.

**Conceptualization :** Consider the course of action and the relevant stakeholders and their relationships for tackling the problem based on the assessment conducted above. Conceptualize possible solutions.

**Draft planning :** Prepare draft plans based on the concepts outlined above. It is most important that multiple alternative solutions are prepared. In cases where coordination in phase 3 does not reach an agreement you may have to come back to this phase again. Carefully drafting proposed plans will avoid such impediment.



Figure 6. The IWRM process for irrigation practitioners: (2) Phase 2: conceptualizing

Figure 6 **The IWRM process for irrigation practitioners: (3) Phase 3: coordinating and detail planning**

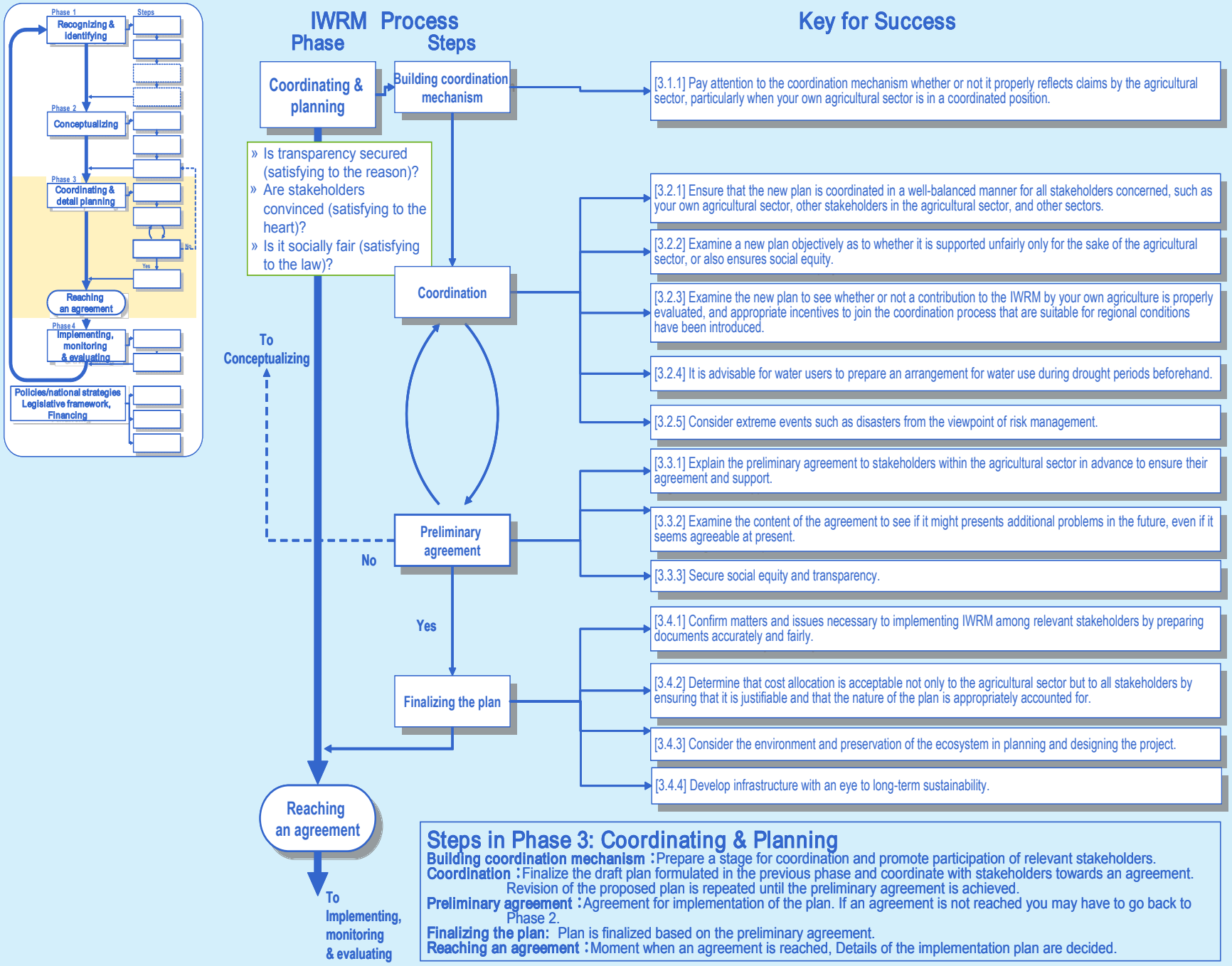
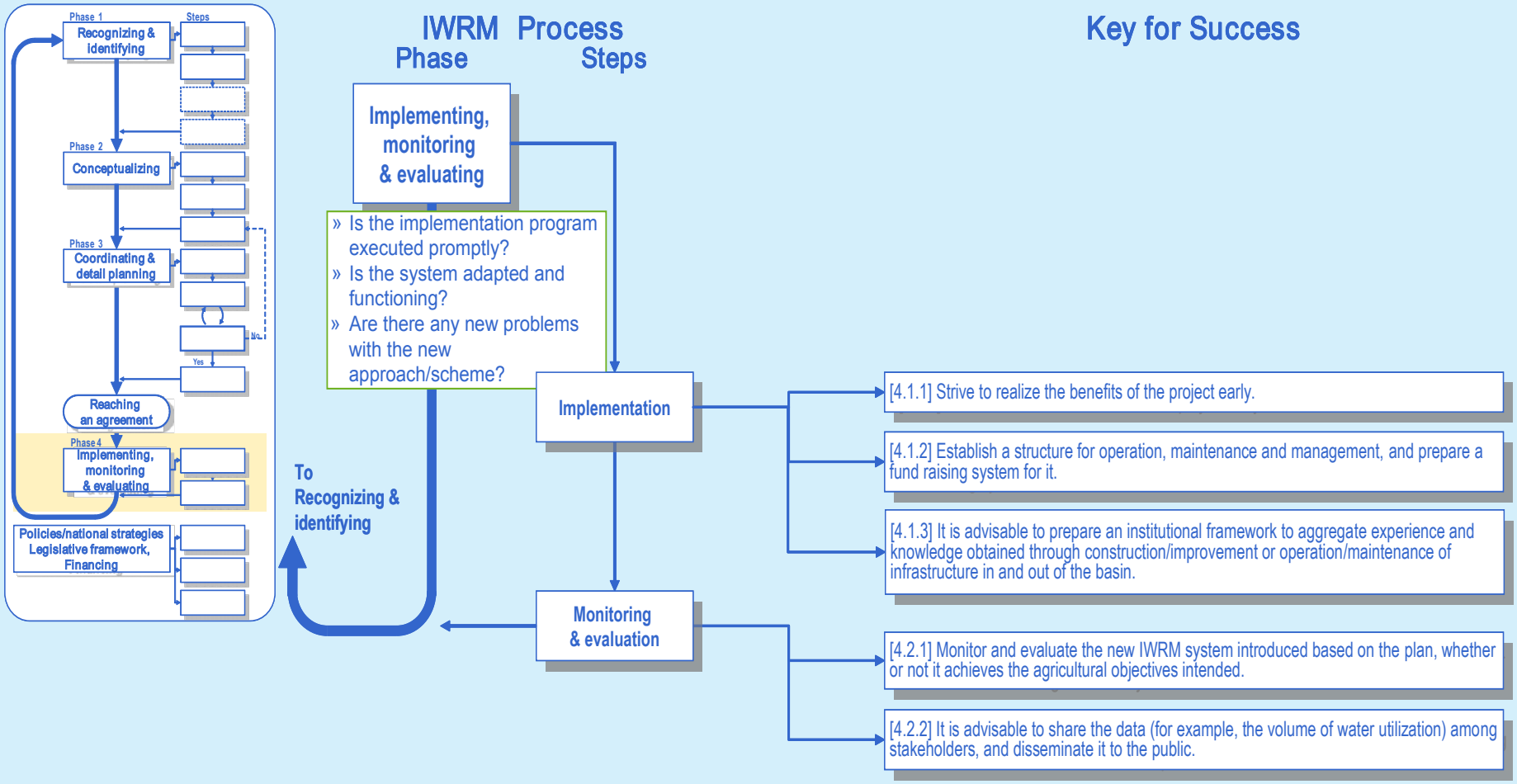



