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NARBO

Network of Asian River Basin Organizations

# IWRM GUIDELINES at River Basin Level

## PART 2-2

## THE GUIDELINES FOR FLOOD MANAGEMENT

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# 1. Features and Structure of the Guidelines

## 1.1 FEATURES

'The Guidelines for Flood Management' is intended for IWRM practitioners of flood management. It is intended to be used 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, it can be used as a reference guide to tackle the various issues and problems they face in their IWRM activities.

## 1.2 STRUCTURE

The Guidelines consist of five parts: 1) Sectoral Perspectives, 2) Key for Success, 3) IWRM Process, 4) Good Examples and 5) Useful Tools. These elements are linked by reference indices, which allow you to move from one to another in the way most convenient to you.

### Chapter 2/Sectoral Perspectives for flood management in IWRM

This section illustrates the principles of actions and interests of water-related sectors in flood management and IWRM. Each sector values water and interacts with water differently. This section provides information on how individual water-related sectors tend to think and act, how these sectors typically relate to flood management and IWRM, and what they might want to convey to other sectors.

### Chapter 3/Key for Success to flood management in implementing the IWRM process

A 'Key for Success' is a key that can be used in practice to help make IWRM succeed. It is a key to enable breakthroughs in challenging situations, opening the door to better IWRM. Many of them have already demonstrated their worth in practice. Some are generic, i.e. they apply to every successful example of IWRM, others may apply only to specific situations, and some may not be in place as yet.

### Chapter 4/IWRM Process

'IWRM Process' describes a typical process for IWRM implementation. It also illustrates keys for success relevant to each phase or step of the process. These help you to orient yourself through the process and serve as a map for finding directions or the correct 'key' for enhancing water resources management.

### Chapter 5/Good Examples for flood management

This section 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 in enhancing IWRM. Furthermore, they are action-oriented guidelines. Good Examples included in these guidelines are collected through actions, by visiting sites and conducting interviews with local resource persons.

### Chapter 6/Useful Tools for flood management

'Useful Tools' provide useful ideas or materials that can be used to explain or understand complex issues encountered during IWRM implementation. Good utilization of these tools will enable effective and efficient implementation of IWRM.

### IMPORTANT NOTE

You do not have to read the entire document. This set of Guidelines is designed to enable you to skip to specific sections depending on your needs.



# 2. Sectoral Perspectives in IWRM

## 2.1 PERSPECTIVES OF OTHER SECTORS

Flood management projects impact various sectors. They can often have the following 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 delay in implementation.

### 2.1.1 Impacts by water-use sectors (domestic, agricultural and industrial water supply and hydropower sectors)

- In withdrawing water from rivers, water-use sectors want their water-intake facilities and locations to enable efficient water diversion.
  - → Water intake structures may block flood-water flow; fewer and smaller structures are desired.

- When developing multi-purpose water storage facilities such as dams, water-use sectors want to secure as much capacity as possible for water utilization.
  - → Due to the limitations of dam capacity, this may interfere with flood-control capacity and efficient flood control operations.

- During flood events, the agricultural sector tries to drain stormwater from their agricultural land as quickly as possible in order to avoid prolonged flooding of crops and the resulting negative impacts to agricultural production.
  - → The timing and quantity of drainage needs to be controlled taking into account river water levels.

- When a structure that crosses a river channel (such as a distribution line for domestic, industrial or agricultural water) is being planned or designed by a water-use sector, they would normally try to find a location, direction or structural design for their structure (bridge, siphon or tunnel) that can distribute water in the most economical way.
  - → In order to prevent such structures from blocking flood flow or negatively impacting flood control facilities such as levees, the water-use sector plan, regarding the location/direction of the structure, needs to be changed accounting for levels of impacts such as flood-flow interference or on flood control facilities, etc. It should also account for river improvement/construction plans for levees, facilities, water courses, etc.

### 2.1.2. Impacts by drainage and sewerage sectors

- Drainage and sewerage sectors expect their drainage facilities and locations to enable fast and efficient stormwater drainage into rivers via urban or sewer drainage systems in order to prevent inland flooding.
  - → In areas where drainage facilities for inland flood control are extensively developed, but the river channel does not have adequate flood control measures implemented, drainage activities or the construction of further drainage facilities could cause the flood discharge capacity of the river to be exceeded. Prohibiting or restricting drainage operations/activities during flood events should be discussed with flood managers. It is neces-

sary to set drainage locations in a manner that minimizes flood risk to the basin by accounting for areas that need to be protected or are vulnerable to flood risks.

### 2.1.3. Impacts by the environmental sector

- The environmental sector is concerned about the environmental impacts of constructing or improving flood control infrastructure.
  - → There could be total opposition from the environmental sector, as well as requests for revising plans, further implementation of environmental impact reduction measures, or detailed investigations and reassessments based on the findings of investigations, etc. These could lead to delays in the realization of benefits from flood control measures.

- The environmental sector considers it desirable that habitats for fauna and flora be maintained in their natural condition. They consider that native vegetation species including trees in river channels should be conserved.
  - → Tree growth in river channels can interfere with flood discharge, or negatively impact flood control facilities such as levees and gates.

### 2.1.4. Impacts by municipalities and developers

- Local municipalities may consider developing housing and industries in the basin with public conveniences and industry as their priorities.
  - → Such developments will increase flood risks and could interfere with river improvement projects.

- They may seek to make effective use of available land by promoting the development of natural and unused land.
  - →This will reduce the infiltration and water retention capacities of the basin areas, resulting in higher basin runoff and higher risk of flooding.

- Local municipalities and developers may wish to utilize and develop land in the basin to optimize the use of land resources.
  - → Increased usage of waterfront areas will increase flood risks. It also may interfere with river channel improvement. Development in the basin reduces stormwater permeability and the storage capacities of the basin. Flood runoff increases and heighten flood risks in the area.

- Local municipalities and developers may wish to utilize the waterfront area of rivers and lakes and promote the use of facilities situated in such areas for recreational purposes, such as sports facilities, parks, promenades, etc. They may wish to promote greater uses of the river and water recreational spaces.
  - → More use of waterfront areas of rivers and lakes during flood events increase flood risks in the area. Locating facilities along the waterfront will also increase flood risks.

### 2.1.5. Relevance with society as a whole

- Society recognizes the threats of floods and the importance of flood risk management when hit by a major flood disaster, but as time passes that awareness fades. This is particularly prominent in areas where people do not suffer directly from floods.
  - → Flood managers are concerned by this and want society to remain alert to potential flood risks as these can occur at any time.

### 2.1.6. Impacts by other sectors

- Fisheries are dependent on the existing environment of rivers. The fishery sector will oppose destruction of fish habitats for flood management. They will also wish to be able to make use of their vessels and construct infrastructure, such as ports, in locations efficient for their business.
  - → Flood control measures that cause significant river and basin alteration may be restricted from the standpoint of fisheries conservation. Fisheries infrastructure may interfere with flood flow or flood control facility construction. Furthermore, decreasing normal flow will also interfere with their navigation.



- When a structure that crosses a river channel (such as roads, railways and lifeline infrastructure) is being planned or designed by other sectors, they would normally try to find a location, direction or structural design for their structure that is the most efficient and economical.
  - → In order to prevent such structures from blocking flood flow or negatively impacting flood control facilities such as levees, coordination is necessary with other sectors regarding the location/direction of the structure and levels of impacts such as flood-flow interference or impacts on flood control facilities, etc. It should also account for river improvement/construction plans for levees, facilities, water courses, etc.

- Navigation sectors or those who transport goods and people using boats may try to construct docks or mooring facilities in a convenient location and try to moor on water for efficient transport. They may also dredge channels in order to ensure adequate navigable space and the preferred route for navigation.
  - → Such activities may interfere with flood flow. The facility locations and their size have to be accounted for and there must be coordination with their representative in order to prevent such impacts. Dredging may increase the discharge capacity of the channel but over-dredging or dredging close to structures could cause river flow to scour river facilities and cause negative impacts.

- People living in poverty may be living or cultivating on the flood plain of a river.
  - → This increases flood risks. Coordination with other policy measures need to be considered in order to prevent a proliferation of new settlements into areas of flood risk and to facilitate the smooth relocation of existing inhabitants.

## 2.2 RELATIONSHIP WITH OVERALL COORDINATION

Flood managers generally coordinate with the relevant stakeholders, together with the managers responsible for overall IWRM coordination. The principle of IWRM coordination requires maximum participation of stakeholders – a process that can take a long time. Close collaboration and a good understanding by IWRM coordinators of the need for flood management are necessary to ensure that adequate priority is given to flood management within the overall water resources management objectives, and that the benefits of flood control measures can be achieved in a timely manner.

Effective collaboration with IWRM coordinators can lead to smooth coordination with other sectors. Flood management can also contribute to other water-use sectors and lead to cost effective multi-sector collaboration. Thus, it is important that flood managers and IWRM coordinators work in close collaboration.

# 3. Key for Success to Flood Management in Implementing the IWRM Process

A 'Key for Success to flood management' is a key that can be used in practice to help make IWRM succeed. They are keys to establishing breakthroughs in challenging situations, or to opening the door for better IWRM. They provide tips and clues for making progress in the IWRM process. (see Fig. 3.1).

Many of the keys for success have been proven in practice and are linked to Good Examples in Chapter 5. Some are generic, in other words, apply to every successful example of IWRM; others may apply only to specific situations, and some may not be in place as yet. You do not have to apply them all. Work with them to see how they can assist you to move ahead with IWRM implementation in your basin.

Each 'Key for Success' 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.

You will also find links to **Useful Tools** and **Good Examples** for easy reference.

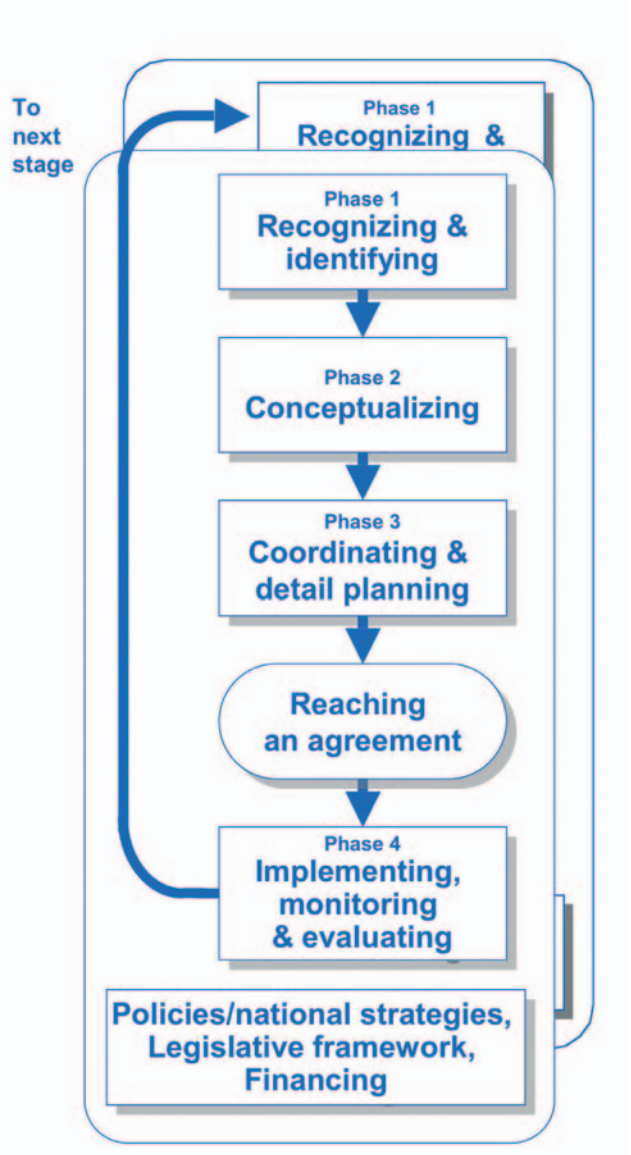



**Fig. 3.1** IWRM Process



## 3.1 PHASE 1: RECOGNIZING AND IDENTIFYING

The important part of this phase is to 'recognize' the need for IWRM and to grasp the overall picture of existing issues in the basin. Things to note in this phase are:

- Do you understand the needs and problems? Are you in need of IWRM?
- Are you aware of past evaluation results and the current situation?
- Are you thinking into the future?

Recognizing the need for IWRM through identification of needs and problems in the basin becomes the catalyst for improving water resources management in the basin. It is important to proactively 'recognize' the needs, and your understanding of the situation can be measured by how well you can make others understand. You can identify existing basin-wide issues by exploring the needs for improving existing approaches or schemes based on existing or past evaluation results, and by being alert to newly-arisen problems and needs as a result of socio-economic and environmental changes.

### 3.1.1 Recognition and identification of problems and needs

#### 1.1.1 Risk assessment

Identify and prioritize the areas at risk of flooding and the extent of that risk in the basin.

- Implementing shortsighted local measures without evaluating the risks for the entire basin may result in vulnerable areas or areas in most need being overlooked.

- To improve the safety level while ensuring overall balance across the basin, mitigate or reduce risks in highly vulnerable areas. For this, it is necessary to identify areas at risk of flooding and the extent of that risk for the entire basin.
- To implement this as quickly as possible, first collect/organize the following information. It is important to identify and prioritize the information necessary for evaluation or decision making.
  - Gather information regarding locations and inundation areas of past flood events from newspaper articles, publications, and interviews with elders, etc.
  - Establish which information is significant: be aware of the sites, observe the basin and listen to people's opinions.
  - Verify the objectivity of the gathered information.
- According to the level of information gathered, attention should be paid to the following points:
  - Areas exposed to highest risks should be identified based on objective information such as geographic, hydraulic or hydrological data of the river and basin, if such data can be obtained. In such cases, the data used along with risk assessment results should be made available to the public to ensure transparency.
  - Risk assessment based on occurrence probability and expected loss can lead to efficient and effective measures.
- It is important to disseminate and share the collected information and assessment results with stakeholders and residents of the basin.

#### Good Examples

- Indonesia: flood risk assessment in the Brantas River Basin >> See 5.3(1)
- Costa Rica: Vulnerability analysis and risk assessment for seismic and flood hazard in Turialba City >> See 5.5.4(1)
- Japan: Identification of flood risk areas in the Kitakami River Basin >> See 5.5.5(1)

### 3.1.2 Public awareness, accountability and capacity building

#### 1.2.1 Capacity building

Conduct regular training, and make use of local experience and technologies.

- River administrators and flood managers must understand the danger of flooding and take appropriate measures in order to prepare. Lack of an appropriate response will lead to an increase in flood damage.

- Under the slogan 'strengthening the disaster reduction capacity of the basin', define the roles of the relevant parties such as river/flood administrators, persons in charge of disaster reduction, and flood prevention groups. Conduct regular training and drills to ensure all can adequately serve in their respective roles. Moreover, establish a capacity-development framework, as listed below, to transmit flood management knowledge and encourage managers familiar with the basin and rivers.
  - o Inherit traditional techniques from elders in the community.
  - o Educate trainers who can organize workshops in their own community.
  - o Utilize the training courses offered by technology cooperation agencies.

**Good Examples**

- Japan: Joint Flood-Fighting Drill – Regular training with various stakeholders in the basin >> See 5.5.5(2)

**Useful Tools**

- Flood fighting drills >> See 6.4
- Workshops for preparing appropriate hazard maps >> See 6.5

#### 1.2.2 Technology development

Develop technology that fully reflects local conditions.

- Adapting technology from other basins or countries without adequate consideration of the local situation will not lead to effective technological development nor effective application of the technology.

- In order to tackle the local situation, it is necessary to undertake technological development/application, building upon regional experience.
- In areas where funding for flood measures is insufficient, it is particularly important to develop technologies utilizing affordable and locally-accessible materials.
  - o Research traditional local techniques.
  - o Establish/revise technological standards, etc.
  - o Develop technologies for efficient collection/distribution of various information.
  - o Develop the human resources needed for technological development/application.

**Good Examples**

- Japan: Control floods using traditional local techniques >> See 5.5.5(3)
- Laos: Riverbank protection using low-cost local materials such as stone and fascine >> See 5.5.6(1)



## 3.2 PHASE 2: CONCEPTUALIZING

The point of this phase is to understand the overall structure of the problem and to conceptualize future actions. Things to note in this phase are:

- Is it in line with social demands?
- Is it well balanced?
- Do you understand the constraints and are you exploring 'what you can do'?

By viewing the structure of the problem from a broader perspective, you will be able to find clues or a place to start to find a solution. Furthermore, you will have to consider the course of action and the relevant stakeholders and their relationships in order to tackle the problem. You can conceptualize possible solutions by laying out various alternatives that meet the basin-wide balance as well as the balance between supply and demand and the balance among stakeholders. then narrow down the list on the basis of the given constraints. You may have to disregard certain aspects of your ideal plan in order to make implementation a reality.

### 3.2.1 Assessment and conceptualization

#### 2.1.1 Stakeholder participation

Understand in advance the roles and responsibilities of stakeholders in the basin.

- Involvement of stakeholders without clearly defined responsibilities or positioning in the basin may result in a failure to achieve consensus.

- Choosing a flood management strategy is an important factor for the well being of both human lives and assets in the region. Achieving the goals set in the strategy is time-consuming, and infrastructure development requires extensive financial resources. It is therefore necessary to create opportunities to enable any stakeholder in the basin to participate. However, establishing a participatory framework without understanding the roles and responsibilities of the stakeholders will lead to misguided policies and failure to achieving consensus–building. Therefore, it is important to clarify the roles and responsibilities in advance. The following points should be taken into account when making a decision on who to involve, at what stage, and how to involve them in relation to the basin issues.
  - Target: Who are affected by floods? What is the magnitude of the impact? Direct/indirect, level of local interaction, public/personal stance, etc.
  - Phases: planning, implementation, monitoring and revision phases of the flood management plan, etc.
  - Methods: public briefing, public hearing, establishing committees, public comments, etc.

**Good Examples**

- Bangladesh: Compulsory public consultation for any flood management plan >> See 5.5.2(1)
- Japan: Stakeholder participation in the Tsurumi River Basin >> See 5.2(3)
- Philippines: Pasig River Rehabilitation Commission >> See 5.1(1)

### 2.1.2 Coordination

Ensure effective coordination and cooperation of interests among stakeholders.

- Smooth implementation of a project is difficult to achieve without clearly defining the responsibilities of stakeholders, coordinating their interests and reaching consensus.

- A characteristics of flood management is that it 'involves numerous beneficiaries and responsible parties interacting with each other in a complicated and diverse manner under various settings, such as upper and lower reaches, left and right banks, or distance from the river.' Thus, it is necessary to establish a common understanding of the history, culture, and features of the basin in order to effectively coordinate flood management efforts. To this end, it is important to first clarify the interests of stakeholders by asking such questions as 'who are impacted by floods and how?', 'who will benefit from flood management measures and how?', and 'who will be responsible for the costs associated with flood management?' The answers to these should be accounted for in facilitating coordination and cooperation among stakeholders.
- Realizing the above-mentioned coordination efforts involves extensive assessments and reviews. First, it is advisable to identify organizations or individuals with the following qualities and involve them, so that the process can be facilitated in the way most appropriate for the local situation:
  - Individuals, such as the local elders, or organizations with a good knowledge of the basin and its characteristics; who are familiar with past flood disasters and their causes, and possess the ability to foresee future flood damage potential.
  - Individuals such as local leaders, or organizations with a good knowledge of who local stakeholders are, and how to get them involved.
  - Individuals or organizations with 'a neutral stance, entrusted by stakeholders involved in past basin activities with specialized knowledge on flood management. Credibility from a wide range of stakeholders is necessary in order to build consensus in the basin and not be influenced by specific stakeholder(s).
- Setting up a specialized body responsible for flood management will facilitate smooth coordination with the related agencies.