Figure 6. The IWRM Process for irrigation practitioners: (3) Phase 3: coordinating and detail planning

Figure 6 **The IWRM process for irrigation practitioners: (4) Phase 4: implementing, monitoring & evaluating**




## Steps in Phase 4: Implementing, Monitoring & Evaluating

**Implementation:** Execute the implementation program and develop a new IWRM approach/scheme. For details of implementation procedures for infrastructure development projects refer to existing manuals for study, design and construction, etc. For establishment of institutional frameworks and organizations refer to existing IWRM manuals.

**Monitoring & evaluation:** シMonitor and evaluate if the newly developed approach or scheme is functioning and watch out for any new problems.



Figure 6. The IWRM process for irrigation practitioners: (4) Phase 4: implementing, monitoring & evaluating

Figure 6 **The IWRM process for irrigation practitioners: (5) Important aspects of the IWRM process: policies/national strategies, legislative framework, financing**

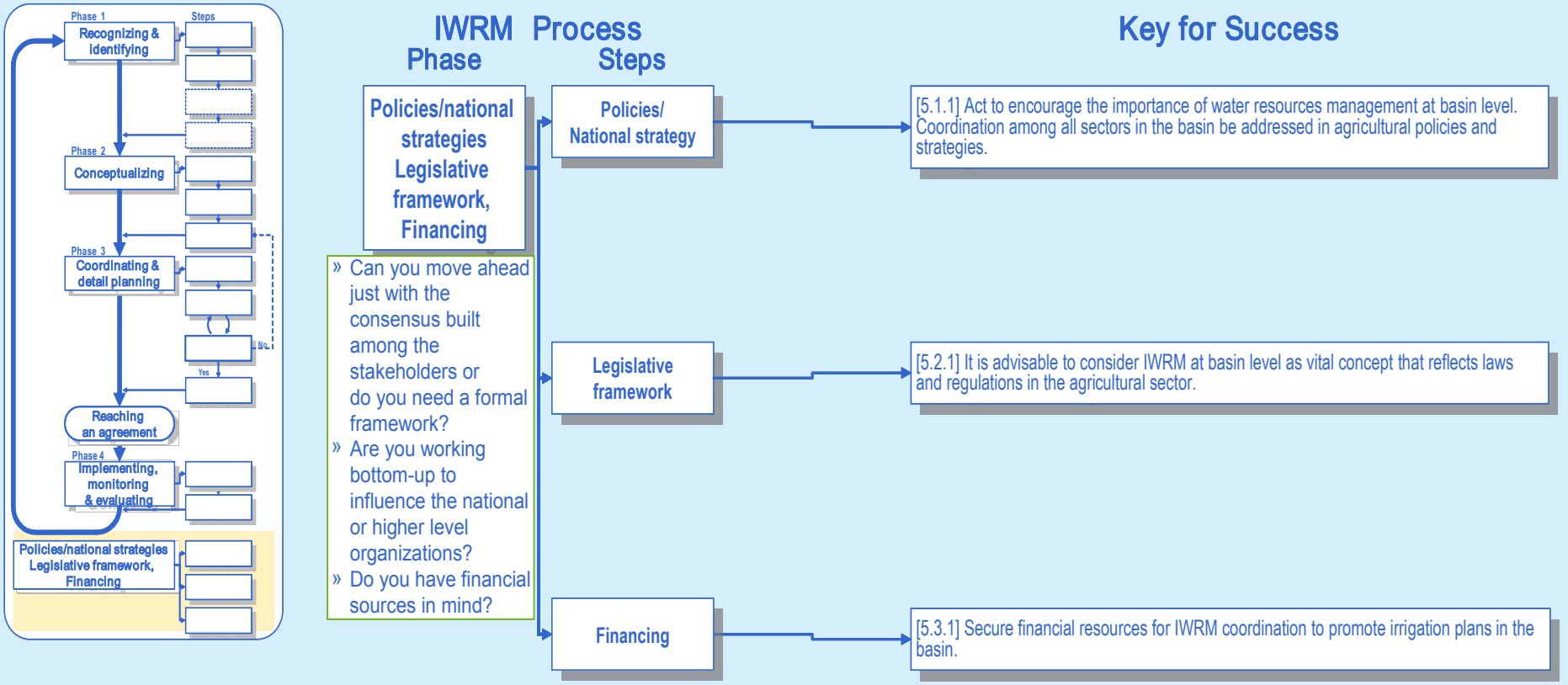



Figure 6. The IWRM Process for irrigation practitioners: (5) Important aspects of the IWRM process: policies/national strategies, legislative framework, financing

## Useful tools

The 'Useful Tools' section provides useful ideas/information for explaining or understanding complex issues that one might face during IWRM implementation. Good utilization of these tools will allow for the effective and efficient implementation of IWRM.

### Useful tools for IWRM coordination

The *Guidelines* provide a number of useful tools that can be used to assist IWRM coordination. Some of these are outlined below. For more details on these tools, please refer to the 'Part 2-1: Guidelines for IWRM Coordination'.

#### (1) Pentagram

The pentagram is a useful tool for comparing alternative plans (Figure 7). The five axes represent the indices to be compared and the evaluation results are plotted on the axis. The plotted points are then connected to create a pentagram. If there are six indices then it will become a hexagram.

You can set the number of indices as appropriate for your needs. The better balanced and larger the created diagram, the better the proposed plan. A pentagram can be created as follows:

1. Create a regular polygonal shape with n vertices.
2. Connect each of the vertices with the centre point of the polygon (hereafter as axes).
3. Label each axis with an evaluation index.
4. Plot on the axes the evaluation results for each index. The vertex point is the perfect score while the worst score is located in the centre of the polygon.
5. Connect the plotted points on the axes by straight lines and create a polygon with n vertices.
6. Complete the pentagram by colouring the inside of the polygon.
7. Create a pentagram for each of the plans.

Figure 7 **Pentagram**

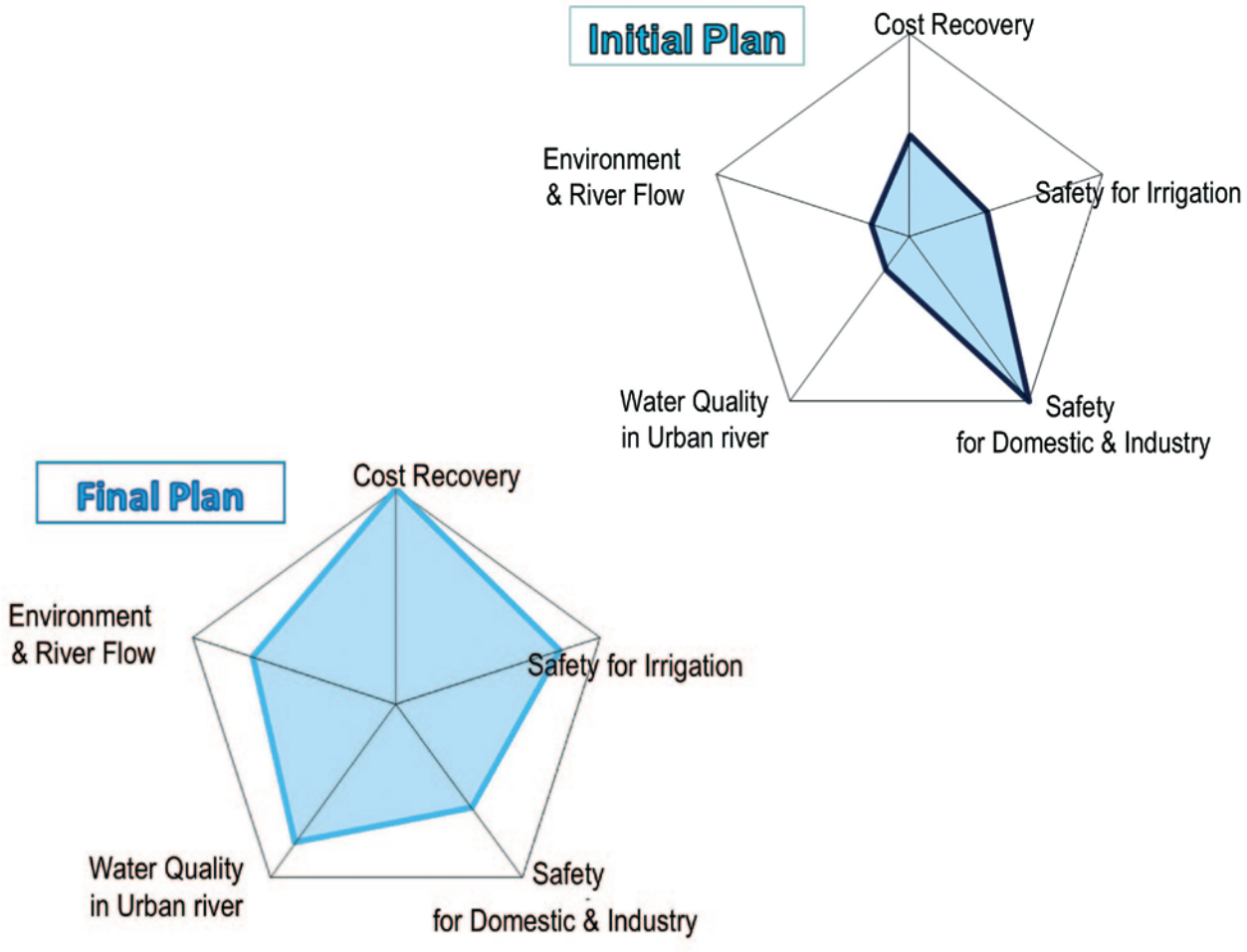


Figure 8 **Visualization of the state of water use**

### (2) Visualization

*1. Water-use status and 'high stress areas'*

When the water resources and the water-use status in the basin are to be assessed under Phase 1: 'Recognizing & identifying', visualization