**Good Examples**

- Japan: Decision-making mechanism centered on the Tsurumi River Basin Council and the Hiji River Basin Committee >> See 5.2(3) and 5.5.5(4)
- Indonesia: Brantas river basin development project >> See 5.3(2)
- Kenya: Establish an organization specialized in flood management administration >> See 5.4(1)

## 3.2.2 Draft planning

### 2.2.1 Planning

Develop a plan for balanced flood management in the entire basin.

- Planning based on one-sided and locally-focused perspectives could lead to adverse effects, wasteful investment, or re-planning.

- As subsequent specific measures will be based on initial planning, the planning stage is extremely important. The balance of flood management in the basin as a whole should be considered during the planning stage. The basin should be the basic unit in planning.
- If a flood management plan has not been developed as yet and a new plan needs be developed, pay attention to the following points:
  - It is necessary to establish a good understanding of the existing plans of other sectors (land use, city planning, etc.) and ensure mutual consistency.



  - Flood mitigation measures in one area could possibly induce flooding in another area. The plan should ideally be agreed upon by other sectors by taking into account the balance between the upper and lower river, and the impacts on the environment and river/water uses.
  - Prepare both long and short-term plans. This will permit the creation of a long-term vision while addressing pressing issues. The long-term plan illustrates the future vision of the basin, while the short-term plan identifies priorities among specific measures.
  - Infrastructure development can take an extremely long period of time before completion. It is necessary to develop a plan in collaboration with other sectors, with a wide range of options, such as retarding ponds, infiltration trenches, and land-use measures/regulations in the basin.
- When coordinating a plan and building consensus, pay attention to the following in order to ensure a socially equitable plan and transparency during the planning process:
  - In order to account for future changes, such as shifts in social situation or public needs, or changes in external conditions due to impacts such as climate change, prepare a framework that allows the plan to be changed or revised in a flexible manner.
  - It is difficult to grasp the overall picture and arrive at the best answer straight away. It is necessary to prepare various options from the draft-planning phase and negotiate and coordinate with and among stakeholders, while taking into account the balance within the basin.
  - Depending on the situation, coordination sometimes requires the suppression of self-interested claims by certain stakeholders. In such cases, negotiate by demonstrating the kinds of negative impacts that could be triggered by their actions.

#### Good Examples

- Japan: Comprehensive flood control measures to cope with rapid urbanization in Tsurumi River Basin >> See 5.2(1)
- Kenya: Integrated flood management plan in Nyando river basin >> See 5.4(1)

## 3.3 PHASE 3: COORDINATION AND DETAIL PLANNING

This phase finalizes the concepts formulated in Phase 2 into a detailed plan and coordinates with stakeholders toward reaching an agreement.

- Is transparency secured (satisfying to the reason)?
- Are stakeholders convinced (satisfying to the heart)?
- Is it socially fair (satisfying to the law)?

Coordination for reaching agreement on a draft plan means revising the plan based on the opinions of relevant stakeholders. A transparent process and public awareness are prerequisites for ensuring effective stakeholder participation. They also ensure the social fairness of the process. Striving to improve the situation of all stakeholders will facilitate reaching an agreement.

### 3.3.1 Building coordination mechanisms and coordination

**2.1.1 Stakeholder participation**

Understand in advance the roles and responsibilities of stakeholders in the basin.

>> See Key for Success [2.1.1]

### 2.1.2 Coordination

Ensure effective coordination and cooperation of interests among stakeholders.

>> See Key for Success [2.1.2]

### 2.2.1 Planning

Develop a plan for balanced flood management in the entire basin.

>> See Key for Success [2.2.1]

## 3.3.2 Preliminary agreement and finalizing the plan

### 3.2.1 Maximized benefit

Implement measures that maximize the benefits of the basin as a whole.

- Infrastructure development necessitates significant investment both in terms of cost and time. Moreover, the infrastructure will be utilized over a long period. Attempts should be made to maximize the basin-wide benefits of such infrastructure development and minimize the negative impacts.

- In areas where sufficient data can be obtained, effective infrastructure allocation and distribution for maximizing benefits should be examined, taking into account current and future development, natural/social environment and historical changes. After careful consideration and selection of the optimal option, undertake the following arrangements or schemes during implementation to allow early realization of the benefits. Careful consideration for appropriate maintenance and environmental conservation are also important.
  - Focus investment on high-risk areas while aiming for early completion of projects and the reduction of total costs.
  - Develop projects in collaboration with other users/donors, utilizing basin-wide coordinating organizations or mechanisms. Consider the flood-related infrastructure development in the basin in a comprehensive manner and try to improve its efficiency.
  - View existing infrastructure as a basin asset, and consider improving the operational efficiency of the existing infrastructure in the basin as a whole. This can include the integrated operation of multiple facilities, reallocation of reservoir capacities, capacity expansion, life-extension of infrastructure by adequate asset management (regular/effective maintenance), etc.
- Sufficient data and objective assessment methodologies are necessary for the evaluation of benefits and impacts. In case such data or methodology are not available, utilizing the support of international agencies or donors can be an option.

### Good Examples

- Japan: Multi-purpose retarding basin >> See 5.2(2)
- Japan: Multi-purpose dam in the Kitakami River Basin – Flood control and other purposes (e.g. water utilization, power generation) >> See 5.5.5(5)



### 3.2.2 Regulation of activities

Prevent actions/activities that cause negative consequences with regards to flood management in coordination with basin stakeholders.

- If development activities in the basin are independently conducted with no consideration for their impact on flood risks, the flood safety level may not improve at the rate that flood managers anticipate.

- In order not to increase flood risks in the basin it is important to undertake the following approaches in coordination/collaboration with the relevant parties in the basin:
  - Request flood managers to conduct risk impact assessments as well as environmental impact assessments.
  - Prevent actions that could disturb river flow and increase the risk of flooding (constructing structures in rivers, sediment embankments, construction of bridges in the bottle-neck section of a river, etc.)
  - Prevent or control large-scale land development that increases runoff (large-scale deforestation, development of natural area, large-scale reclamation, etc.)
  - Regulate land use in the floodplains to prevent increase in flood risks due to development activities.
  - Reduce the number of residential houses at risk from floods and promote flood-resistant housing.
  - Install facilities to reduce runoff (rainwater storage/infiltration facilities).
  - Improve the awareness of residents on how to avoid risks through flood insurance, etc.

#### Good Examples

- Japan: Enforce installation of runoff control facility >> See 5.2(4)
- Bangladesh: Legislation controlling developments in flood plains and wetlands, and the new concept of flood control >> See 5.5.2(2)

### 3.2.3 Raising awareness

Take steps to ensure residents understand the existing risks in the river/basin.

- Lack of prior understanding of flood risks among basin residents could cause intensified damage.

- Reduce and minimize flood damage by improving local awareness. Provide information on risks and evacuation.
- It is important to gradually facilitate residents' understanding according to the level of existing knowledge on flood disasters.
  - Research local stories on historical floods and traditional measures against flooding.
  - Understand the roles of levees, dams, natural basin storage, etc.
  - Incorporate knowledge on flood management into the school education curriculum.
  - Facilitate understanding of the roles of national government, municipalities, local communities and individuals (self-help/mutual-help/public assistance).
  - Understand the roles of citizen groups and volunteers.

#### Good Examples

- Philippines: Information Campaign and Publicity >> See 5.1(3)

#### Useful Tools

- Flood hazard map >> See 6.1

### 3.2.4 Information sharing

Inform residents of risks as soon as possible at the time of flooding.

- Alerting residents at immediate risk is the first priority in order to minimize casualties and reduce flood damage.

- At the time of flood occurrence, promptly communicate and alert residents, and execute an evacuation at an appropriate time in an appropriate manner in order to minimize causalities and reduce flood damage. In regions where a communication framework is not yet established, proactively promote the development of an observation system, while ensuring that individuals know what levels of rain or river water could cause danger and require an evacuation. Useful information can be obtained from past floods or traditional wisdom passed down from community elders.
  - It is advisable to establish a reliable communication system and secure several options of communication (alarm bells, whistles, oral communication, blasting sounds, siren, TV, radio, etc).
  - Regular communication and evacuation drills should be undertaken.

#### Good Examples

- Philippines: Development flood forecasting and warning systems for river basins >> See 5.1(4)
- Argentina: Share information with public >> See 5.5.1(1)
- Thailand: Installation of Early Warning System and staffing a person responsible for evacuation guidance >> See 5.5.7(1)

#### Useful Tools

- Distribution of flood alert information via GFAS >> See 6.2

### 3.2.5 Crisis management

Prepare a framework/system that can execute crisis management in a basin.

- If flood protection measures are insufficient and unexpected events occur, the lack of a quick and effective flood emergency response could result in serious flood damage.

- In order to minimize casualities among residents and damage to assets in the basin, it is necessary to establish a crisis management system. Effective crisis management requires that procedures for emergency response are pre-set for decision makers and related agencies and that adequate training takes place.
- If crisis management systems or institutional capacities are insufficient, damages can be minimized through strengthening the disaster response capacities focusing on self/public help of the local community:
  - Set up meetings with elders in the community to hand down local traditional techniques.
  - Establish crisis management systems taking into account the characteristics of each community.
  - Establish communication methods (alarm bells, whistles, oral communication, blasting sound, siren, TV, radio, etc).
  - Conduct regular disaster communication training/drills.
  - Secure evacuation facilities and evacuation routes.
- Technological development is also required to standardize crisis management and communication techniques or to establish common platforms to facilitate information dissemination. A global cooperation network to deal with such technological development is required.

#### Good Examples

- Bangladesh: Construction of multi-purpose cyclone shelters >> See 5.5.2(3)

#### Useful Tools

- Training of disaster crisis management >> See 6.3



## 3.4 PHASE 4: IMPLEMENTING, MONITORING AND EVALUATING

This aim of this phase is to implement, develop, manage and operate the agreed scheme or framework (including infrastructure development or establishment of legislation or institutional framework). Things to note in this phase are:

- Is the implementation programme executed promptly?
- Is the system adapted and functioning?
- Are there any new problems with the new approach/scheme?

Prompt execution of the implementation programme and early realization of its impacts and effectiveness is important for the IWRM process. However, things do not always turn out as planned. There are times when the established approach or scheme does not function in the way expected. Thus, monitoring is an important aspect of an IWRM process. Furthermore, it is necessary to retain a broad view and be alert for new problems caused by social changes, etc.

It is also important to evaluate the impacts of issues not addressed in the current plan and see if such issues need further attention in the future. This leads to the 'recognizing and identifying' phase in the next stage of the IWRM spiral.

### 3.4.1 Implementation, monitoring and evaluation

**3.2.1 Maximized benefit**

Implement measures that maximize the benefits of the basin as a whole.

>> See Key for Success [3.2.1]

**3.2.2 Regulation of activities**

Prevent actions/activities that cause negative consequences with regards to flood management in coordination with basin stakeholders.

>> See Key for Success [3.2.2]

**3.2.3 Raising awareness**

Take steps to ensure residents understand the existing risks in the river/basin.

>> See Key for Success [3.2.3]

**3.2.4 Information sharing**

Inform residents of risks as soon as possible at the time of flooding.

>> See Key for Success [3.2.4]

**3.2.5 Crisis management**

Prepare a framework/system that can execute crisis management in a basin.

>> See Key for Success [3.2.5]

## 3.5 IMPORTANT ASPECTS OF THE IWRM PROCESS: POLICIES/NATIONAL STRATEGIES, LEGISLATIVE FRAMEWORKS AND FINANCING

Policies/national strategies, legislative frameworks and financing are important throughout the entire IWRM process. Things to note in this phase are:

- Can you move ahead with just the consensus built among stakeholders or do you need a formal framework?
- Are you working bottom-up to influence national or higher level organizations?
- Do you have financial sources in mind?

Policies/national strategies and legislative framework are established at the national level except in the case of special regional or local laws and regulations. These have significant impacts on water resources management. However, it takes enormous time and effort to establish a new framework or amend existing ones. It is important to always consider whether these are really necessary in order to proceed with the IWRM process. If it can be achieved through consensus among stakeholders instead of laying out a national level framework a lot of time will be saved.

Furthermore, financing is an important aspect of the IWRM process. You must be aware of the budgeting schedule and undertake the necessary actions. If you are expecting financial assistance from donors you must also be aware of their approval and procedural schedules.

### 3.5.1 Policies/national strategy, legislative framework and financing

#### 5.1.1 National strategy

Position flood management within the national strategy.

- Decision makers, the media and the public show great concern about floods and natural disasters immediately following a flood disaster. However, such awareness gradually fades. Flood-related political measures are often postponed or not implemented because their impacts are not obvious in the short-term, thus lowering their priority on the political agenda.

- To prevent public disaster awareness from diminishing and ensure adequate priority is given to flood management, it is first necessary to position flood management within a national development plan and make it a part of the national strategy.
- It is advisable to include in the strategy short, medium and long-term goals, achievements expected in each phase, and required financial resources, so that the strategy can be further reviewed and strengthened.

**Good Examples**

- Japan: Provision of a framework for comprehensive river improvement >> See 5.5.5(6)
- Uganda: Formulation of the national disaster risk reduction and management policy >> See 5.5.8(1)

#### 5.1.2 Legislation

Specify in legislation that flood management is the responsibility of national government, municipalities and residents, and clarify their respective roles.

- Floods have the potential to inflict damage on anyone residing in the river basin. Everyone must be involved in flood mitigation in one way or another in the form of self-help, mutual-help or public support. However, individuals or organizations acting independently in an uncoordinated manner will result in delays in decision-making, duplication of measures and amplification of negative impacts to others.



- Uncoordinated actions by individuals or organizations can be problematic not only at the time of disaster but also during the preventative stage – a critical aspect of flood management. Therefore, it is necessary to specify in legislation that flood management is the responsibility of national government, municipalities and residents, and clarify their respective roles. In addition, clarifying the financial responsibilities of the national government and municipalities is favourable to ensuring effectiveness.
- Floods broadly affect the basin and its stakeholders, therefore it is advisable to clarify the roles of the relevant sectors with regard to flood management.
  - o Clarify the roles of flood management-related agencies in the basin, especially with regard to the coordination and implementation of their responsibilities, including residents.
  - o Define stakeholder (related agencies) participation in the basin during the planning, implementation and review phases.
  - o Conduct environmental impact assessments to minimize negative impacts on the environment when flood control infrastructures are developed.

**Good Examples**

- Japan: Enactment of a new law for urban flood damage mitigation measures, enforcing basin-based measures and sectional coordination >> See 5.2(4)

### 5.1.3 Financing

Continue stable investment for flood management with a long-term perspective.

- Impacts realized by short-term investment for flood management are often limited, while the desired effects may not be easy to bring about.

- It is necessary to establish a financing framework which allows for stable and continuous investment in flood management with a long-term perspective, regardless of social and economic changes. The feasibility of realizing such a framework can be enhanced through the following schemes:
  - o Ensure that stable and continuous investment is agreed at the national level, and achieve national consensus.
  - o Clarify benefits and costs, and monitor the effectiveness of the investment.
  - o Coordinate with other water users, such as water supply or irrigation sectors, and explore cost-reduction strategies by making projects multi-purpose.

**Good Examples**

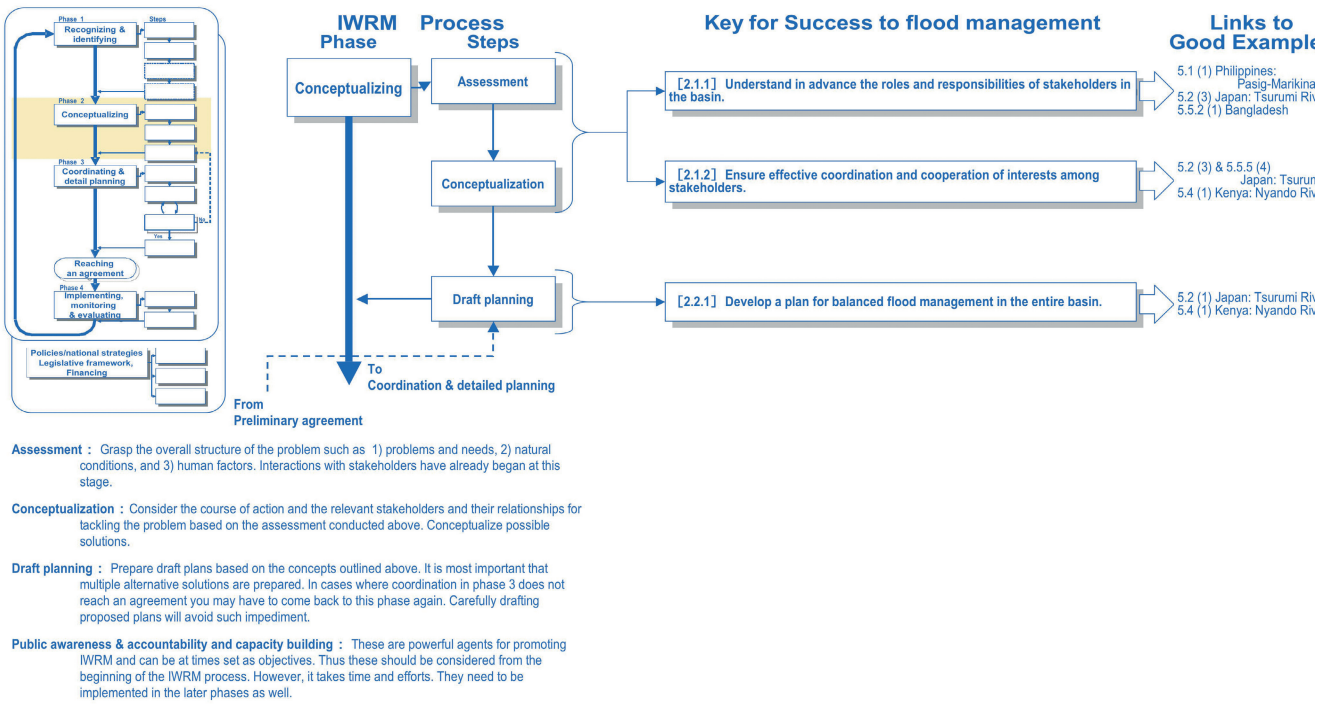
- Japan: 'Soil Conservation and Flood Control Urgent Measures Act' and 'Flood Control Special Account Act' – realized the establishment of long-term plans on flood control as well as secured financial resources under the laws >> See 5.5.5(7)
- China: New fundraising system to mobilize funds from multiple sources >> See 5.5.2(1)

# 4. IWRM Process

## 4.1 PHASES, STEPS AND KEYS FOR SUCCESS IN THE IWRM PROCESS

In Part 2, an IWRM process at a given stage is described 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.

The IWRM process and its respective steps are each linked to a relevant 'Key for Success' and 'Good Examples' included in chapters 3 and 5 of these Guidelines.