of the basin situation can be useful in determining high-stress areas or important locations to be addressed in the allocation and coordination of water resources.

**Figure 9** **Visualization of a high stress area**

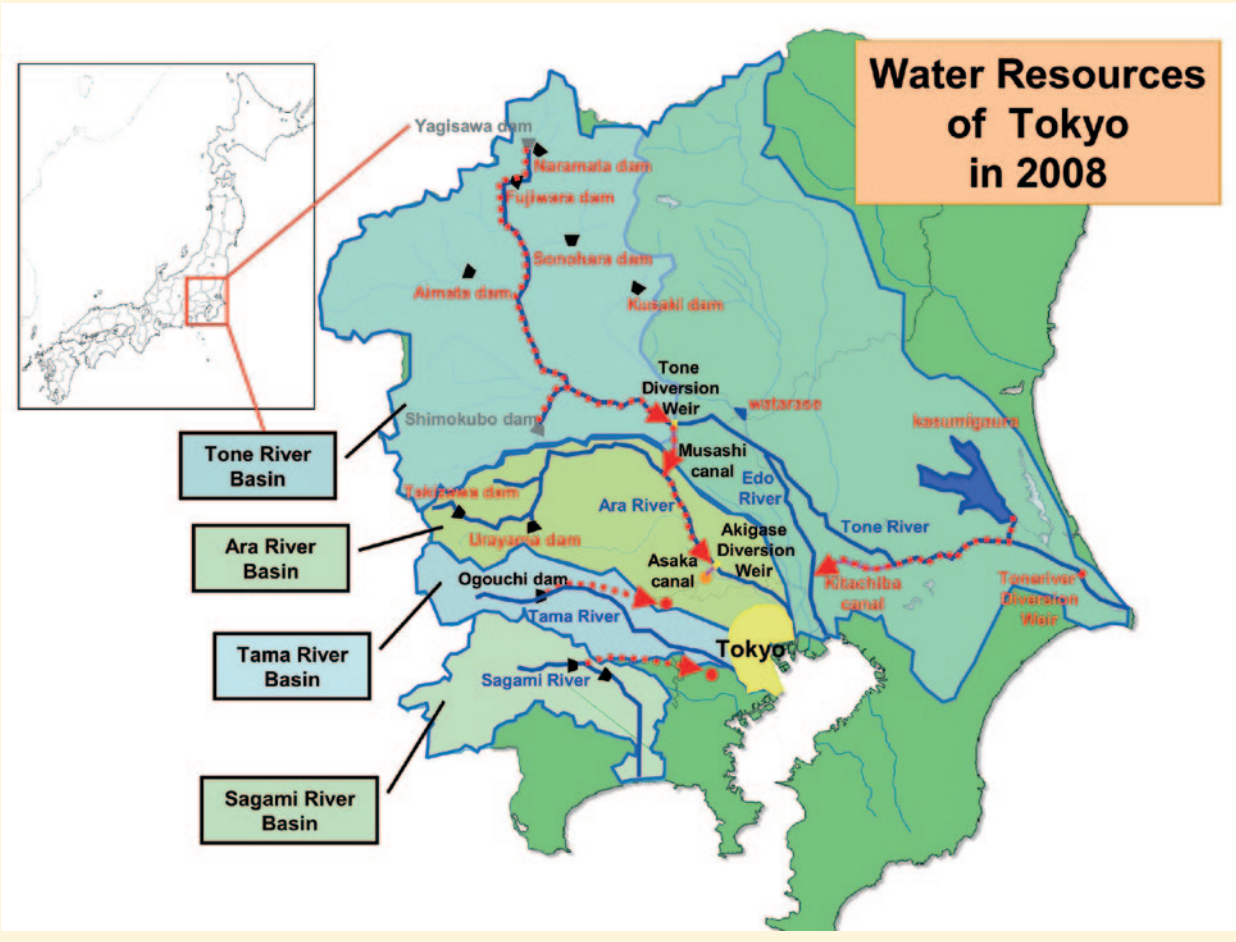
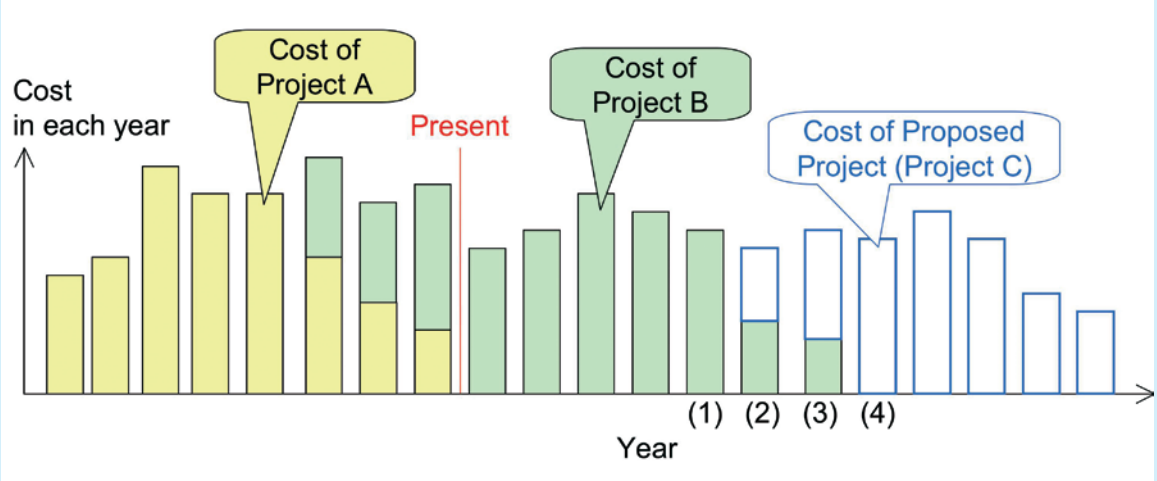


Figure 10 **Visualization of a sector's budget**



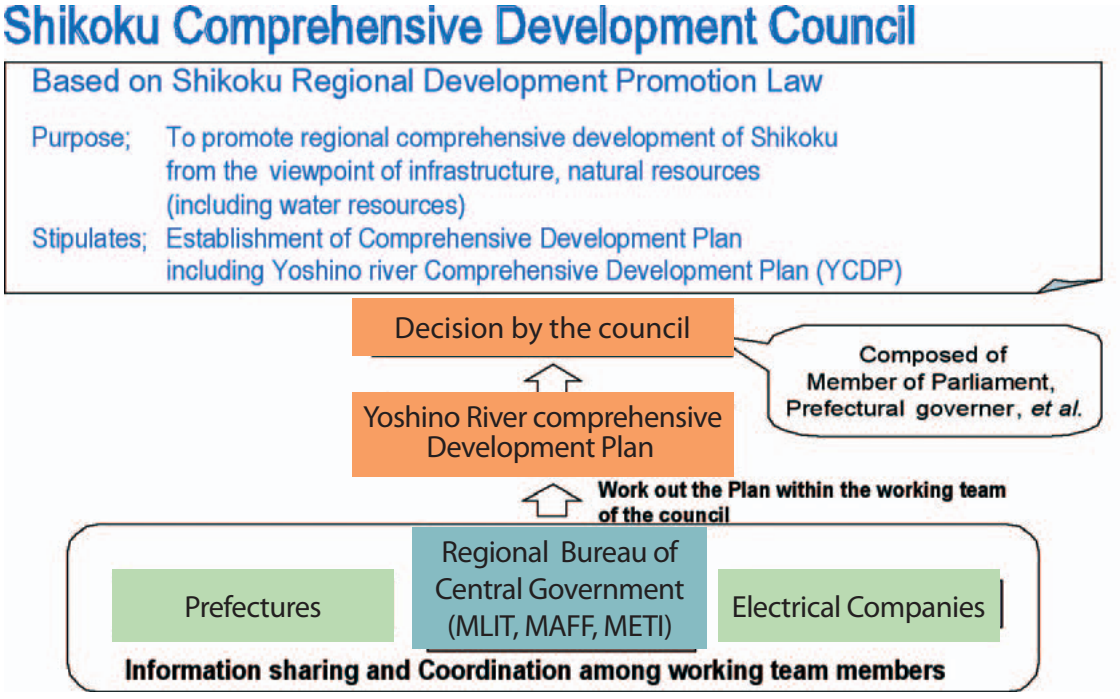

*2. Sectors' budget conditions (above)*

One of the important conditions for sectors to consider when participating in a project is their financial condition. If the managers in charge of coordinating an IWRM project are aware of the financial conditions of the sectors involved when preparing the project implementation plan, this can greatly facilitate the coordination process.

*3. Planning framework (below)*

In water resources development, a master plan is generally developed before individual projects are planned and implemented. It is useful to visualize such planning frameworks and flows in order to better understand the overall frame and structure of water resources development (Figure 11).