**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.

**Fig. 4.1.1** IWRM process and the headings of the 'Key for Success' and 'Good Examples'

### 4.1.1 Phase 1: Recognizing and identifying

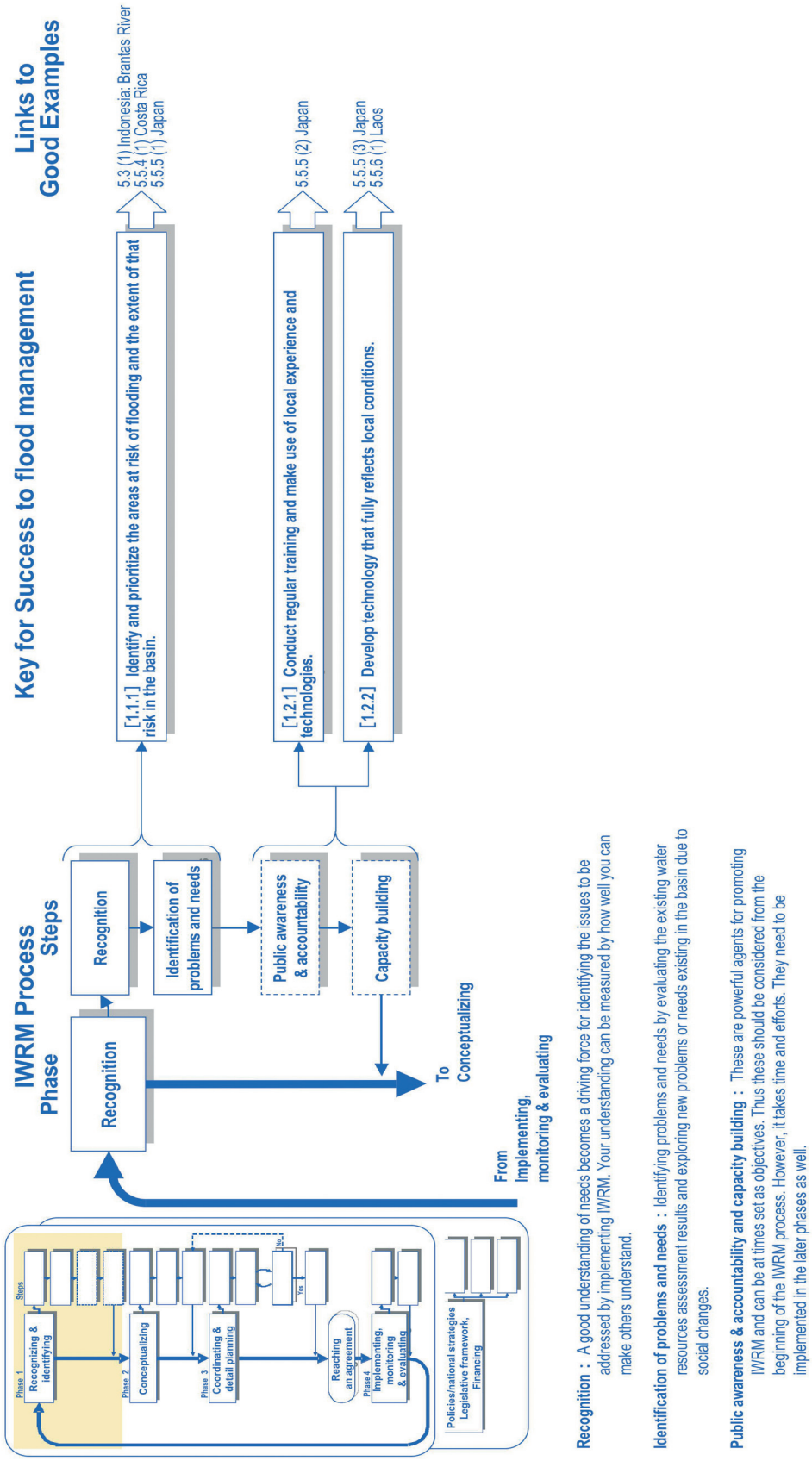



**Fig. 4.1.2** Phase 1: Recognizing and identifying

## 4.1.2 Phase 2: Conceptualizing

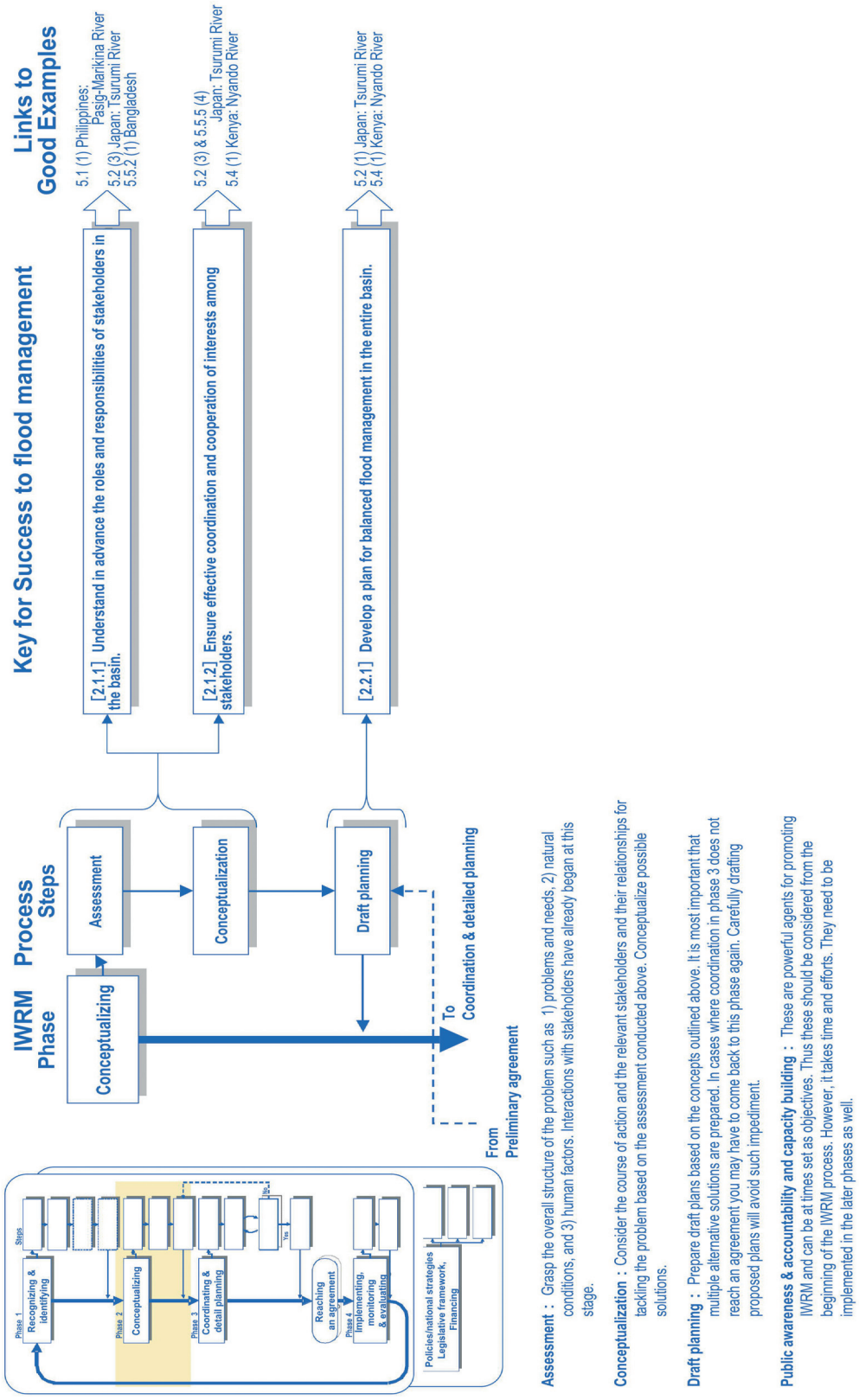



**Fig. 4.1.3** Phase 2: Conceptualizing

### 4.1.3 Phase 3: Coordination and detail planning

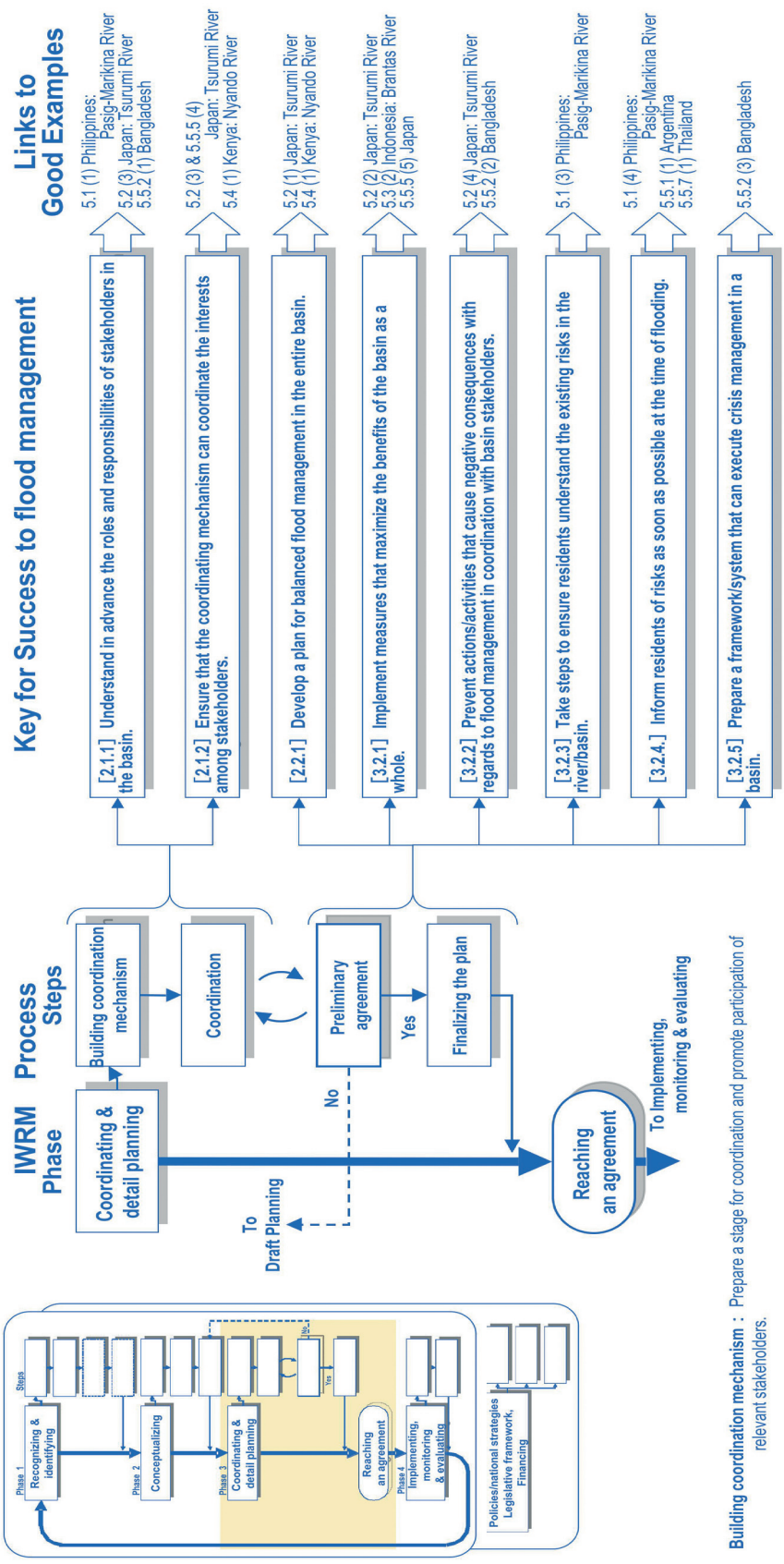



**Fig. 4.1.4** Phase 3: Coordination and detail planning

## 4.1.4 Phase 4: Implementing, monitoring and evaluating

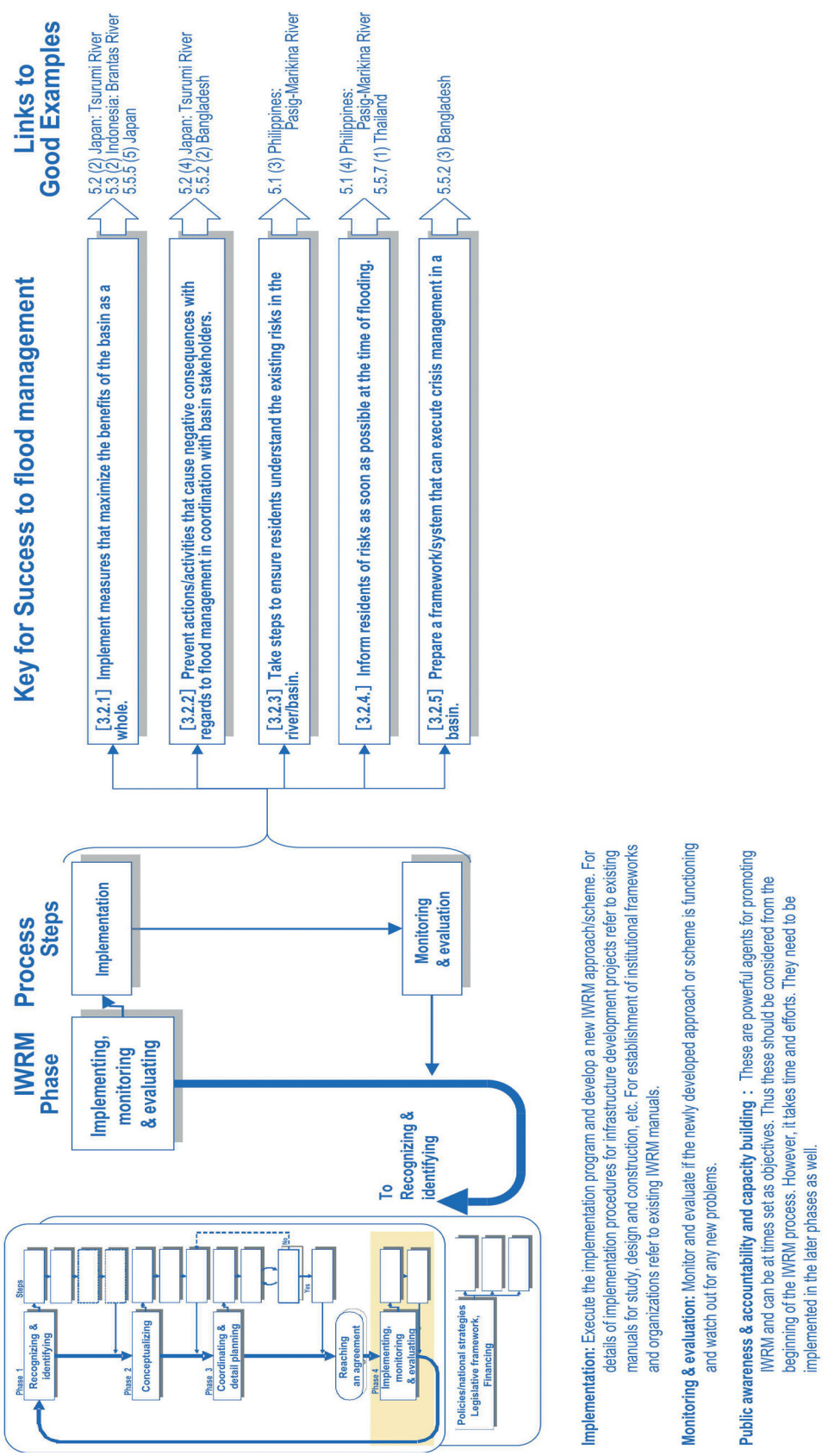



**Fig. 4.1.5** Phase 4: Implementing, monitoring and evaluating

### 4.1.5 Important aspects of IWRM process: Policies/national strategies, legislative framework, financing

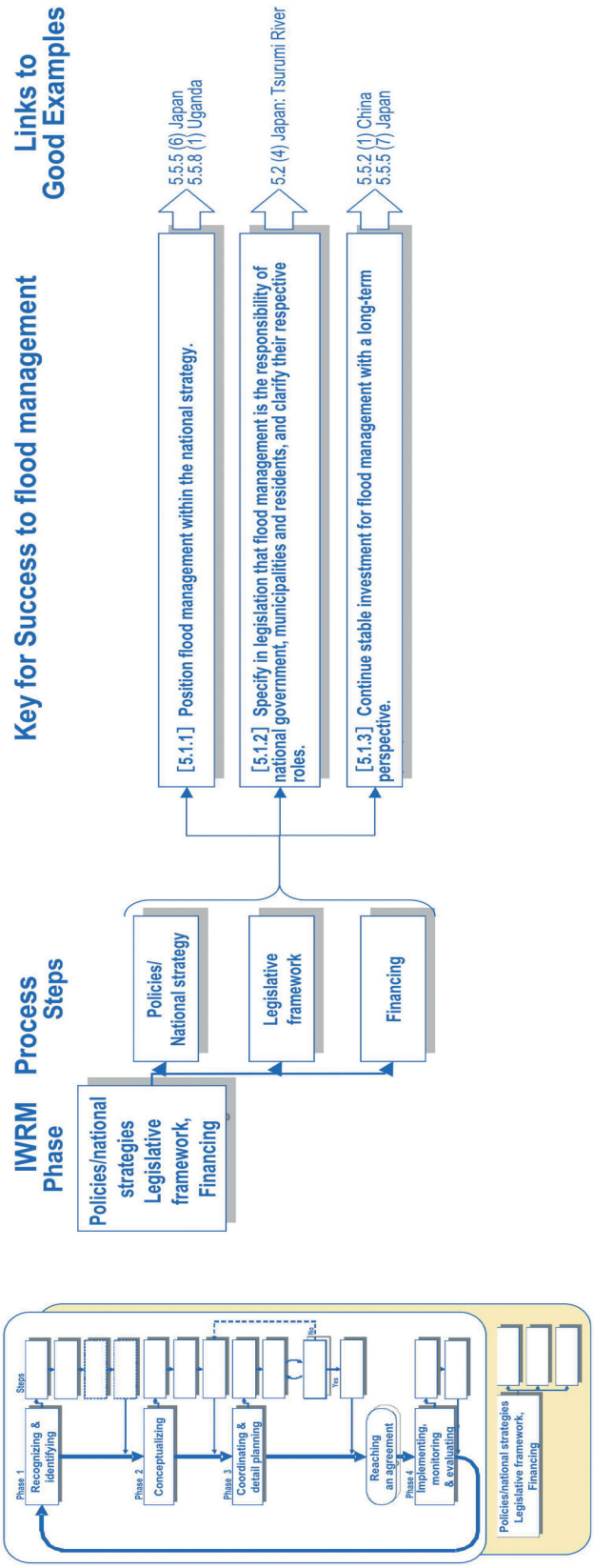



**Fig. 4.1.6** Important aspects of IWRM process: Policies/national strategies, legislative framework, financing

## 4.2 THE 'IWRM SPIRAL' CONCEPTUAL MODEL

### 4.2.1 The IWRM spiral

This guideline provides a conceptual model of the 'IWRM spiral, which explains the IWRM process, in certain river basins, moving towards a more sustainable approach.

The model provides the following advantages.

- It helps users to understand both their current situation and where to head next in the IWRM process by integrating a timeframe.
- It enables users to seek better solutions that adapt to changes.
- It facilitates reaching agreements and increasing ownership at each 'turn of the spiral.'
- It provides a framework for looking ahead and planning for the next 'turn of the 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 your position is 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.

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.

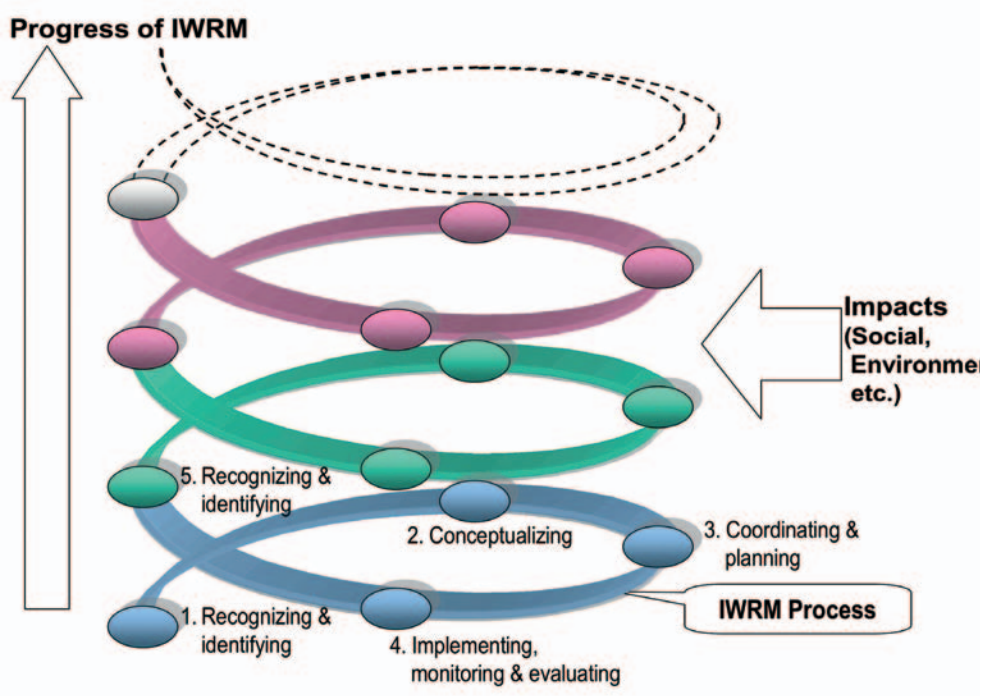



**Fig. 4.2.1** Spiral evolution of IWRM



### 4.2.2 Stages of the IWRM spiral

The IWRM spiral begins by recognizing the necessity for IWRM. First, you need to grasp an overall picture of the basin. Start with the information already in your possession. This will help you understand the issues and problems existing in the basin, leading to recognition/identification of the need for introducing an IWRM approach. You will then assess the current circumstances and conceptualize possible solutions. Prepare a plan and finalize it through coordination with relevant stakeholders, then implement the plan to create a new IWRM scheme or approach in the basin. This is the first stage of the spiral.