Figure 11 **Visualization of a planning framework**



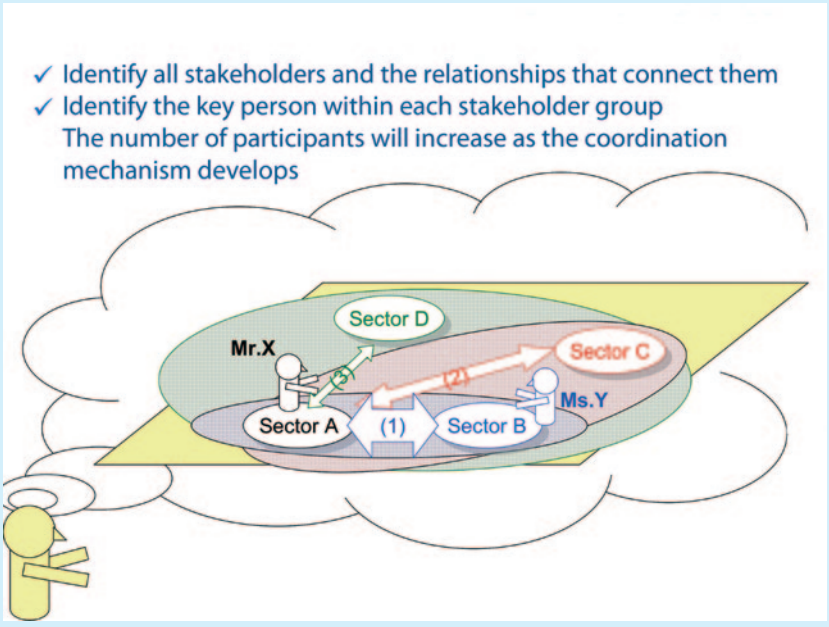
*(3) Cost allocation method*

When a multi-purpose infrastructure development is jointly implemented, the cost allocation among sectors must be agreed upon from the outset. Generally sectors are divided into groups that share the same purpose, and a cost is allocated to each. If a sector has multiple purposes that sector is included in each of the relevant purpose groups.

The remaining cost (non-separable cost) is allocated among the purpose groups in the following manner:

- Determine for each purpose group the cost of implementing the project individually (provisionally estimated cost) and the justifiable investment amount, and select the lesser of the two.
- Deduct the separable cost from the cost above for each purpose group.
- Allocate the remaining cost among purpose groups in proportion to the amount determined above.

Figure 12 **Grasping positioning of stakeholders and their mutual relationships**




*(4) Grasping the positioning of stakeholders and their mutual relationships*

Understanding the positioning and relationships of and among stakeholders is useful in laying out strategies for stakeholder involvement effectively and efficiently. Such efficiency is improved further if a key person is identified and involved (Figure 12).

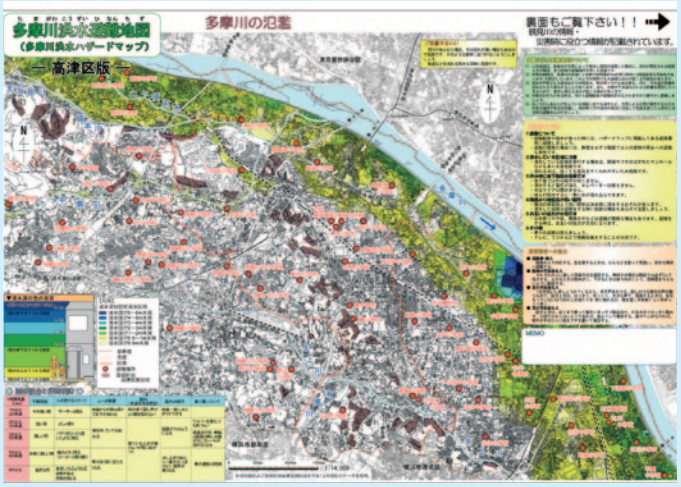
## Useful tools for flood management

*(1) Flood hazard map*

A flood hazard map provides information such as anticipated inundation areas, severity of the inundation, evacuation facilities, etc. It is aimed at promoting the quick and safe evacuation of residents and minimizing damages in the event of flooding.

Posting hazard maps in communities facilitates public awareness of floods among local residents. They provide information such as anticipated inundation depth and locations of evacuation shelters. It is also useful to indicate information understandable not only by local residents but also to travellers or foreign residents (Figure 13).