The stages to follow begin with recognizing either the necessity for improving the current IWRM approach/framework or for a new IWRM system. Recognition of needs may be triggered by intensification of problems left over from the previous stage, such as rapid increase in demands, or by increasing concern over new issues, such as climate change.

### 4.2.3 Recognizing the stage shift

The stage changes when you recognize the need for change. Moving up the spiral is a time-consuming process, and requires reaching agreements with stakeholders and building consensus. It is important that water resources managers recognize changes or needs, and take early action while ensuring public understanding and support.

Significant changes in the basin, such as economic development, changes in social values and demands, and unexpected crisis situations can become the opportunity to realize the need for improving or revising water resources management. Such changes can become the driving force for better water resources management, and should be considered as a chance to improve IWRM in your basin.

### 4.2.4 Where do you stand in the spiral?

Where do you stand in this spiral? Where is your basin situated in the spiral? What phase are you in? Are you in the phase for 'recognizing' changes or 'conceptualizing'? How many stages have you already been through in the IWRM spiral? Take a moment and think about it. It is useful to approximately situate yourself in the spiral when reading these Guidelines in order to find the information you need.

If you cannot find a solution appropriate for you, change your position in the spiral. Looking at different phases or steps in the IWRM process by flipping back and forth through the Guidelines may help you. Thinking about your positioning allows you to check if you have missed any steps in the past, as well as helping you to visualize actions that may be necessary in the future.

# 5. Good Examples for Flood Management

This section includes good examples of flood management with reference to IWRM at the river basin level, in the form of Case Stories illustrating actual IWRM efforts, and 'Extracted Key for Success' highlighting elements of success for enhancing IWRM, based on interviews conducted at sites.

### 1) Case Story (explaining the process pathway):

A Case Story lays out the facts in a sequential manner and illustrates the pathway towards the 'Key for Success' (KFS). The Case Story includes links to the 'Extracted Key for Success' so that one can understand how the Key

| Facts | Ref. to KFS |
|---|---|
| **5. Developing a legal framework for basin measures**<br>To address the issue of urban rivers including Tsurumi, a new law for urban flood damage mitigation measures was enacted in 2004 enforcing basin-based measures and sectoral coordination among river and sewerage administrators and related local governments in urban river basins.<br>The key features of this law are as follows:<br>• Jointly develop a plan for reducing flood disasters in the basin by river and sewage administrators, related prefectural governors, and municipal governments. | KFS-<br>5.2 (4) |

**Fig. 5.1** Format and Example of Case Story

### 2) Extracted Key for Success:

The Extracted Key for Success illustrates why the 'Key for Success' was implemented and what the thought process behind it was. In order to ensure the relevance of keys for success to users, 'the Key' is explained in a generalized manner together with conditions and limitations for its application. It also includes references to 'Useful Tools' that may enhance its effectiveness.

| | |
|---|---|
| **[ Title ]**<br>Legislation and regulation of activities | ← Type of a problem to solve |
| **[ Situation ]**<br>- Moreover, as over twenty years have passed since the development of the Basin Improvement Plan, differences have arisen from land use compared to the original plan…. | ← Description of the situation |
| **[ Problem ]**<br>- Urban cities have been frequently hit by heavy rains in recent years and flood damage to underground spaces has become an emerging issue. There was a need for a new approach to flood disaster reduction…. | ← Problems encountered |
| **[ How the problem was overcome ]**<br>- To address the issue in urban rivers including Tsurumi, a new law for urban flood damage mitigation measures was enacted in 2004 enforcing basin-based measures and sectoral coordination among river and sewerage administrators and related local governments in urban river basins…. | ← Measures taken to overcome the problem |

*(Continued next page)*

**Fig. 5.2** Format and example of Extracted Key for Success



**[ Title ]**
Legislation and regulation of activities

**[ The key ]**
[5.1.2] Specify in legislation that flood management is the responsibility of national government, municipalities and residents, and clarify their respective roles.

- It is necessary to specify through legislation that flood management is the responsibility of national government, municipalities, residents, and so on, and clarify the roles of each of them.

← Wisdom behind the measures taken in a generalized terms

**[ Conditions and limitations in applying the Key ]**
- Strong leadership of flood managers is essential to establish a new legislation....

← Conditions and limitations, tools to enhance the application of the KFS

**[ Ideas for enhancing the applicability of the Key ]**
- New law for urban flood damage mitigation measures, enforcing basin-based measures and sectoral coordination between river and sewerage administrators and related local governments....

| No. | River, Country | Classification |
|---|---|---|
| 5.1 | Philippines: Pasig–Marikina River Basin | (1) Stakeholder participation<br>(2) Regulation of activities<br>(3) Raising awareness<br>(4) Information-sharing |
| 5.2 | Japan: Tsurumi River Basin | (1) Planning<br>(2) Maximized benefit<br>(3) Stakeholder participation and coordination<br>(4) Legislation and regulation of activities |
| 5.3 | Indonesia: Brantas River Basin | (1) Risk assessment<br>(2) Coordination |
| 5.4 | Kenya: Nyando River Basin | (1) Coordination and planning |
| 5.5 | Other Examples | |
| 5.5.1 | Argentina | (1) Information-sharing |
| 5.5.2 | Bangladesh | (1) Stakeholder participation<br>(2) Regulation of activities<br>(3) Crisis management |
| 5.5.3 | China | (1) Financing |
| 5.5.4 | Costa Rica | (1) Risk assessment |
| 5.5.5 | Japan | (1) Risk assessment<br>(2) Capacity building<br>(3) Technology development<br>(4) Stakeholder participation<br>(5) Maximized benefit<br>(6) National strategy<br>(7) Financing |
| 5.5.6 | Laos | (1) Technology development |
| 5.5.7 | Thailand | (1) Information-sharing |
| 5.5.8 | Uganda | (1) National strategy |

**Table 3** Summary of Examples

## 5.1 PHILIPPINES: PASIG–MARIKINA RIVER BASIN

| Facts | Ref. to KFS |
|---|---|

### 1. Background

The Pasig-Marikina River with a total catchment area of 621 sq. kilometers runs through the center of Metro Manila and flows out to Manila Bay. Because the river runs through the low-lying areas, people living in the area suffer from annual flooding. Recent flood disasters have occurred in 1986, 1990, 1991, 1994 and 1997. The flood in 2002 killed ten people and inundated 100,000 houses.

In 1985, the Mangahan Floodway was completed in order to protect the centre of Metro Manila against a flood discharge, corresponding to a 100-year return period of the Pasig-Marikina River, by diverting the excess flood discharge of the Marikina River into the Laguna Lake. However, the Marikina Control Gate Structure (MCGS), which was proposed to fully attain maximum utilization of the floodway, was not constructed because of its impacts on river transportation, thus the floodway was not utilized to its maximum capacity.


**Fig. 5.1.1** Location Map of Pasig-Marikina River



| Facts | Ref. to KFS |
|---|---|
| **2. Planning and relocation order**<br><br>**(1) Flood control and drainage master plan**<br>The flood control and drainage master plan of the Pasig-Marikina River System was formulated by the Department of Public Works and Highways (DPWH) in their study carried out from 1988 to 1990. The Pasig River Rehabilitation Commission (PRRC), consisting of representatives from national and local government agencies, was established. The commission developed the Pasig River Rehabilitation Master Plan, which covered such multi-sectoral issues as housing, waste management, and flood control.<br><br>The PRRC, a multi-agency organization, was created under Executive Order No. 54, primarily to rehabilitate the Pasig River that was fast deteriorating because of poor waste management and disposal by factories and homes along its banks. It is mandated to draw up an updated and integrated master plan on the rehabilitation of the Pasig River, taking into account its potential for transportation, recreation and tourism. The creation of the PRRC will ensure that the Pasig River, which is considered to be a vital artery in the transport of goods and people, remains a viable alternative for decongesting the road network system of Metro Manila and its environs. It will be rehabilitated to its historically pristine condition so that it is conducive to transport, recreation and tourism, and will benefit the development of Metro Manila and the country in general.<br><br>The Commission, which is presently under the leadership of the Department of Environment and Natural Resources (DENR), is composed of different national government agencies, such as from the Office of the Executive Secretary, Metro Manila Development Authority (MMDA), Department of Budget and Management (DBM), DPWH, Housing and Urban Development Coordinating Council (HUDCC), Department of Tourism (DOT), Department of Transportation and Communications (DOTC), Department of Finance (DOF), Department of Trade and Industry (DTI), Department of National Defense (DND), and the Department of Interior and Local Government (DILG: Local Government Units (LGUs), as well as some Non-Governmental Organizations (NGOs) and private companies, are members of the Board of Commissioners. In particular, the DPWH has been appointed in-charge of the civil works for flood mitigation, especially channel improvement.<br><br>Regular attendance of the commissioners meetings proved problematic as senior members of the above agencies were often unable to attend, due to conflicting schedules, sending lesser representatives instead. The key to building consensus lies in the equal opportunity afforded to stakeholders to voice their views and opinions on the different programs presented at every commissioners meeting, and only thorough deliberation and scrutiny of every program and proposal can lead to better understanding and support of the actions in question.<br><br>**(2) Issues to informal settlers**<br>Due to the urbanization and concentration of the population in Metro Manila, people with low incomes resided along the river bank, aggravating flood disasters in the area. Garbage disposal and wastewater discharge by local residents led to a reduction of discharge capacity and sedimentation, leading to further aggravation of flood events.<br><br>A relocation order was issued to informal settlers living in the flood prone areas. | KFS-5.1 (1)<br><br>KFS-5.1 (2) |

| Facts | Ref. to KFS |
|---|---|
|  <br>**Fig. 5.1.2** Informal settlers<br><br>The relocation of informal settlers living along the Pasig River is being carried out by the PRRC with the assistance of the NHA, concerned LGUs and other related agencies through the LIAC. There are about 125 identified informal settler families affected by the PMRCIP – Phase II, and they will be relocated to areas developed by the PRRC. With every relocation the LIAC is always at the forefront ensuring that the relocation process is being properly carried out. Initially, there were problems regarding both relocation sites and necessary funding but these have since been properly addressed. Resistance from the informal settler families was a more common problem, however, thanks to proper dialogue and the presence of community leaders and LIAC, they were eventually convinced to vacate the areas.<br><br>This responsibility lies with the LGUs. After each relocation, the cleared areas were turned over to the associated LGU for monitoring and proper maintenance as well as to ward off new settlers and returnees. | KFS-5.1 (2) |
| **3. Improvement of public awareness**<br><br>Pasig-Marikina river basin also had the following problems:<br>• River water was polluted due to urbanization and the discharge of untreated sewage.<br>• The dredging works in the downstream section of the Pasic River, needed to increase discharge capacity, could lead to leakage of toxic substances contained in the sediment, disturbance to urban functions due to construction, noise pollution, and so on. It was necessary to ensure that residents understood that the river scenery would change with the new flood walls along the riverbanks.<br>• Furthermore, the project had to be coordinated alongside local projects implemented by local agencies prior to the project.<br><br>Therefore, the goal was to reduce flood disasters and improve the river environment through the Pasig-Marikina River improvement project while improving public awareness on disasters and the environment. | |



| Facts | Ref. to KFS |
|---|---|
| Information Campaign and Publicity (ICP) was conducted to obtain understanding from the neighboring residents.<br><br>This was implemented in order to establish and create a huge and effective campaign informing of the project and to give those affected a better understanding of the project thereby winning their support and cooperation for its smooth implementation. The ICP has been successfully carried out during the Detailed Engineering Design Stage of the project from 2000 to 2004, which is demonstrated by the strong support and cooperation received from the stakeholders in the ongoing implementation of the project.<br><br>Through proper coordination with the different agencies and LGUs, overlapping of some of the developments along the Pasig River was avoided. As both national and local government are making efforts to address the flood control problem together with beautification and development programs, some committees within the LGUs were specifically created, such as LIAC involving representatives from the national government agencies, i.e. MMDA, NHA, PRRC and others, to ensure that all related programs of national and local government are properly considered and integrated into one program.<br><br>Several ICP activities and events were carried out and continuously being undertaken to ensure that the project draws consistent support and cooperation not only from the LGUs and NGOs but also from the public. This includes extending the campaign to the other four LGUs, i.e. the direct beneficiaries of the project (PMRCIP – Phase II) namely Manila, Makati, Mandalyong, and Pasig, and on different occasions so as to kick start ICP activities in each LGU. At the same time ICP materials such as brochures, leaflets, posters and signages will be distributed to the people in order to give them a clearer and better overview of the project. The project also utilizes media placements such as radio, TV, print, and even the Internet. Continual training of each community motivator is also being carried out so as to better equip them once they work in the area and provide community-based explanatory discussions together with project representatives. All of these measures were found to be effective in obtaining a better understanding from the LGUs, NGOs, and the public as a whole.<br><br>PRRC has already constructed more than twenty Linear Parks along the Pasig River since 2004, which has enhanced the beauty of areas along the riverbanks to create a more favorable environment. Several of these linear parks were created in areas where river improvements were already under construction under the Five Priority Areas – showcases of the project using local funds. However, there are areas where river improvements were constructed simultaneously with the linear parks development under the ADB-Funded PRRC projects. For areas where linear parks were constructed ahead of the river improvement, implemented under the PMRCIP – Phase II, proper coordination with LGUs and related agencies were continuously undertaken to ensure that existing developments, and other issues and concerns, were taken into consideration. | KFS-<br>5.1 (3) |


**Fig. 5.1.3** Leaflet

| Facts | Ref. to KFS |
|---|---|
| **4. Development of a flood forecasting system**<br><br>In a highly urbanized city like Metro Manila, a flood forecasting and warning system was also necessary in addition to the river improvements and the installation of discharge facilities. However, due to the lack of a hydrological observation network it was difficult to forecast flooding with great accuracy. The area was prone to inundation even with small to medium sized floods.<br><br>DPWH developed the Effective Flood Control Operation System (EFCOS) – the management of EFCOS has now moved to MMDA.<br><br>The EFCOS gathers real time data of rainfall and water levels at selected hydrological observation stations within the Pasig-Marikina River Basin and the Laguna Lake as monitored by the Rosario Master Control Station. These same data are transmitted to PAGASA via Antipolo Relay Station for data sharing purposes. The Rosario Master Control Station processes the hydrological data received and carries out flood forecasting on-line. These flood forecasts are disseminated by radio broadcast to the public by the MMDA. This flood information is also conveyed to the different government agencies concerned such as PAGASA, DPWH Central Office, NCR Head Office, and LGUs through telephone lines. The LGUs are responsible for the preparation of flood disaster management plans including relief operations through its Local Disaster Coordinating Council (LDCC).<br><br>Unfortunately, the operation of EFCOS has been temporarily shut down due to budget constraints. As the EFCOS is now under the management of MMDA, and they also suffer from a lack of funds, development and maintenance cannot be assured at present. However, it is understood that EFCOS will resume operation once funds become available. | KFS-<br>5.1 (4) |

[Interviewee: Ms. Lydia C. Aguilar (DPWH)] [Interviewer and report: Mr. Masayuki Shiraishi, Mr. Akira Nishimura (Japan Water Agency)]



## (1)Stakeholder participation

**[ Title ]**
Stakeholder participation

**[ Situation ]**

- The Pasig-Marikina River, with a total catchment area of 621 sq. kilometers runs through the centre of Metro Manila and flows out to Manila Bay. Because the river runs through low-lying areas, people living in the area suffer from annual flooding.
- In 1985, the Mangahan Floodway was completed to protect the centre of Metro Manila against a flood discharge, corresponding to a 100-year return period of the Pasig-Marikina River, by diverting the excess flood discharge of the Marikina River into the Laguna Lake. However, the Marikina Control Gate Structure (MCGS), which was proposed to fully attain the maximum utilization of the floodway, was not constructed due to its impacts on river transportation, thus the floodway was not utilized to its maximum capacity.
- Flood disasters occurred in the Pasig-Marikina River in 1986, 1990, 1991, 1994 and 1997. The flood in 2002 killed ten people and inundated 100,000 houses.

**[ Problem ]**

- The cross-sectoral project design and implementation were required to rapidly realize the effectiveness of flood control measures.

**[ How the problem was overcome ]**

- The flood control and drainage master plan of the Pasig-Marikina River was formulated by DPWH in their study carried out from 1988 to 1990.
- TPRRC, consisting of representatives from national and local government agencies, was established. The commission developed the Pasig River Rehabilitation Master Plan, which covered such multi-sectoral issues as housing, waste management, and flood control.
- The establishment of the master plan was facilitated through coordination among stakeholders.

**[ The key ]**

**[2.1.1] Understand in advance the roles and responsibilities of stakeholders in the basin.**
**[2.2.1] Develop a plan for balanced flood management in the entire basin.**

- Coordinate closely with relevant agencies and organizations.
- Involve the stakeholders during the planning process.

**[ Conditions and limitations in applying the KFS ]**

- Identify all the coordinating mechanisms applicable to the project.
- Close coordination with relevant agencies and organizations depends on the availability of the concerned agencies.
- Involvement of stakeholders during the planning stage will depend on the acceptance of the project by the stakeholders.

**[ Ideas for enhancing the applicability of the KFS ]**

- The people involved in the process should be highly qualified in terms of flood control and multi-purpose river basin management.

**(2) Regulation of activities**

**[ Title ]**
Regulation of activities

**[ Situation ]**
- Although informal settlers live along the river, the river improvement project had to be carried forward.

**[ Problem ]**
- Due to the urbanization and concentration of the population in Metro Manila, people with low incomes were residing along the river bank aggravating flood disasters in the area.
- Garbage disposal and wastewater discharge by the local residents led to a reduction of discharge capacity and sedimentation, leading to further aggravation of flood disasters.

**[ How the problem was overcome ]**
- A relocation order was issued to the informal settlers living along the river by the PRRC with the assistance of relevant central and local governments.
- About 125 families were affected by PMRCIP – Phase II and relocated to the developed areas.
- With every relocation, LIAC is always at the forefront ensuring that the relocation process is being properly carried out. Initially, there were problems regarding both relocation sites and necessary funding but these have since been properly addressed.
- Resistance from the informal settler families was a more common problem however, thanks to proper dialogue and the presence of community leaders and LIAC, they were eventually convinced to vacate the areas.
- After each relocation, the cleared area was turned over to LGUs for monitoring and managing as well as to ward off new settlers and returnees.

**[ The key ]**
**[3.2.2] Prevent actions/activities that cause negative consequences with regards to flood management in with basin stakeholders.**
**[3.2.3] Take steps to ensure residents understand the existing risks in the river/basin.**
- Implement a massive and effective information campaign and publicity on the project.
- Coordinate closely with relevant agencies and organizations.
- Undertake proper and accurate identification of informal settlers.

**[ Conditions and limitations in applying the KFS ]**
- Ensure stakeholders acceptance of the project.
- Provide the necessary budget in order to implement aggressive activities.
- Close coordination with related organizations depends on each organization's availability.
- Carry out census-tagging and validation operations on the affected informal settlers.