Figure 13 **Tama River flood hazard map for Takatsu Ward, Kawasaki**

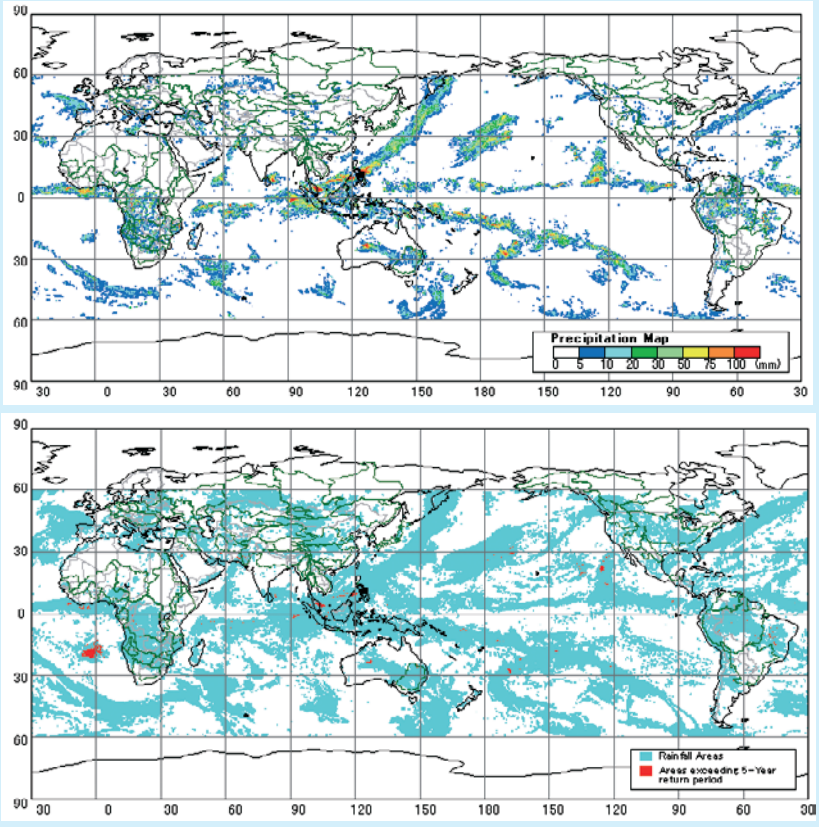



***Source:*** Kawasaki City web site

*(2) Distribution of flood alerts and flood forecast information via GFAS/IFAS*

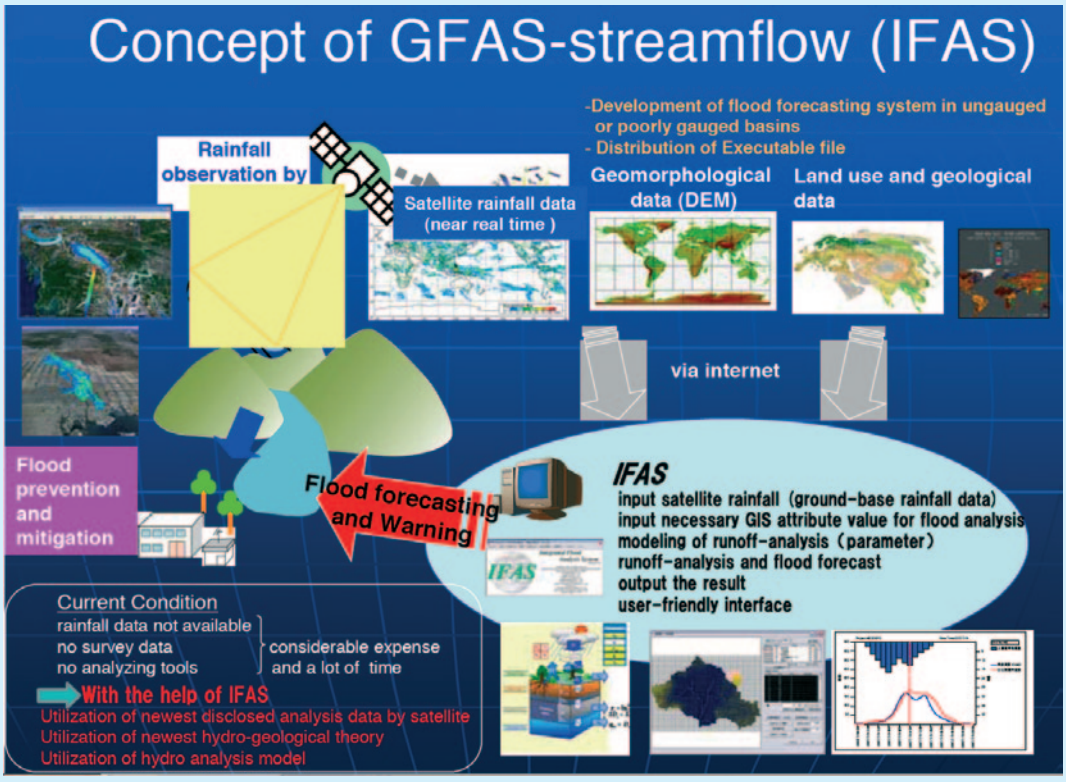
GFAS (Global Flood Alert System) is a system that automatically forecasts flooding worldwide by computing real-time basin rainfall for world rivers based on earth observation satellite data. This system assists the flood forecasting of developing countries that lack access to the telemeter rainfall observation network (Figure 14).

Figure 14 **World precipitation map and hazard areas**




***Source:*** Website of the Infrastructure Development Institute of Japan:
(top) www.internationalfloodnetwork.org
(bottom) http://gfas.internationalfloodnetwork.org/gfas-web

Figure 15 **Concept of GFAS-streamflow (IFAS)**




*(3) Integrated Flood Analysis System*

The Integrated Flood Analysis System (IFAS) implements interfaces to input ground-based and satellite-based rainfall data as well as GIS functions to create river channel networks, and estimates the parameters of a default runoff analysis engine and interfaces to display output results (Figure 15). [http://www.icharm.pwri.go.jp]

*(4) Training of disaster crisis management*

Practical training programmes in a role-playing style are effective for enhancing the management capacities of disaster managers while raising disaster awareness among floodplain residents (Figure 16). They enhance the abilities of managers to respond to disasters effectively and minimize the damage caused by such disasters (Figure 16).

Figure 16 **Practical training programme in Japan**

**Source:** Foundation of River & Basin Integrated Communications, Japan web site

**Source:** Hokkaido Regional Development Bureau's Ishikarigawa Development and Construction Department web site

Figure 17 **Joint flood-fighting drill in the Tone river basin**

**Source:** Edogawa River Office web site

*(5) Flood fighting drills*

Flood-fighting drills can be implemented involving local residents, private companies, local disaster managers, and NGOs. Some examples include drills on information dissemination, river inspection, and flood-fighting construction and technologies. Conducting such drills annually before flood seasons may be effective, in particular by specifying a 'flood prevention month/week', for example (Figure 17).

*(6) Workshops for preparing appropriate hazard maps*

By conducting workshops on how to prepare or utilize hazard maps targeting local floods, disaster managers can promote hazard map preparation in the basin. Such organizations as ICHARM (International Center for Water Hazard and Risk Management) organize such workshops for managers from developing countries (Figure 18).

*(7) Integrated flood management (IFM)*

Integrated flood management is a concept that aims to make a shift from conventional flood management of 'controlling' floods to trying to achieve sustainable development of the basin while maximizing the net benefit from flood plains by appropriately 'managing' floods.

The Associated Programme on Flood Management (APFM) promotes the concept of Integrated Flood Management (IFM). IFM integrates land and water resources development in a river basin, within the context of Integrated Water Resources Management (IWRM), with a view to maximizing the net benefit from floodplains and minimizing loss of life due to extreme hydrological events. [http://www.apfm.info/index.htm]

Figure 18 **Workshops on making hazard maps**

**Source:** Public Works Research Institute ICHARM web site

# World Water Assessment Programme side publications, 2009

**During the consultation process for the third edition of the World Water Development Report, a general consensus emerged as to the need to make the forthcoming report more concise, while highlighting major future challenges associated with water availability in terms of quantity and quality.**

**This series of side publications has been developed to ensure that all issues and debates that might not benefit from sufficient coverage within the report would find space for publication.**

**The 21 side publications released so far represent the first of what will become an ongoing series of scientific papers, insight reports and dialogue papers that will continue to provide more in-depth or focused information on water–related topics and issues.**

## Insights

Freshwater and International Law: The Interplay between Universal, Regional and Basin Perspectives — *by Laurence Boisson de Chazournes*

IWRM Implementation in Basins, Sub-Basins and Aquifers: State of the Art Review — *by Keith Kennedy, Slobodan Simonovic, Alberto Tejada-Guibert, Miguel de França Doria and José Luis Martin for UNESCO-IHP*

Institutional Capacity Development in Transboundary Water Management — *by Ruth Vollmer, Reza Ardakanian, Matt Hare, Jan Leentvaar, Charlotte van der Schaaf and Lars Wirkus for UNW-DPC*

Global Trends in Water-Related Disasters: An Insight for Policymakers — *by Yoganath Adikari and Junichi Yoshitani at the Public Works Research Institute, Tsukuba, Japan, for the International Center for Water Hazard and Risk Management (ICHARM), under the auspices of UNESCO.*

Inland Waterborne Transport: Connecting Countries — *by Sobhanlal Bonnerjee, Anne Cann,Harald Koethe, David Lammie, Geerinck Lieven, Jasna Muskatirovic, Benjamin Ndala, Gernot Pauli and Ian White for PIANC/ICIWaRM*

Building a 2nd Generation of New World Water Scenarios — *by Joseph Alcamo and Gilberto Gallopin*

Seeing Traditional Technologies in a New Light: Using Traditional Approaches for Water Management in Drylands — *by Harriet Bigas, Zafar Adeel and Brigitte Schuster (eds), for the United Nations University International Network on Water, Environment and Health (UNU-INWEH)*

## Dialogue Series

Introduction to the IWRM Guidelines at River Basin Level — *by Toshihiro Sonoda for UNESCO-IHP, and the Network of Asian River Basin Organizations (NARBO)*

Water Adaptation in National Adaptation Programmes for Action: Freshwater in Climate Adaptation Planning & Climate Adaptation in Freshwater Planning — *by Gunilla Björklund, Håkan Tropp, Joakim Harlin, Alastair Morrison and Andrew Hudson for UNDP*

Integrated Water Resources Management in Action — *by Jan Hassing, Niels Ipsen, Torkil-Jønch Clausen, Henrik Larsen and Palle Lindgaard-Jørgensen for DHI Water Policy and the UNEP-DHI Centre for Water and Environment*

Confronting the Challenges of Climate Variability & Change through an Integrated Strategy for the Sustainable Management of the La Plata River Basin — *by Enrique Bello, Jorge Rucks and Cletus Springer for the Department of Sustainable Development, Organization of American States*

Water and Climate Change: Citizen Mobilization, a Source of Solutions — *by Marie-Joëlle Fluet, Luc Vescovi, and Amadou Idrissa Bokoye for the International Secretariat for Water and Ouranos*

Updating the International Water Events Database — *by Lucia De Stefano, Lynette de Silva, Paris Edwards and Aaron T. Wolf, Program for Water Conflict Management and Transformation, Oregon State University, for UNESCO PCCP*

Water Security and Ecosystems: The Critical Connection — *by Thomas Chiramba and Tim Kasten for UNEP*

## Scientific Papers

Freshwater Biodiversity versus Anthropogenic Climate Change — *by Luc Vescovi, Dominique Berteaux, David Bird and Sylvie de Blois*

The Impact of Global Change on Erosion and Sediment Transport by Rivers: Current Progress and Future Challenges — *by Desmond E. Walling, Department of Geography, University of Exeter, for the International Sediment Initiative of IHP UNESCO*

Climate Changes, Water Security and Possible Remedies for the Middle East — *by Jon Martin Trondalen for UNESCO PCCP*

A Multi-Model Experiment to Assess and Cope with Climate Change Impacts on the Châteauguay Watershed in Southern Quebec — *by Luc Vescovi, Ouranos; Ralf Ludwig, Department of Geography, University of Munich; Jean-François Cyr, Richard Turcotte and Louis-Guillaume Fortin, Centre d'Expertise Hydrique du Québec; Diane Chaumont, Ouranos; Marco Braun and Wolfram Mauser, Department of Geography, University of Munich*

Water and Climate Change in Quebec — *by Luc Vescovi, Ouranos; Pierre Baril, Ministry of Transport, Québec; Claude Desjarlais; André Musy; and René Roy, Hydro-Québec. All authors are members of the Ouranos Consortium*

Investing in Information, Knowledge and Monitoring — *by Jim Winpenny for the WWAP Secretariat*

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International Hydrological Programme of UNESCO

**Contact details:**
Toshihiro Sonoda
Programme Specialist
UNESCO- Division of Water Sciences
Email: t.sonoda@unesco.org
Website: www.unesco.org/water

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