**[ Ideas for enhancing the applicability of the KFS ]**
- Establishment of a Local Inter-Agency Committee.



### (3) Raising Awareness

**[ Title ]**
Raising awareness

**[ Situation ]**
- River improvement of the Pasig-Marikina River was necessary to protect the Metro Manila from flood disasters and to restore the lush environment in and around the rivers.

**[ Problem ]**
- The dredging works in the downstream section of the Pasig River, needed to increase discharge capacity, could lead to leakage of toxic substances contained in the sediment, disturbance to urban functions due to construction, and so on. It was necessary to ensure that the residents understood that the river scenery would change with the new flood walls along the riverbanks.
- Furthermore, the project had to be coordinated alongside local projects implemented by local agencies prior to the project.
- The goal was to reduce flood disasters and improve the river environment through the Pasig-Marikina River improvement project.

**[ How the problem was overcome ]**
- Information Campaign and Publicity (ICP) was conducted to obtain understanding from the neighboring residents.
- This was a massive and effective campaign informing of the project to give those affected a better understanding of the project thereby winning their support and cooperation for its smooth implementation. The ICP has been successfully carried out thanks to the strong support and cooperation received from the stakeholders.
- Several ICP activities and events were carried out and are continuously being undertaken to ensure that the project continues to draw support and cooperation not only from LGUs and NGOs but also from the public. This includes extending the campaign to the other four LGUs, i.e. the direct beneficiaries of the project (PMRCIP – Phase II), and on different occasions so as to kick start the ICP activities in each LGU.

**[ The key ]**
**[3.2.3] Take steps to ensure residents understand the existing risks in the river/basin.**
- Implement a massive and effective information campaign and publicity of the project.
- Coordinate closely with relevant agencies and organizations.
- Ensure that all related programs of national and local government are properly considered and integrated into the project.

**[ Conditions and limitations in applying the KFS ]**
- Accurate identification of stakeholders within the river basin.
- Benefits in the basin must be properly identified and quantified.
- Provide the necessary budget to be able to implement awareness-raising activities.
- Early understanding of all the programs by national and local government within the river basin.

**[ Ideas for enhancing the applicability of the KFS ]**
- Establishment of a Local Inter-Agency Committee.
- Provide training/seminars for the concerned stakeholders.

### (4) Information-sharing

**[ Title ]**
Information-sharing

**[ Situation ]**
- In a highly urbanized city like Metro Manila, flood forecasting and a warning system was also necessary in addition to river improvements and the installation of discharge facilities.

**[ Problem ]**
- Due to the lack of an hydrological observation network it was difficult to forecast flooding with great accuracy. The area was prone to inundation even with small to medium sized floods.

**[ How the problem was overcome ]**
- EFCOS gathers real time data of rainfall and water levels at selected hydrological observation stations within the Pasig-Marikina River Basin and the Laguna Lake as monitored by the Rosario Master Control Station.
- The Rosario Master Control Station processes the hydrological data received and carries out flood forecasting on-line. These flood forecasts are disseminated to the public through radio broadcasts by the MMDA. This flood information is also conveyed to the different government agencies concerned such as PAGASA, DPWH Central Office, NCR Head Office and LGUs through telephone lines. The LGUs are responsible for the preparation of flood disaster management plans including relief operations through its LDCC.
- At present, the operation of EFCOS has been temporarily shut down due to budget constraints. Operation of EFCOS will resume once funds become available.

**[ The key ]**
**[3.2.4] Inform residents of risks as soon as possible at the time of flooding.**
**[3.2.5] Prepare a framework/system that can execute crisis management in a basin.**
- Provide the necessary budget to be able to operate the EFCOS.
- Ensure the availability of the necessary spare parts for EFCOS equipment.
- Coordinate closely with related agencies and organizations.

**[ Conditions and limitations in applying the KFS ]**
- All communication equipment must be in tip-top condition.
- Must have an effective organizational structure.
- Necessary sustainable budget must be specifically programmed.
- Provide the necessary funds for the purchase of the necessary equipment and spare parts.
- Close coordination with related agencies and organizations depends on the availability of the concerned agencies.

**[ Ideas for enhancing the applicability of the KFS ]**
- The people involved in EFCOS should be highly qualified in terms of flood forecasting and warning systems.
- Provide training of/seminars for EFCOS staff.

## 5.2 JAPAN: TSURUMI RIVER BASIN

| Facts | Ref. to KFS |
|---|---|

### 1. Background

Japan was hit by extremely severe water-related disasters almost every year after World War II, each causing hundreds and thousands of deaths and missing persons. Such disasters include Typhoon Kathleen in September 1947, Typhoon Ione in September 1948, Typhoon Kanogawa in September 1958, Typhoon Isewan in September 1959, and so forth.

Tsurumi River (basin area 235 sq. kilometers, total length 42 km) is a small and gently sloped river. The region has not experienced serious disasters with a high death toll, but its low-lying areas along the middle/lower reaches of river has suffered from frequent flooding due to fluvial and surface water.

Most of the Tsurumi river basin lies in relatively low and flat hills and is suited for urban development. It also has geographic advantages as it is close to big cities like Kawasaki and Yokohama, and can also be easily accessed from central Tokyo. For this reason, after 1960, along with the rapid increase in industrial/economic activities and the remarkable improvement of the transportation systems in the Tokyo metropolitan area, the development in the Tsurumi river basin progressed rapidly. The urban areas indicating only 10 per cent of the basin in 1958 increased up to 60 per cent by 1975. It is now as high as 85 per cent.

The Tsurumi River has a relatively long section affected by the tide level of the Tokyo Bay because the downstream section of the river is gently sloped. It also has a meandering river course due to the hills surrounding the rivers. These natural conditions made the areas in the downstream section of the river prone to flood disasters. Furthermore the rapid development of the basin reduced the rainwater permeability of the land causing the flood water discharge to peak faster with higher magnitude. Moreover, the flood risks increased due to the development of the flood vulnerable low-lying land. In addition, the flood-control measures of the local government, including river improvements in the upstream medium and small rivers, and the construction of drainage pumps and channels, lacked careful consideration of the balance between the protection of upper and lower reaches, which ended up magnifying the flood risks of the downstream section of the mainstream of the Tsurumi River.

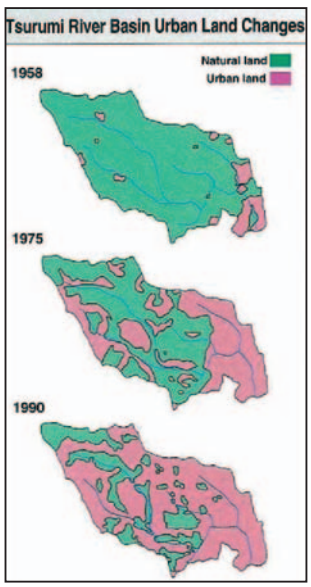



**Fig 5.2.1** Land changes by urbanization

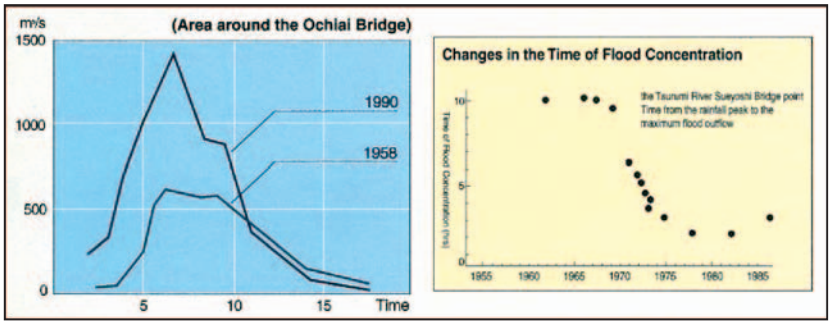



**Fig 5.2.2** Changes of discharge and time of flood concentration

| Facts | Ref. to KFS |
|---|---|
| **2. Comprehensive Flood Control Measures**<br><br>The problem outlined above is not specific to Tsurumi River but is a common issue among urban rivers throughout Japan. So-called urban flood disasters have come to occur frequently. For the urban rivers, it was difficult to solve the problem only through conventional river improvement works, in which flood waters are collected into the river and allowed to flow out into the sea as quickly as possible, for the following reasons:<br><br>• The expansion of the river channel in the densely populated urban area is extremely difficult to undertake for a number of reasons including the difficulties associated with acquiring the required land due to the rapid rise in land prices, pollution caused by construction works, and so on.<br>• The conventional river improvement is associated with high costs and long construction times. This means that the flood safety level will remain low for a long period of time until the project is completed. However, a rising demand from society for improvements in the level of urban safety means that this issue has to be addressed sooner.<br>• Urban rivers frequently experience extreme flood events thus increasing flood damage in the area. Conventional measures that deal only with river channels are often inadequate.<br><br>To deal with such situations 'comprehensive flood control measures' were proposed. The comprehensive flood control measures include not only the conventional flood control projects but also measures to reduce flood or sediment runoff by preventing development in the basin, increasing the water retention capacity of the basin, promoting safe land use in the areas at risk of flood inundation or sediment disasters, improving flood warning/evacuation systems, establishing relief program for the victims, and so on. Overall, the comprehensive flood control measures aim to minimize flood damage in the basin.<br><br>In Japan, an urban river suffering from the lowering of the flood safety level due to rapid urban development was designated as a 'river specified for comprehensive flood control measures'. Collaboration and coordination among various measures and land use planning were promoted in a comprehensive manner. Under the comprehensive flood control measures, the following were implemented:<br><br>• Vigorously advance river improvement works for flood control.<br>• Develop a Basin Improvement Plan, which identifies the appropriate measures for increasing the water retention and retarding capacities of the basin, and implement various measures based on this plan.<br>• Make public the map of inundation areas in the case of major floods to promote proper land use and serve as useful information for evacuation during an emergency.<br>• Promote public understanding and cooperation on flood control issues in the river basin.<br><br>Moreover, to facilitate such efforts, it was decided that the 'Basin council for comprehensive flood control measures', comprised of river administrators and other related divisions such as urban development, be established for each basin based on the collective opinion of the relevant local governments. | KFS-5.2 (1) |



| Facts | Ref. to KFS |
|---|---|
| Tsurumi river basin was also designated as the specified river for comprehensive flood control measures. Being the first in Japan, comprehensive measures of control flooding by maintaining or improving the water retention or permeability of the basin began in the 1970s under the consensus of the related agencies in the basin, in addition to the conventional flood control measures by river improvement. Furthermore, the 'Basin Improvement Plan' was developed and appropriate measures were identified for each of the three basin areas: the water retention area, the flood control area, and the lowland area, based on land characteristics.<br><br>• **Water retention area**: The water retention area refers to the area whose function for temporarily permeating or retaining stormwater needs to be ensured or expanded for flood control purposes. Geographically, it is a river head area such as a hill or plateau located in the middle or upstream reaches of the basin. In the water retention area, measures for developing stormwater retention facilities and promoting appropriate land use should be implemented in order to maintain or enhance its current water retention function as much as possible.<br>• **Flood control area:** The flood control area refers to the area where stormwater or river water overflow can temporarily flow in, and where the function of temporarily storing such water needs to be ensured or expanded. Geographically it is generally a low-lying area along the river in the middle or upstream reaches of the basin. It is susceptible to inundation and likely to become a natural retarding basin during flooding. In the flood control area, its current stormwater retention function should be maintained. River management measures should be implemented in this area in order to increase the level of flood safety.<br>• **Lowland area**: The lowland area is generally an area that is susceptible to inundation by flooding or by rainwater captured in the basin, and where active inundation control measures must be implemented. Geographically it is a low-lying, flat urban area along a river. In the low-land area, necessary river improvements should be implemented along with promotion of inland water drainage strategies. Operation of newly installed pumps will be controlled according to the levels of river discharge. Stormwater retention facilities will also be installed in feasible locations. | KFS-5.2 (1) |
| **3. Efforts in the river and the basin**<br><br>As mentioned earlier Tsurumi River Basin was extensively urbanized, and houses were built close to rivers in the downstream areas. This made it expensive to widen the existing rivers while excavation of the channel wouldn't have realized sufficient enhancement in the discharge capacity. Thus, a solution other than the conventional river channel improvement was indispensable.<br><br>It was proposed to build a flood retarding basin within the urbanization control area close to the Shin-Yokohama station, which was used as agricultural land, mainly rice paddies. It was a large-scale project covering an area of 84 ha and a flood control capacity of 3.9 million cubic meters. The land owners already had some thoughts for the future uses of the land, and the land prices in the region had risen sharply around this time, thus purchasing the land raised a number of difficulties.<br><br>Recognizing the high value of the site, it was decided to utilize the site for multiple purposes by building public facilities while utilizing it for flood control. It allowed for an effective utilization of land, and cost sharing with other sectors reduced the cost to be covered by the flood control sector. The planning for this multi-purpose retarding basin | KFS-5.2 (2) |

| Facts | Ref. to KFS |
|---|---|
| began in the 1970s with many years of discussions among the relevant local governments in the area.<br><br>As a result, it was positioned as a centre for sports and recreation with facilities such as the rehabilitation centre and athletics parks. The 'International Stadium Yokohama' built on the site is the largest sports stadium in Japan with a capacity of 72,000 people and a total area of 173,000 sq. meters. It adopted the *pilotis* structure (elevated-platform) in order to avoid hindering flood control capacity. The stadium was the venue of the 2002 FIFA World Cup final and became known to the world.<br><br>Besides the multi-purpose retarding basin, the Tsurumi river basin currently has 3,300 disaster prevention reservoirs (about 2.7 million cubic meters). There are also numerous runoff control facilities such as rainwater infiltration facilities, and flood-proof elevated flow housing is being promoted.<br><br>  <br>**Fig 5.2.2** Integrated flood management | |
| **4. Establishment of the coordination mechanism**<br><br>While flood control measures have been implemented for the Tsurumi River Basin with a focus on the basin, urbanization of the basin has generated problems such as a deterioration of the natural environment and water quality. As the implementation of comprehensive flood control measures increased the flood safety level, people's interest shifted to environmental concerns and usage. It became necessary to incorporate the water cycle concept in the subsequent measures and promote nature-oriented and multi-functional comprehensive flood control strategies that would ensure environmental conservation and land use while encouraging the extensive participation of stakeholders.<br><br>It was then decided to realize a pioneering initiative to foster a sound water cycle system in the Tsurumi river basin by focusing on the basin perspective when addressing the issues of the region and the cities. This initiative also encompassed efforts to restore people's close relationship with the river, which was lost in the course of urbanization during the latter half of the twentieth century. Specifically, the Tsurumi River Basin Water Master Plan was designed to provide guidelines for creating an environmentally sound water cycle in the Tsurumi river basin. This plan was developed based on cumulative joint efforts between the government and basin residents through the implementation of comprehensive flood control measures. The Tsurumi River Basin Water Council was also established. Specific basin management strategies were proposed with a focus on the following five aspects: (1) flood control (measures during floods), (2) water environment during ordinary times, (3) natural environment, (4) measures during earthquake and fire, and (5) waterfront recreation.<br><br>In 2004, the Tsurumi River Basin Water Master Plan Promotion Declaration was announced and a framework was established for promoting joint efforts among basin residents, citizens' organizations, and government towards implementing the master plan in order to achieve basin safety and coexistence with nature. | KFS-<br>5.2 (3) |

| Facts | Ref. to KFS |
|---|---|

Action plans for effectively implementing measures based on the Tsurumi River Basin Water Master Plan have been developed through the close partnership among people, citizens' organizations, companies, and government. Organizations responsible for implementing the measures respectively set goals as well as the time period needed to achieve their goals. These goals are near-term goals for the next five years or so. Progress in the implementation of the action plans is appropriately managed through monitoring.


**Fig 5.2.4** Workshops

**Fig 5.2.5** Regular cleanup activities

### 5. Developing a legal framework for basin measures

The flood safety level in Tsurumi river basin is improving as various measures, both in the rivers and in the basin, are being implemented under the comprehensive flood control measures. However, with its basin being highly utilized, it cannot be said that the current river/sewerage/basin facilities provide an adequate safety level. Moreover, as over twenty years have passed since the development of the Basin Improvement Plan, there have been differences in land use compared to the original plan. Also, as the runoff control facilities in the basin were not legally positioned in the conventional comprehensive flood control measures, many facilities were not properly maintained or reclaimed. In addition, Japanese urban cities have been frequently hit by heavy rains in recent years and flood damage to underground spaces has become a growing concern. There was a need for a new approach to flood disaster reduction.

To address the issue of urban rivers including Tsurumi, a new law for urban flood damage mitigation measures was enacted in 2004 enforcing basin-based measures and sectoral coordination among river and sewerage administrators and related local governments in urban river basins.

KFS-5.2 (4)

The key features of this law are as follows:

- Jointly develop a plan for reducing flood disasters in the basin by river and sewage administrators, related prefectural governors, and municipal governments.
- Enforce the installation of a runoff control facility with new development activities, which would reduce the rainwater permeability of the basin. Oblige existing facilities in the basin to be conserved.

KFS-5.2 (4)

- Prepare and publish anticipated urban flood area map (flooding of rivers) and anticipated urban inundation area map (flooding due to surface water).

Tsurumi river basin was designated to come under the law as the first river in 2005. The cooperation in the basin among the relevant sectors will be further strengthened in the future. The river and sewerage administrator and the local governments in the basin have jointly developed the plan for reducing flood disasters in the basin, and are working to achieve improvements in the flood safety level as early and as reliably as possible, aiming towards creating a city (basin) that is resistant to flood disasters.

| Facts | Ref. to KFS |
|---|---|

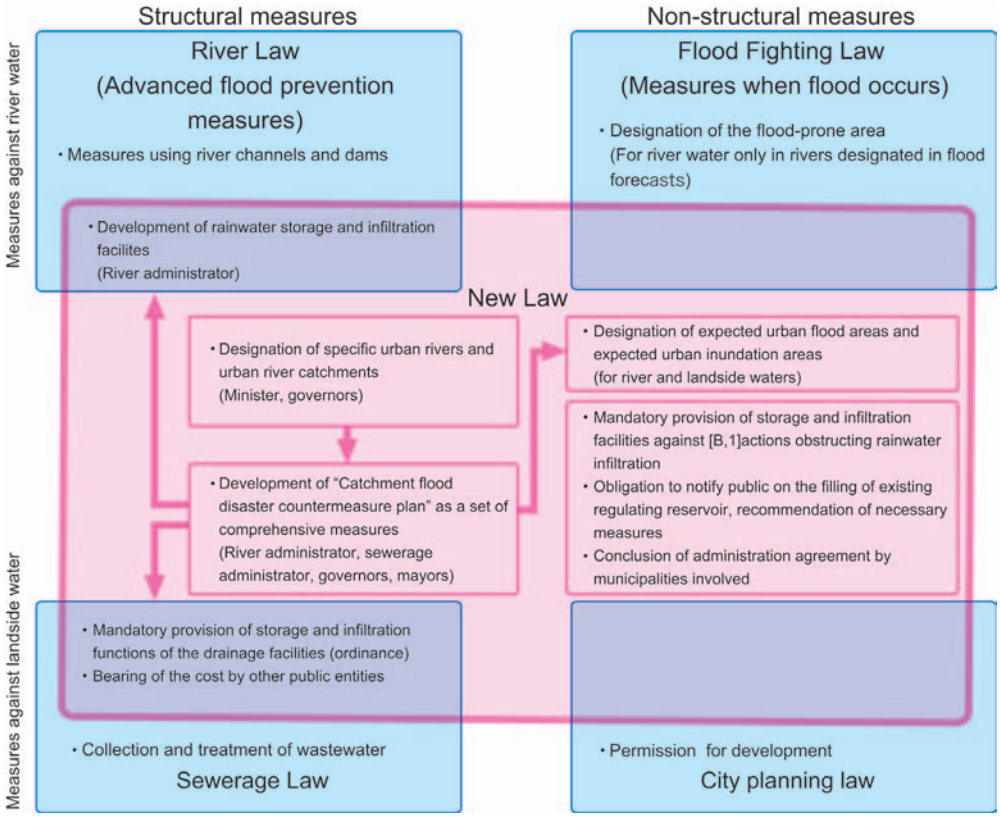



**Fig 5.2.6** Legal framework for a basin

[Interviewee: Mr. Kenji Suzuki (Director of Keihin River Office, MLIT)]
[Interviewer and report: Mr. Naoki Fujiwara, Mr. Ken Yoneyama (CTI Engineering)]

### (1) Planning

**[ Title ]**
Planning

**[ Situation ]**
- The Tsurumi River has a relatively long section affected by the tide level of the Tokyo Bay because of the gently sloping downstream section of the river. It also has a meandering river course due to the hills surrounding the rivers. These natural conditions made the areas in the downstream section of the river prone to flood disasters.
- Furthermore the rapid development of the basin reduced the rainwater permeability of the land causing the flood water discharge to peak faster with higher magnitude.

**[ Problem ]**
- The expansion of the river channel in the densely populated urban area is extremely difficult for a number of reasons including difficulties in acquiring the necessary land due to the rapid rise in land prices, pollution caused by construction works, and so on.
- Conventional river improvements implied high costs and long construction times. This means that the flood safety level will remain low for a long period of time until the project is completed. A rising demand from society for the improvement of urban safety has to be addressed sooner.
- Urban rivers frequently experience extreme flood events increasing flood damage in the area. Conventional measures dealing only with the river channels are often inadequate.



**[ How the problem was overcome ]**

- An urban river suffering from the lowering of the flood safety level due to rapid urban development was designated as a 'river specified for comprehensive flood control measures'. Collaboration and coordination among various measures and land use planning were promoted in a comprehensive manner.
- Under the comprehensive flood control measures, the following were implemented:
  - Vigorously advance river improvement works for flood control.
  - Develop a Basin Improvement Plan, which identifies the appropriate measures for increasing the water retention and retarding capacities of the basin, and implement various measures based on this plan.
  - Make public the map of the inundation area caused by major floods to promote proper land use and to serve as useful information for evacuation during emergency.
  - Promote public understanding and cooperation on flood control issues in the river basin.

**[ The key ]**

**[2.2.1] Develop a plan for balanced flood management for the entire basin.**

- Collaboration and coordination among various measures and land use planning are promoted within the flood management plan in an integrated manner.

**[ Conditions and limitations in applying the KFS ]**

- Plans and measures that only deal with river channels are inadequate.

**[ Ideas for enhancing the applicability of the KFS ]**

**(2) Maximized benefit**

**[ Title ]**

Maximized benefit

**[ Situation ]**

- Tsurumi river basin was extensively urbanized, and houses were built close to the rivers in the downstream areas. It made it expensive to widen the existing rivers and the excavation of the channel wouldn't have realized sufficient enhancement in the discharge capacity. Thus, a solution other than the conventional river channel improvement was indispensable.

**[ Problem ]**

- It was proposed to build a flood retarding basin within the urbanization control area close to the Shin-Yokohama station, which was used as agricultural land, mainly rice paddies.
- It was a large-scale project, with an area of 84 ha and a flood control capacity of 3.9 million cubic meters. The land owners already had some thoughts for the future uses of the land, and land prices in the region had risen sharply around this time, thus purchasing the land raised a number of difficulties.

**[ How the problem was overcome ]**

- Recognizing the high value of the site, it was decided to utilize the site for multiple purposes by building public facilities while utilizing it for flood control. It allowed for an effective utilization of the land, and cost sharing with other sectors reduced the cost to be covered by the flood control sector.
- It was positioned as a centre for sports and recreation with such facilities as a rehabilitation centre and athletics parks.

**[ The key ]**

**[3.2.1] Implement measures that maximize the benefits of the basin as a whole.**

- Development of projects in collaboration with other users in a comprehensive manner allows for early completion of the flood related infrastructures.

**[ Ideas for enhancing the applicability of the KFS ]**

- Multi-purpose infrastructures considered land use, recreation, and the environment.

### (3) Stakeholder participation and Coordination

**[ Title ]**
Stakeholder participation and coordination

**[ Situation ]**
- While flood control measures have been implemented for the Tsurumi river basin with a focus on the basin, urbanization of the basin has generated such problems as a deterioration of the natural environment and water quality.

**[ Problem ]**
- As the implementation of comprehensive flood control measures increased the flood safety level, people's interest shifted to environmental concerns and usage. Against this backdrop, it became necessary to incorporate the water cycle concept in the subsequent measures and promote nature-oriented and multi-functional comprehensive flood control strategies that would ensure environmental conservation and land use, and encourage the extensive participation of stakeholders.

**[ How the problem was overcome ]**
- Tsurumi River Basin Water Master Plan was designed to provide guidelines for creating an environmentally sound water cycle in the Tsurumi river basin. This plan was developed based on cumulative joint efforts between the government and basin residents through the implementation of comprehensive flood control measures. The Tsurumi River Basin Water Council was also established.
- Specific basin management strategies were proposed with a focus on the following five aspects: (1) flood control (measures during floods), (2) water environment during ordinary times, (3) natural environment, (4) measures during earthquake and fire, and (5) waterfront recreation.

**[ The key ]**
**[2.1.1] Understand in advance the roles and responsibilities of stakeholders in the basin.**
**[2.1.2] Ensure effective coordination and cooperation of interests among stakeholders.**
- It is necessary to incorporate the water cycle concept in the subsequent measures and promote nature-oriented and multi-functional comprehensive flood control strategies.

**[ Conditions and limitations in applying the KFS ]**
- It is not easy to reach an agreement without the basis and foundation of a close partnership between people, citizens' organizations, companies, and government.

**[ Ideas for enhancing the applicability of the KFS ]**
- Establishment of the River Basin Water Council and the design of the River Basin Water Master Plan between basin residents, citizens' organizations and governments.



### (4) Legislation & Regulation of activities

**[ Title ]**
Legislation and regulation of activities

**[ Situation ]**
- It cannot be said that the current river/sewerage/basin facilities in Tsurumi river basin provide an adequate safety level, with its basin being highly utilized.
- Moreover, as over twenty years have passed since the development of the Basin Improvement Plan, differences have arisen from land use compared to the original plan.

**[ Problem ]**
- As the runoff control facilities in the basin were not legally positioned in the conventional comprehensive flood control measures, many facilities were not propoerly maintained or reclaimed.
- In addition, Japanese urban cities have been frequently hit by heavy rains in recent years and flood damage to underground spaces has become an emerging issue. There was a need for a new approach to flood disaster reduction.

**[ How the problem was overcome ]**
- To address the issue in urban rivers including Tsurumi, a new law for urban flood damage mitigation measures was enacted in 2004 enforcing basin-based measures and sectoral coordination among river and sewerage administrators and related local governments in urban river basins.
- The river and sewerage administrator and local governments in the basin have jointly developed the plan for reducing flood disasters in the basin.
- Enforce the installation of a runoff control facility with new development activities, which would reduce the rainwater permeability of the basin. Oblige existing facilities in the basin to be conserved.

**[ The key ]**
**[5.1.2] Specify in legislation that flood management is the responsibility of national government, municipalities and residents, and clarify their respective roles.**
**[3.2.2] Prevent actions/activities that cause negative consequences with regards to flood management in coordination with basin stakeholders.**
- It is necessary to specify through legislation that flood management is the responsibility of national government, municipalities, residents, and so on, and clarify the roles of each of them.
- It is also necessary to oblige citizens in urban river basins to implement measures for increasing water retention and retarding capacities.

**[ Conditions and limitations in applying the KFS ]**
- Strong leadership of flood managers is essential to establish a new legislation.

**[ Ideas for enhancing the applicability of the KFS ]**
- New law for urban flood damage mitigation measures, enforcing basin-based measures and sectoral coordination between river and sewerage administrators and related local governments.

## 5.3 INDONESIA: BRANTAS RIVER BASIN

| Facts | Ref. to KFS |
|---|---|
| **1. Background**<br><br>As a major river basin in East Java, Brantas has become the main water source supporting an area covering nine regencies and five municipalities with a total population of 15.5 million in 2004. Originating from an active volcano, the potential threat of Mount Kelud erupting looms over the area. In addition, unique topographic conditions arising from a winding clockwise watercourse and the eruption of Mount Kelud has caused the riverbed to rise decreasing its flood capacity in areas where floods frequently occurred. Vast fertile deltas offer ideal areas to plant food crops especially rice. The area has become a major food-producing region. Indonesia's second largest city is located downstream of the river and hence requires an important water supply for domestic purposes.<br>The Brantas Basin has a large capacity to develop. Except for irrigation infrastructure in the early 1960s, no major infrastructure has been embarked upon to regulate water and collect water during the rainy season for use during the dry season. The eruption of Mount Kelud in 1951 had the effect of raising the riverbed while decreasing its flood capacity. Frequent floods caused regular damage to the region, which in turn decreased rice productivity. Comprehensive development of the entire Brantas Basin should be prioritised together with community development, which must also be strengthened. | |
| **2. Challenge of River Basin Development**<br><br>The development of the Brantas Basin began with a comprehensive multi-purpose project based on the concept 'One River, One Plan' and included multi-purpose dams and reservoirs which, among other things, improved flood control, irrigation, power generation, domestic and industrial water supply. A special inter-provincial and cross-sectoral institution, the Brantas River Basin Development Project (BRBDP), was set up in 1961to implement basin wide development run by central government.<br>Priorities were selected within each of the different stages of development, which in turn will lead to the subsequent stages. Initially the overall development plan was conducted for the entire basin and was known as the Brantas Plan (1958), which was later consolidated as the Master Plan 1 of the Brantas River Basin (1961). Flood control was the main priority of Master Plan 1 while irrigation development became the main priority of Master Plan 2 (1973), with domestic and industrial water supply the priority in Master Plan 3 (1985).<br>Growing industries as well as cities require a continuous and adequate supply of electricity and water from within the area. Hydroelectric power could potentially provide a safe power source for the region. At the same time, environmental degradation caused by intensive human activities, especially in the upper catchment areas, has already commenced at an alarming rate. Following the completion of facilities, conservation and effective water management became the main priority of Master Plan 4 (1998). A special institution, namely Jasa Tirta I Public Corporation was set up in 1990 to conduct operation and maintenance (O&M) of completed water resources infrastructures and water resources management in Brantas River Basin by implementing beneficiaries pay principle for O&M cost recovery in order to gradually reduce the national budget for water resources management in the basin. The Brantas River Basin Development Plan finally became committed to the principle 'One River, One Plan, One Integrated Management'. | KFS<br>5.3 (2) |



| Facts | Ref. to KFS |
|---|---|

### 3. Project prioritizing of staged Master Plan

When the Brantas River Basin Development began in 1958, the basin suffered from floods almost annually causing severe damage resulting in personal injury, crop damage and losses to basin assets .This was due to the large amounts of volcanic debris and ash from Mount Kelud, in1951, which caused a gradation of the Brantas riverbed and thus reduced the discharge capacity of the river.

Although flood prevention was the main priority, severe food shortages were a national problem and electric power was needed for regional development. The Master Plan therefore had to be implemented in phases in parallel with other development projects.

Project priorities were economically evaluated by applying the B/C (benefit/cost) method. Flood control was selected for Master Plan I (1961). Karangkates Dam and Kali Konto (Selorejo) Dam were considered the best B/C projects as they mainly focused on flood control but also power generation and irrigation. Irrigation infrastructure rehabilitation in the Lower Brantas Delta was selected as the second priority, Lengkong Dam and Porong River development for flood mitigation was the third priority. Following construction of the Sutami (Karangkates) Dam (1972) and of the Kali Konto (Selorejo) Dam (1972), the frequency of floods decreased drastically, which led to the next stages of priority development.

KFS-5.3 (1)

Project priorities were economically evaluated by applying the EIRR (Economic Internal Rate of Return) method and five projects were selected for Master Plan 2 (1973). Lodoyo - Tulungagung Irrigation Development together with Wlingi multi-purpose Dam, Bening Dam, Lodoyo Dam, Mrican Barrage, Menturus and Jatimlerek Rubber Dams became the main priority in Master Plan 2 because of their focus on the provision of irrigation water to support the national drive for self-sufficiency in food protection. River development in the middle reach was the second priority, while the third priority was Pare - Nganjuk Irrigation Project.

**First master plan**

| Projects | B/C | Priority |
|---|---|---|
| 1) Karangkates Dam<br>2) K. Konto Dam | (0.82 Cent/kWh) | 1 |
| 3) Porong River Improvement<br>4) Lengkong Dam | 1.96 | 3 |
| 5) Brantas Delta Irrigation Facilities | - | 2 |
| 6) Sabo facilities | - | continue |
| 7) Wlingi Dam | - | next phase |
| 8) Lodoyo Irrigation | - | next phase |
| 9) Lodoyo Sand Removal | - | next phase |

*(Continued on next page)*

| Facts | Ref. to KFS |
|---|---|

**Second master plan**

| Projects | EIRR | Priority |
|---|---|---|
| 1) Wlingi multiple-purpose project<br>2) Lodoyo ~ Tulungagung Agricultural Development Plan | 15.5 | 1 |
| 3) Brantas Middle Reaches River Improvement | 15.7 | 2 |
| 4) Pare ~ Nganjuk Agricultural Development Plan | 12.3 | 3 |
| 5) Ngrowo river coastal district flood-control plan | 5.1 | 4 |
| 6) Blitar ~ Kediri Agricultural Development Plan | 9.0 | 5 |

### 4. Return Period of Flood Control

As concern for flood control grew, the design-flood discharge was based on the following: the importance of the river (main and tributary reaches), the flood prevention levels of other Indonesian rivers, and the scale of the damage potential.

- *The main stream of the Brantas River*: 10-year flooding is set as the design-flood discharge in Master Plan 1, and 50-year flooding is set in Master Plan 2.
- *Tributaries*: a 10~25 year flood is set as the design-flood discharge in Master Plan 1 in accordance with the flood prevention level of other rivers in the country. The design-flood discharge of the Widas River will be set at 25-year flooding.
- Identify the areas at risk of flooding and the extent of that risk.
- Develop a plan that accounts for balanced flood management for the entire basin.

[Interviewee: Dr. Mochammad Amron (Member of the IWRM Guidelines Steering Committee)]
[Interviewer: Mr. Toshiyuki Yoshioka, Mr. Hiroyoshi Tanaka (Japan Water Agency)]



### (1) Risk assessment

**[ Title ]**
Risk assessment

**[ Situation ]**
- In the 1950s, although flood prevention was the top priority, severe food shortages was also a national problem while electric power was needed for regional development. It had to be implemented in a phased manner in parallel with other development projects.

**[ Problem ]**
- Although the Brantas River Basin Development began in 1958, the basin suffered from almost annual floods causing severe damage, personal injury, crop damage, and losses to basin assets. This was due to the large amounts of volcanic debris and ash from Mount Kelud in 1951, which caused a gradation of the Brantas river bed and thus reduced the discharge capacity of the river.

**[ How the problem was overcome ]**
- Project priorities were economically evaluated by applying the B/C method. Flood control was selected for Master Plan I. Karangkates Dam and Kali Konto (Selorejo) Dam were considered the best B/C project as they mainly focused on flood control, but also power generation and irrigation.
- Project priorities were economically evaluated by applying the EIRR (Economic Internal Rate of Return) method and five projects were selected for Master Plan 2.
- As concerns flood control, the design-flood discharge was decided in view of the importance of the river (main and tributary reaches), the flood prevention levels of other Indonesian rivers, and the scale of the damage potential, as follows:
  - The main stream of the Brantas River: 10-year flooding is set as the design-flood discharge in the Master Plan I, and 50-year flooding is set in Master Plan 2.
  - Tributaries: a 10~25 year flood is set as the design-flood discharge in Master Plan I in accordance with the flood prevention level of other rivers in the country. The design flood of the Widas River will be set at 25-year flooding.
  - Identify the areas at risk of flooding and the extent of that risk.
  - Develop a plan that accounts for balanced flood management for the entire basin.

**[ The key ]**
**[1.1.1] Identify and prioritize the areas at risk of flooding and the extent of that risk in the basin.**
- The development projects listed in the Master Plan were economically evaluated using the B/C method and EIRR. Social conditions were also evaluated before establishing the implementation priorities among the projects.

**[ Conditions and limitations in applying the KFS ]**
- To have objective information about costs and benefits.

**(2) Coordination**

**[ Title ]**
Coordination

**[ Situation ]**
- Due to its unique topographic condition arising from a winding clockwise watercourse, and the eruption of Mount Kelud, which had caused the river bed to rise decreasing its flood capacity, floods occurred frequently. Vast fertile deltas offer ideal areas to plant food crops especially rice. The area has become a major food-producing region. Indonesia's second largest city is located downstream of the river and hence requires an important water supply for domestic purposes.

**[ Problem ]**
- The Brantas Basin has a large capacity to develop. Except for irrigation infrastructure in the early 1960s, no major infrastructure has been embarked upon to regulate water and collect water during the rainy season for use during the dry season. Today each provincial government manages its own water supply. The eruption of Mount Kelud in 1951 had the effect of raising the riverbed while decreasing its flood capacity. Frequent floods caused regular damage to the region, which in turn decreased rice productivity. Comprehensive development of the entire Brantas Basin should be prioritised together with community development, which must also be strengthened.

**[ How the problem was overcome ]**
- The development of the Brantas Basin began with a comprehensive multi-purpose project based on the concept 'One River, One Plan' and included multi-purpose dams and reservoirs which, among other things, improved flood control, irrigation, power generation, domestic and industrial water supply. A special inter-provincial and cross-sectoral institution, BRBDP, was set up to implement basin wide development run by central government.
- Following completion of these flood control measures, irrigation and other facilities, a special institution was set up for integrated water resources management. The Brantas River Basin Development Plan finally became committed to the principle 'One River, One Plan, One Integrated Management'.

**[ The key ]**
**[2.1.2] Ensure effective coordination and cooperation of interests among stakeholders.**
- The inter-provincial and cross-sectoral BRBDP was established.

**[ Conditions and limitations in applying the KFS ]**
- There were initiatives of the central government.



## 5.4 KENYA: NYANDO RIVER BASIN

| Facts | Ref. to KFS |
|---|---|

### 1. Background

Nyando River Basin, located in the southern part of Kenya, has a basin area of 3,625 sq. kilometers and its river flows into Lake Victoria. For the low-lying areas of the lower river (Kano plains), prior to flowing into the river, irrigation development is urgently required. This area is frequently hit by floods, causing direct damage to private homes, farm crops, domestic animals, public facilities as well as causing massive economic and human hardship including hygiene issues such as the spread of infectious diseases like malaria, cholera and typhoid among the vulnerable population mostly pregnant women and children.

There are approximately 44,000 residents (2003) living in this flood-prone area, and every year the flood affects a number of victims.

| Year | Number of victims | | | Flooded farmland (ha) |
|---|---|---|---|---|
| | Deaths | Evacuees | Affected | |
| 2002 | - | 10,000 | 28,650 | 3,090 |
| 2003 | 6 | 5,000 | 15,000 | 3,000 |
| 2004 | 6 | 400 | 10,000 | 4,000 |

**Table 5.4.1** Flood disaster damage

### 2. Strengthening the organizational capacity for flood control

The factors contributing to the increase of flood disasters in Nyando river basin include the population increase, the ageing public facilities, and land degradation in the basin (due to unrestrained logging and traditional cultivation practices in the upstream region). Floodplains were once used for agriculture and livestock pasturing but people began to occupy the area, which increased the impact of floods. Furthermore, the lack of maintenance and management of the river embankments also increased the risks.

**Fig. 5.4.1** Flow blockage by culverts

Culverts under roads were frequently blocked because of the accumulation of sediment, woods and other waste from upstream. Debris removal and improvement of the culvert by increasing its cross-sectional area to allow debris to pass or by replacing it with a bridge, was deemed necessary.

Despite the fact that floods were increasingly becoming a major issue, no competent organization specializing in flood management administration existed. Thus, in order to strengthen organizational capacity, it was decided to implement the following measures:

KFS-5.4 (1)

| Facts | Ref. to KFS |
|---|---|
| 1) A flood management unit was established within the head office of Water Resources Management Agency (WRMA).<br>2) An officer in charge of flood management was assigned to the office of Lake Victoria's southern basin region. | |
| **3. Developing a flood management plan**<br><br>Currently, priority projects are being selected and implemented while developing a flood management plan for the Nyando river basin. It aims to realize community-based flood management by proposing a process to secure transparency, and for community participation and consensus-building in the project implementation phase.<br><br>In addition, a flood management training plan was developed, and the National Disaster Operations Center (NDOC) is conducting studies on disaster status analysis and disaster management in collaboration with related government agencies and the military. The training plan is implemented on a regular basis for search/rescue activities | KFS-5.4 (1) |

**[References]**

Strategy for flood management for Lake Victoria Basin, Kenya (APFM, September 2004).
The development study for regional development programme in Nyando and Homa-Bay Districts in the Republic of Kenya (JICA, 2007).



## (1) Coordination and Planning

**[ Title ]**
Coordination and Planning

**[ Situation ]**
- Nyando River Basin is frequently hit by floods causing direct damage to private homes, farm crops, domestic animals, public facilities as well as causing massive economic and human hardship including hygiene issues such as the spread of infectious diseases like malaria, cholera and typhoid among the vulnerable population mostly pregnant women and children.

**[ Problem ]**
- The factors contributing to the increase of flood disasters in Nyando River Basin include the population increase, ageing public facilities, and land degradation in the basin (due to unrestrained logging and traditional cultivation practices in the upstream region).
- Lack of maintenance and management of the river embankments also increased the risks.

**[ How the problem was overcome ]**
- Despite the fact that floods were increasingly becoming a major issue, no competent organization specializing in flood management administration existed. Thus, in order to strengthen organizational capacity, it was decided to implement the following measures:
  1) A flood management unit was established within the head office of WRMA.
  2) An officer in charge of flood management was assigned to the office of Lake Victoria's southern basin region.
- Currently, priority projects are being selected and implemented while developing a flood management plan for the Nyando River Basin. It aims to realize community-based flood management by proposing a process to secure transparency, and for community participation and consensus-building in the project implementation phase.
- In addition, a flood management training plan was developed, and NDOC is conducting studies on disaster status analysis and disaster management in collaboration with related government agencies and the military. The training plan is implemented on a regular basis for search/rescue activities and flood evacuation.

**[ The key ]**
**[2.1.2] Ensure effective coordination and cooperation of interests among stakeholders.**
**[2.2.1] Develop a plan for balanced flood management in the entire basin.**
- Without a competent organization specialized in flood management administration it is impossible to reduce flood damage.
- It is also important to develop maintenance and training plans.

**[ Ideas for enhancing the applicability of the KFS ]**
- Establishment of an organization specialized in flood management.
- Development of a flood-management training plan.

## 5.5 OTHER EXAMPLES

### 5.5.1 Argentina

**(1) Information-sharing**

**[ Title ]**
Information-sharing

**[ Situation ]**
Operation and maintenance of dams and dam safety as a matter of concern.

- A series of significant hydropower schemes including large dams has been constructed since the end of the 1960s. The dams have played an important role in the development of the area and of the whole country. The dimensions of these dams and reservoirs upstream have made dam safety a relevant issue in the community. During 25 years, the Federal Government, through its state-owned corporation Hidronor S.A., was in charge of the design, construction, and operation of the hydraulic developments of the region, including dam safety issues.

**[ Problem ]**
Privatization and division of the operation of hydropower schemes.

- As a result of the modernizing reforms and the re-structuring of national assets being carried out by the Federal Government, operations of the Comahue region hydropower schemes were privatized in 1993.

**[ How the problem was overcome ]**
Establishment of a special agency for dam safety and the promotion of information-sharing.

- On the basis of an agreement between the Federal Government and the provincial governments of Río Negro, Neuquén, and Buenos Aires, the *Organismo Regional de Seguridad de Presas Comahue* (ORSEP Comahue) (Dam Safety Regional Bureau Comahue) was created by National Executive Decree. This new institution, the first of its kind in Argentina, is responsible for the technical regulatory functions and the supervision of the structural safety of the dams and reservoirs in the region, and is, therefore, the body responsible for enforcing compliance with the structural norms and standards, as determined by the concessionary contracts drawn up by the Federal Government and the private international consortia.
- The setting up by the state of a specific organization for dam safety supervision and regulation of the large hydropower complex of the Comahue region has been an important institutional development in Argentina. The new system, comprising a state regulatory entity and private concessions, has demonstrated significant improvements in dam safety supervision, implementation of remedial work, and emergency action plans.
- In addition to regulation and supervision, ORSEP pays special attention to communication in order to allow people to familiarize themselves with dam safety conditions. ORSEP disseminates dam safety information and promotes educational activities such as the installation of signs in residential areas indicating evacuation procedures, as well as producing several booklets and conducting field studies for school students. Experience has shown that this policy has had a more positive effect than the lack of information that existed in the past.

**[ The key ]**
**[3.2.4] Inform residents of risks as soon as possible at the time of flooding.**

- Sharing information facilitates IWRM activities by raising awareness and promoting the participation of stakeholders and the public.

**[ Conditions and limitations in applying the KFS ]**

- Promoting information disclosure and educational activities to facilitate public awareness needs funding at a certain level.

**[ Ideas for enhancing the applicability of the KFS ]**

- Prepare a funding mechanism to secure continuity and sustainability.

**[ Reference ]**
Dam safety in the Comahue Region of Argentina, F. L. Giuliani and C.A. Yema, Organismo Regional de Seguridad de Presas del Comahue-ORSEP Comahue (ORSEP, 1998).



### 5.5.2 Bangladesh

**(1) Stakeholder participation**

**[ Title ]**

Stakeholder participation

**[ Situation ]**

- Due to its unique geographical location and topography, Bangladesh is one of the most flood-prone countries in the world. It is affected by flash floods, rain-fed and river floods, and floods due to cyclonic storm surges. Approximately 20–25 per cent of Bangladesh's territory is inundated during the monsoon season. Such flooding provides fertile agricultural land, and the floodplains in Bangladesh are densely populated and intensely utilized. On the other hand, during the last half-century at least eight extreme flood events occurred affecting about 50–70 per cent of Bangladesh's territory with far reaching negative impacts on human life and the national economy.

**[ Problem ]**

- Although government-led structural and non-structural flood control measures were implemented, the country still faced frequent flood damages including loss of human lives. Stakeholder involvement was therefore necessary to effectively implement flood control measures.

**[ How the problem was overcome ]**

- To involve all kinds of stakeholders both at national and local levels, the government has updated the guidelines for participatory water management. As a result of this response, public consultation has been made compulsory for any flood management project.
- Some pilot studies have recently been completed to ensure effective public participation in dissemination as well as in flood preparedness activities at the community level. In three pilot areas, base line surveys were initially conducted to understand the perception of the people regarding floods, flood information and preparedness. Based on these surveys, methodologies were developed for constituting a Community Based Organization (CBO) for flood management. Intensive consultation and training were conducted for the local people to develop their capacity for dissemination of flood information and preparedness. It was found that the pilot area studies were very useful to develop a nationwide flood preparedness program.

**[ The key ]**

**[2.1.1] Understand in advance the roles and responsibilities of stakeholders in the basin.**

- Make public consultation compulsory for any flood management project.

**[ Ideas for enhancing the applicability of the KFS ]**

- Conduct base line surveys to understand the perception of people regarding floods, flood information and preparedness.
- Consultation and training for local people.

**[ Reference ]**

The Associated Programme on Flood Management, Case study in Bangladesh.
(http://www.apfm.info/pdf/case_studies/cs_bangladesh.pdf)

**(2) Regulation of activities**

**[ Title ]**

Regulation of activities

**[ Situation ]**

- Due to its unique geographical location and topography, Bangladesh is one of the most flood-prone countries in the world. It is affected by flash floods, rain-fed and river floods, and floods due to cyclonic storm surges. Approximately 20–25 per cent of Bangladesh's territory is inundated during the monsoon season. Such flooding provides fertile agricultural land and the floodplains in Bangladesh are densely populated and intensely utilized. On the other hand, during the last half-century at least eight extreme flood events occurred affecting about 50–70 per cent of Bangladesh's territory with far reaching negative impacts on human life and the national economy.

**[ Problem ]**

- Flood control measures have been implemented in Bangladesh over the past fifty years, and a variety of structural measures were implemented. However, in spite of all the structural activities, it was found that the people living in the medium-high and medium lowlands are not safe from flooding during moderate to extreme flood events.

**[ How the problem was overcome ]**

- The government placed more emphasis on non-structural means for flood mitigation, in particular by adopting a policy of involving communities in flood management. The government then decided to control developments in the flood plains, for instance, by legislating.
- In addition, the government introduced a new concept of control-flooding that took in consideration stakeholders instead of making some areas completely flood-free.
- A pilot project was set up on the basis of this concept, which is known as the Compartmental Pilot Project (CPP) Tangail.
- The project was divided into several units on the basis of land topography and micro-hydrological zoning. In this pilot project, flooding was allowed in some units, as decided by the stakeholders through consultation among themselves.

**[ The key ]**

**[3.2.2] Prevent actions/activities that cause negative consequences with regards to flood management in coordination with basin stakeholders.**

- Control the developments in the flood plains, for instance, by legislating.

**[ Ideas for enhancing the applicability of the KFS ]**

- Legislative measures to stop encroachments on the flood plains.

**[ Reference ]**

The Associated Programme on Flood Management, Case study in Bangladesh
(http://www.apfm.info/pdf/case_studies/cs_bangladesh.pdf)



### (3) Crisis management

**[ Title ]**
Crisis management

**[ Situation ]**
- Bangladesh is located in the world's largest delta formed by the Ganges, Brahmaputra, and Meghna rivers. Most of Bangladesh lies in lowland, nine meters below sea level. Twenty per cent of the land is flooded during the monsoon season causing significant flood damage. Thus, disaster counter measures are an important national issue. Powerful Cyclone Sidr hit southwestern Bangladesh in November 2007 and caused extensive damage to the country, leaving 3,363 people dead and 871 people missing. The number of victims totaled 8,920,000, and some 560,000 houses were totally destroyed.

**[ Problem ]**
- 30 of the 64 districts in Bangladesh suffered damage from Cyclone Sidr – one of its most powerful cyclones ever. The four most damaged districts were Patuakhali, Barguna, Pirojpur, and Bagerhat. These districts were not equipped with enough cyclone shelters and many residents were unable to evacuate.

**[ How the problem was overcome ]**
- The government of Bangladesh requested the Japanese government to construct multi-purpose cyclone shelters. The Japanese government approved the Programme for Construction of Multi-purpose Cyclone Shelters in the area affected by Cyclone Sidr, through a disaster prevention and reconstruction assistance grant funding cooperation.
- This programme plans to construct 38 cyclone shelters in the four above-mentioned districts. New shelters will provide refuge for about 61,000 people during a disaster. These shelters will be used as schools during normal times, providing an opportunity to improve the educational environment in addition to increasing readiness for disaster. Hence, there are great expectations for these cyclone shelters.

**[ The key ]**
**[3.2.5] Prepare a framework/system that can execute crisis management in a basin.**
- The shelter can be used for evacuation and education for disaster reduction.

**[ Conditions and limitations in applying the KFS ]**
- Could lead to the formation of concrete projects immediately.

**[ Reference ]**
Website of the Japan International Cooperation System
(http://www.jics.or.jp/jigyou/musho/bousai/bangladesh_200808.html)
Website of the International Centre for Water Hazard and Risk Management
(http://www.icharm.pwri.go.jp/html/research/pdf/pdf_0706/bang_e.pdf)

### 5.5.3 China
### (1) Financing

**[ Title ]**
Financing

**[ Situation ]**
- China has been frequently hit by massive floods and has suffered flood disasters. The critical issue is that about 8 per cent of the land area located in the middle and downstream of the seven major rivers is prone to floods, where 50 per cent of the total population live and contribute over two-thirds of total agricultural and industrial production.

**[ Problem ]**
- One of the big issues in the water sector, as with other sectors, is the lack of funds for the construction of new projects, the renewal and rehabilitation of available projects, and even for operation and maintenance. Capital investment to the water sector has for a long time been kept at a very low level, i.e. 2–3 per cent of total capital investment of central government.

**[ How the problem was overcome ]**
- Since the 1980s, a new approach to fund-raising has been promoted in all economic sectors in order to secure stable funding sources. In the past the flood control program and other resources development programs were mainly funded by central government, the new system introduces contributions from government at all levels. In addition, the new system tries to mobilize funds from multiple sources through loans, bonds, stocks, and foundations in addition to government appropriation. The new system encourages investment from enterprises, the private sector, foreign investors, and farmers in the form of labour contributions.

- The new system is set up as follows:
  - Central and local governments (mainly provincial governments) share investments via appropriation for major projects of the seven major river basins with a specified ratio according to the size of the projects and the division of respective rights and responsibilities. For those projects whose impact is concentrated within one province, they are mainly funded by local governments.
  - In the 1990s the special fund for flood control was established for local governments to fund local flood projects.
  - Since 1992 a special funding system has been established in a number of administrative regions so that the fund is also generated from beneficiaries. A substantial funding contribution for the construction of the Huang Pu River dyke was raised from riparian enterprises. About 400 million yuan was generated in Huaihe River Basin within a six-year period.

**[ The key ]**
**[5.1.3] Continue stable investment for flood management with a long-term perspective.**
- Make it possible to collect funds from multiple sources.

**[ Ideas for enhancing the applicability of the KFS ]**
- Mobilize funds from multiple sources through loans, bonds, stocks, and foundations in addition to government appropriation.

**[ Reference ]**
The Associated Programme on Flood Management, Case study China: Flood Management (http://www.apfm.info/pdf/case_studies/cs_china.pdf)

### 5.5.4 Costa Rica

**(1) Risk assessment**

**[ Title ]**

Risk Assessment

**[ Situation ]**

- Turialba city is at risk from at least two hazardous phenomena, namely seismic hazard and flood hazard. The last major earthquakes to hit the surrounding areas of Turialba occurred in Limon 1991 and in Pejibaye in 1993 causing much alarm and heightened awareness of the potential risks to the major urban area. (Lamadrid, 2002). Heavy rainfall is a common natural phenomenon in the Turialba city and this causes flash floods of the Colorado River, the Gamboa Stream and other small watercourses.

**[ Problem ]**

- It is necessary to carry out risk assessment in order to estimate the potential damage of a particular hazard.

**[ How the problem was overcome ]**

- Risk assessment for seismic and flood hazards was carried out using state-of-the-art GIS. GIS (software package) tools are required to create a model, make evaluations, and calculate a return period of the particular hazardous phenomenon in question. In dealing with the assessment of seismic and flood hazards, the following objectives were established:
  - To generate hazards maps for different return periods.
  - To identify the element of risk and estimate the vulnerability value.
  - To calculate the damage and assess the risk due to the hazard in question.

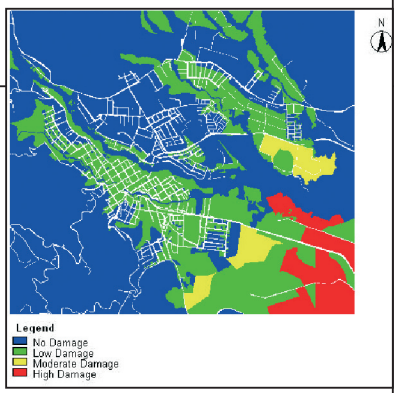



**Fig. 5.5.1** Annual expected damage maps

**[ The key ]**

**[1.1.1] Identify and prioritize the areas at risk of flooding and the extent of that risk in the basin.**

- GIS technology represents a great advantage especially in terms of damage calculation, vulnerability and risk analysis.
- Incorrect distribution of damage value of flood hazard can be avoided by using detailed information in map analyses and table calculations, paying more attention to agricultural areas.

**[ Ideas for enhancing the applicability of the KFS ]**

- Risk assessment for seismic and flood hazards using state-of-the-art GIS.

**[ Reference ]**

Vulnerability Analysis And Risk Assessment For Seismic And Flood Hazard In Turialba City, Costa Rica (The UNESCO-RAPCA project, 2000)
(http://www.itc.eu/external/unesco-rapca/Informes%20estudiantes%20ITC/Analisis%20de%20riesgo%20en%20Turrialba%20Costa%20Rica/Risk%20assessment.pdf)

### 5.5.5 Japan

**(1) Risk assessment**

**[ Title ]**

Risk assessment

**[ Situation ]**

- Kitakami River running through the central part of Iwate Prefecture is the largest river in the Tohoku region of Japan. The width of the river channel in its upstream section is approximately 250 meters, but it has a lack of capacity to stream large floods in the midstream section where the channel width is only 100 meters and with a narrow valley 28 km in length.

**[ Problem ]**

- The midstream section had a lower discharge capacity than the downstream section and there was a delay in levee development. The area often suffered from flood disasters.

**[ How the problem was overcome ]**

- Examining the progress status of the flood control project and the status of flood damage occurence identified locations exposed to the risk of flooding.

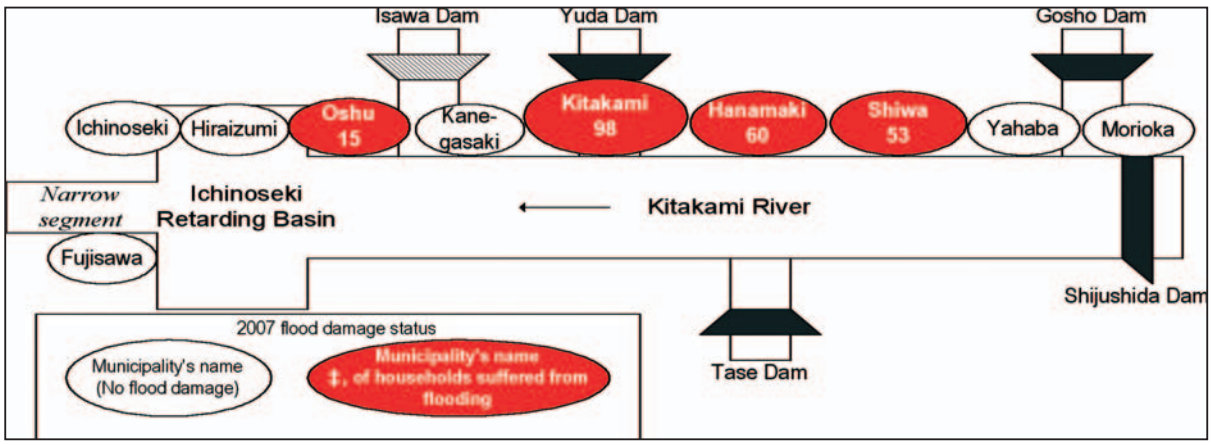



**Fig 5.5.2** Progress status of the flood control project

**[ The key ]**

**[1.1.1] Identify and prioritize the areas at risk of flooding and the extent of that risk in the basin.**

- Evaluating the progress status of the flood control projects and the status of flood damage occurrence identified that areas at risk of flooding.

**[ Conditions and limitations in applying the KFS ]**

- Information on the sequence of flood control projects implemented in the basin and their progress is available.
- Information on flood damages occurring in the basin is available.

**[ Ideas for enhancing the applicability of the KFS ]**

- Database that records all flood control projects in the basin in an inter-annual manner.
- Information dissemination mechanism that reports the status of flood damage immediately after its occurrence.

**[ Reference ]**

Website of the Iwate Office of River and National Highway, Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan.
(http://www.thr.mlit.go.jp/iwate/kawa/seibi_keikaku/dai3/image/dai3_siroyu2.pdf) (in Japanese)



### (2) Capacity building

**[ Title ]**
Capacity building

**[ Situation ]**
- Japan is highly exposed to flooding due to its natural and social environments and floods occur every year throughout the country as a result of heavy rain and typhoons.

**[ Problem ]**
- When Japan was hit by Typhoon Number 10 in 1986, the strenuous effort by communities to minimize flood damage was publicized and led to the further realization that community-led flood fighting was extremely important. It was considered critical to ensure that every citizen understood the significance and importance of flood fighting as well as to continue to improve the level of their awareness towards flood fighting activities.

**[ How the problem was overcome ]**
- In Japan, May (June in Hokkaido) is set as the flood-fighting month as flood season generally begins after this month. During this period, comprehensive flood drills are organized throughout the country and local residents, corporations, disaster prevention stakeholders and NGOs participate in them.
- A flood drill provides training concerning information communication, river patrolling, and flood-fighting construction techniques/skills.

**[ The key ]**
**[1.2.1] Conduct regular training, and make use of local experience and technologies.**
- In the case of Japan, a flood-fighting framework has been established and the techniques and capacities for flood-fighting are being developed through training.

**[ Conditions and limitations in applying the KFS ]**
- Relevant organization is required by law – Flood Fighting Law – to conduct the flood drills every year in Japan.

**[ Ideas for enhancing the applicability of the KFS ]**
- Mechanism for transferring skills across generations.

**[ Reference ]**
Website of the Ministry of Land, Infrastructure, Transport and Tourism, Japan.
(http://www.mlit.go.jp/report/press/river03_hh_000015.html) (In Japanese).

### (3) Technology development

**[ Title ]**
Technology development

**[ Situation ]**
- In the past, people in Japan knew how to live with floods without large-scale facilities.
- In postwar Japan however, modern flood control engineering was introduced where continuous levees are constructed to channel floodwater downstream.

**[ Problem ]**
Construction of continuous levees had become the standard flood control technique employed in Japan. However, their limitation was recognized as they take a long time to complete, and such measures alone cannot completely prevent flood damage. Recent changes in social values had also prompted needs for addressing not only flood issues but also the preservation of diverse functions of rivers.

**[ How the problem was overcome ]**
- It was recognized that accepting some level of inundation while minimizing their negative impacts is important for flood risk management, leading to the reappraisal of traditional flood control techniques.

  *Kasumitei*

  *Kasumitei* is a group of discontinuous levees that form a duplex structure upstream and downstream. Floodwater is temporarily retained in the gaps between the levees to reduce the volume of water rushing downstream.

- Since traditional flood control techniques such as *seigyu* use natural materials instead of concrete, they create harmony with the surrounding environment. Its rugged surface promotes plant growth in their natural habitats over time and provides a home for such burrowers as shrimps and eels. Such traditional flood control techniques create an ecologically sound river environment.

  *Seigyu*

  *Seigyu* is a pyramid shaped structure designed to slow the river flow toward the bank and levee and change its direction to prevent erosion. It was used in many rapid flow rivers because of its simple and stable structure.

- There is increasing awareness on the need for new flood control approaches in order to avoid the devastating flood damage that has recently occurred in and outside of the country. There is also increasing awareness for seeking more environmentally sound flood control solutions while promoting unique community planning through integrating river and urban development by means of looking at the entire basin and water cycle rather than only looking at the river channel.

**[ The key ]**
**[1.2.2] Develop technology that fully reflects local conditions.**
- Applied methods that have been traditionally conducted in the basin.

**[ Conditions and limitations in applying the KFS ]**
- The guidelines have been prepared for the traditional method.

**[ Reference ]**
Website of the Kofu Office of River and National Highway, Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan
(http://www.ktr.mlit.go.jp/koufu/kawa/dento/) (in Japanase)



### (4) Stakeholder participation

**[ Title ]**
Stakeholder participation

**[ Situation ]**
- Geographical features of the area make it difficult to implement flood control measures. The flood safety level remains low, even after the completion of the Special Emergency Project for the Relief from Severe, Natural Disaster in Rivers implemented in the wake of floods in 1995.
- Waterfront community events and tourist attractions are often held.
- The river is lined with many trees that are planted to protect against flood damage, and which provide habitats for diverse plants and animals.
- Increasing pollutant load in the basin is damaging the water quality of existing dams.
- Downstream flow volume is significantly affected by water discharge of existing dams for hydraulic power generation.

**[ Problem ]**
- The revised River Law that went into effect in 1997 requires the opinion of relevant prefectural governors or municipal mayors for developing a river improvement plan to resolve the issues noted above. It also requires both expert opinion and public opinion in such plans when necessary. The challenge was how to incorporate the opinions of various stakeholders in a river improvement plan for solving the above mentioned problems.

**[ How the problem was overcome ]**
Basin committee meetings were held.
- The committee met four times during the period from October 31, 2003 to March 22, 2004, to finalize river improvement plan.
- Principle of disclosure (open-door meetings, disclosure of information via website).
- Committee members include academic experts and relevant municipal mayors.

Basin residents' opinions were collected.
- Via postcards and Internet (582 respondents).
- Five opinion exchange sessions were held (758 participants).
- Public hearings were held (10 attendants, 175 observers).
- Information centre (143 participants).
- Four on-site workshops were held (160 participants).

**[ The key ]**
**[2.1.2] Ensure effective coordination and cooperation of interests among stakeholders.**
- From more people, to hear more opinions, and try to secure more opportunities.

**[ Conditions and limitations in applying the KFS ]**
- It is clear that the primary responsibility of the entire basin lies with central government.

**[ Reference ]**
Ozu River & Road Office, Ministry of Land, Infrastructure, Transport and Tourism, Japan. (http://www.skr.mlit.go.jp/oozu/index.html) (In Japanese).

**(5) Maximized benefit**

**[ Title ]**
Maximized benefit

**[ Situation ]**
- Kitakami River running through roughly the central part of Iwate Prefecture is the largest river in the Tohoku region of Japan. Expected population increases and economic development in the region such as high-speed railways and highways, were under development.

**[ Problem ]**
- Both the upstream and midstream sections were subject to frequent flooding as their discharge capacity was lower compared to the downstream section, for which adequate levees were developed at an early stage.

**[ How the problem was overcome ]**
- Five dams and flood control basins were built targeting the main stream and tributary streams.
- Each facility has been designed as a multi-purpose facility.
- Covering the midstream to upstream sections, these multi-purpose dams were designed not only to control flooding but also to supply water for power generation and agricultural purposes as well as for domestic uses. These dams significantly contribute to the region, which has been a farm belt since ancient times and has been enticing businesses to develop industrial areas and provide industrial supplies.

**[ The key ]**
**[3.2.1] Implement measures that maximize the benefits of the basin as a whole.**
- The benefits to the entire basin were considered, not only in terms of the reduction in flood damage but also water use and its impact on basin development.

**[ Ideas for enhancing the applicability of the KFS ]**
- Basin master plan and infrastructure development plan for the basin exists.
- An organization or an entity that can oversee the basin as a whole and implement necessary measures.

**[ Reference ]**
Website of the Kitakami River Integrated Dam Management Office, Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan.
(http://www.thr.mlit.go.jp/kitakato/) (In Japanese)



### (6) National strategy

**[ Title ]**
National strategy

**[ Situation ]**
- Since the end of World War II (1945), there had been an average of 1,000 natural disaster victims almost every year in Japan.
- In September 1959, Typhoon Isewan hit the areas around Nagoya resulting in 5,098 missing or dead and devastated the Chukyo Industrial Area, which had been recovering from the war.

**[ Problem ]**
- The level of flood damage caused by Typhoon Isewan was notably high and a wide range of areas centred around Nagoya were devastated by tidal surges and severe storms leaving postwar Japan in turmoil.
- The lessons learned from Typhoon Isewan, which revealed the weak points of the Japanese disaster prevention administration, came to light and it was largely recognized that the capacity of the administration needed to be fundamentally improved.

**[ How the problem was overcome ]**
- The lessons learned from Typhoon Isewan revealed inadequacies in the conventional disaster prevention system and the establishment of a basic law was increasingly required to develop a comprehensive and well-planned disaster prevention system. The Disaster Measures Basic Law was accordingly established in October 1961, two years after Typhoon Isewan.
- The Disaster Measures Basic Law was considered revolutionary as it specified a systematic framework to carry out comprehensive and structured national disaster prevention initiatives concerning damage caused by winds, floods and earthquakes alongside individual measures carried out based on related laws.
- The government was mandated to annually report on the disaster plans to parliament and any flood prevention/mitigation measures were implemented. It ensured that the disaster mitigation be discussed as an important subject in parliament even in a year without many disasters. This also led to the establishment of a 'Special committee for disasters' in both upper and lower houses of parliament.

**[ The key ]**
**[5.1.1] Position flood management within the national strategy.**
- Government is required to annually report to parliament on disaster management.

**[ Conditions and limitations in applying the KFS ]**
- The importance of flood management was widely recognized in its history of experiencing flood disasters.

**[ Ideas for enhancing the applicability of the KFS ]**
- Raise public awareness on the importance of flood control.

**[ Reference ]**
Satoru NISHIKAWA, Director for Disaster Preparedness, Public Relations and International Cooperation, Cabinet Office, Government of Japan, International Association of Traffic and Safety Sciences.
(http://www.iatss.or.jp/review/32-2/pdf/32-2-05.pdf) (In Japanese)

### (7) Financing

**[ Title ]**
Financing

**[ Situation ]**
- In the beginning of the Meiji Period, Japan was frequently exposed to serious flood damage caused by the major rivers. The establishment of comprehensive flood control measures was urgently required and, as a result, the River Law was established in 1896 forming the foundation of the modern flood control system.
- After a major flood event that took place in 1910, flood control projects, to build continuous levees in the areas exposed to risks of flooding, were planned.
- However, not much progress was seen in the flood control projects as World War II was soon to break out.

**[ Problem ]**
- As the above flood control project made little progress during the war, serious flood damage occurred on a frequent basis. The postwar devastated land was hit by a series of major typhoons including Typhoon Kathleen in 1947.
- Based on the lessons learned from repeated flood damage, the importance of comprehensive and well-planned flood control projects to be carried out over a long period of time became increasingly recognized.

**[ How the problem was overcome ]**
- As a result of Typhoon Isewan in 1959, which saw devastating flood damage (5,098 missing and dead), the Soil Conservation and Flood Control Urgent Measures Act and the Flood Control Special Accounting Law were established in 1960 to introduce the first-ever statutory flood control projects that would span a long period of time (either five or ten years).
- The establishment of these laws has enabled flood control projects to be carried out over a long period of time with adequate financial support.

**[ The key ]**
**[5.1.3] Continue stable investment for flood management with a long-term perspective.**
- The long-term plan was formulated based on the law related to flood control.

**[ Ideas for enhancing the applicability of the KFS ]**
- Framework for preparing and evaluating long-term financial plans.

**[ Reference ]**
Website of the Ministry of Land, Infrastructure, Transport and Tourism, Japan.
(http://www.mlit.go.jp/river/trash_box/singi/to-1.html) (In Japanese).

### 5.5.6 Laos

**(1) Technology development and application**

**[ Title ]**

Technology development and application

**[ Situation ]**

- Laos faced massive erosion along the Mekong River around Vientiane by 1990.

**[ Problem ]**

- Gabion works were constructed in 1990 with the aid of donors. However, the cost was high due to the use of imported materials, therefore low-cost sustainable measures were needed.

**[ How the problem was overcome ]**

- The feasibility of sustainable and low-cost riverbank protection techniques appropriate for the Mekong River using Japanese river work technology was investigated. The river protection technique noted above was transferred to the Ministry of Communication Transport Post and Construction's (MCTPC) counterpart through pilot works. A master plan for Mekong riverbank protection around Vientiane was also formulated.
- *Method*: Environment friendly riverbank protection via the soda method, a traditional Japanese riverbank protection method, was used.
  - This method was introduced and developed in Japan by Dutch engineers in the early years of the Meiji era (1868–1912). Soda-mattress work applied to foot protection is so flexible that it is less influenced by fluctuations of the riverbed. It is suitable for foot protection and foot protection dikes for slow-flowing rivers.
  - Materials used for fascines are mainly broadleaf trees, which are readily available locally, hard and tough wood such as chestnut, oak, live oak, and sawtooth oak, as well as flexible and sticky wood such as Japanese snow bell, Japanese rowan, magnolia, maple, cherry, lindera, maruba mansaku (*Hamamelis japonica* var. *obtusata*), and Japanese clethra, which have adapted to the harsh arctic climate.

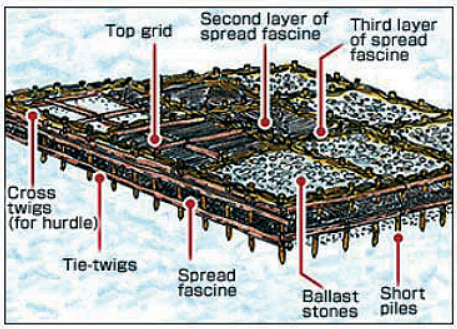



**Fig 5.5.3** River protection technology

**[ The key ]**

**[1.2.2] Develop technology that fully reflects local conditions.**

- Use of low-cost domestic methods and materials is important for sustainable development.

**[ Ideas for enhancing the applicability of the KFS ]**

- Environment friendly riverbank protection via the soda method.

**[ Reference ]**

The Project on Riverbank Protection Works (JICA).
(http://project.jica.go.jp/laos/0245124E0/english/01/index.html)

### 5.5.7 Thailand

**(1) Information-sharing**

**[ Title ]**
Information-sharing

**[ Situation ]**
- In Thailand, flooding occurs because of tropical disturbances, typhoons or a combination of the two. The heavy rainfall swells the rivers, which burst their banks or creates severe flooding conditions along the tributaries from backwater effects. Flooding in the river basins in Thailand is often severe. Urban areas along the mainstream are regularly flooded. The peak flood period lasts from early June in the north to early December in the south.

**[ Problem ]**
- Although various measures were taken to reduce damage from frequent flooding, loss of lives and properties still occured each year. In 2004, 398 villages were identified as under high risk from floods and mudslides, and urgent measures were required for these villages.

**[ How the problem was overcome ]**
- Data of rainfall, runoff and water level have been collected particularly for these areas, and an early warning system was set up for each village.
- The system provides a simple rainfall measurement station, which automatically records and transmits information on rainfall levels. When recorded levels of rainfall in a given time reach a critical level (i.e. likely to present a danger) the system will automatically transmit signals to the responsible persons in the potentially affected regions.
- Each locality has a trained person qualified to act under these circumstances to alert other villagers informing them of the steps to take for their safety.
- The data is linked to the Water Crisis Prevention Center at the national level.

**[ The key ]**
**[3.2.4] Inform residents of risks as soon as possible at the time of flooding.**
- Install the early warning system and deploy the trained person to act quickly so as to alert other villagers.

**[ Ideas for enhancing the applicability of the KFS ]**
- Flood warning system that automatically transmit signals to the persons in charge.

**[ Reference ]**
United Nations Educational Scientific and Cultural organization
World Water Development Programme
National Water Development Report: Thailand
(http://www.unesco.org/water/wwap/wwdr/wwdr2/case_studies/pdf/thailand_full_cs.pdf)



### 5.5.8 Uganda

**(1) National strategy**

**[ Title ]**

National strategy

**[ Situation ]**

- Uganda's economy and level of development has been steadily improving mainly through the utilization of its abundant natural resources. The thrust of her development policies lies in socio-economic transformation through the modernization of agriculture and industry. At the same time, Uganda has a high population growth rate with the population almost doubling every ten years. Alongside the development process, Uganda has witnessed both human and naturally induced disasters, yet it has obvious gaps in its approach to the reduction, prevention, and response to disasters. As a result, national development gains are at risk. The key gaps are in institutions, risk identification, knowledge management, governance, and emergency response.

**[ Problem ]**

- In accordance with the 1981 African Charter on Human and Peoples Rights, the government is responsible for guaranteeing their citizens the right to a dignified life, which embraces 'the right to life' of individuals threatened or affected by disaster, i.e. the right to have steps taken in order to preserve life when threatened'.

**[ How the problem was overcome ]**

- The National Disaster Risk Reduction and Management Policy, working in harmony with her mid-and long-term development ambitions and strategies, was established. The Office of the Prime Minister shall prepare guidelines for operationalizing this policy.
- This policy includes;
  - Institutional framework.
  - Strategies mechanisms.
  - Cross-sectoral linkages.
  - Legal framework.
  - Monitoring and evaluation.

**[ The key ]**

**[5.1.1] Position flood management within the national strategy.**

- The National Disaster Risk Reduction and Management Policy, working in harmony with her mid-and long-term development ambitions and strategies, was established.

**[ Ideas for enhancing the applicability of the KFS ]**

- Establishment of The National Disaster Risk Reduction and Management Policy.

**[ Reference ]**

Uganda , 2007, The National Disaster Risk Reduction and Management Policy.
(http://www.ugandaclusters.ug/dwnlds/0502Programs/DisasterPrep/UgandaDRRMPolicy.pdf)

# 6. Useful Tools for Flood Management

## 6.1 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 quick and safe evacuation of residents and minimizing damages in the event of flooding.

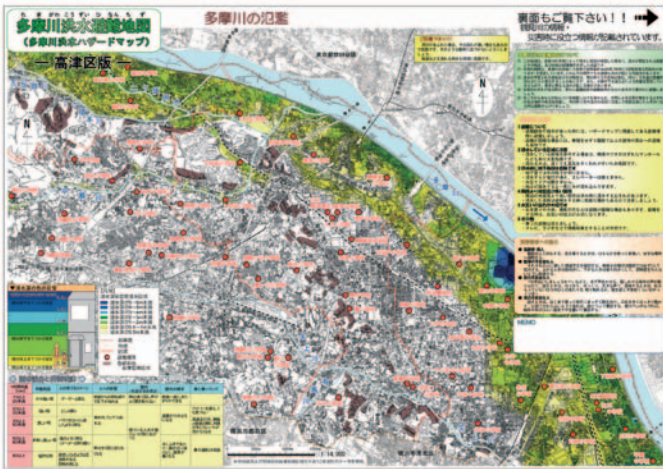



**Fig. 6.1.1** Tama River Flood Hazard Map for Takatsu Ward, Kawasaki [Source: Kawasaki City web site]

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.

**Fig. 6.1.2**
[Source: Ministry of Land, Infrastructure, Transport and Tourism River Bureau web site]

**Fig. 6.1.3** Had Yai, Thailand

## 6.2 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.

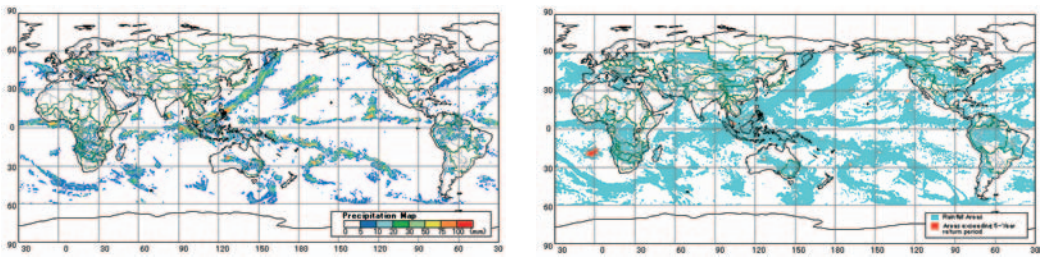


**Fig. 6.2.1** World precipitation map and hazard areas
[Source: Infrastructure Development Institute – Japan web site
http://www.internationalfloodnetwork.org/
http://gfas.internationalfloodnetwork.org/gfas-web/]

The IFAS (Integrated Flood Analysis System) implements interfaces to input ground-based and satellite-based rainfall data, GIS functions to create river channel networks, and estimates the parameters of a default runoff analysis engine and interfaces to display output results.

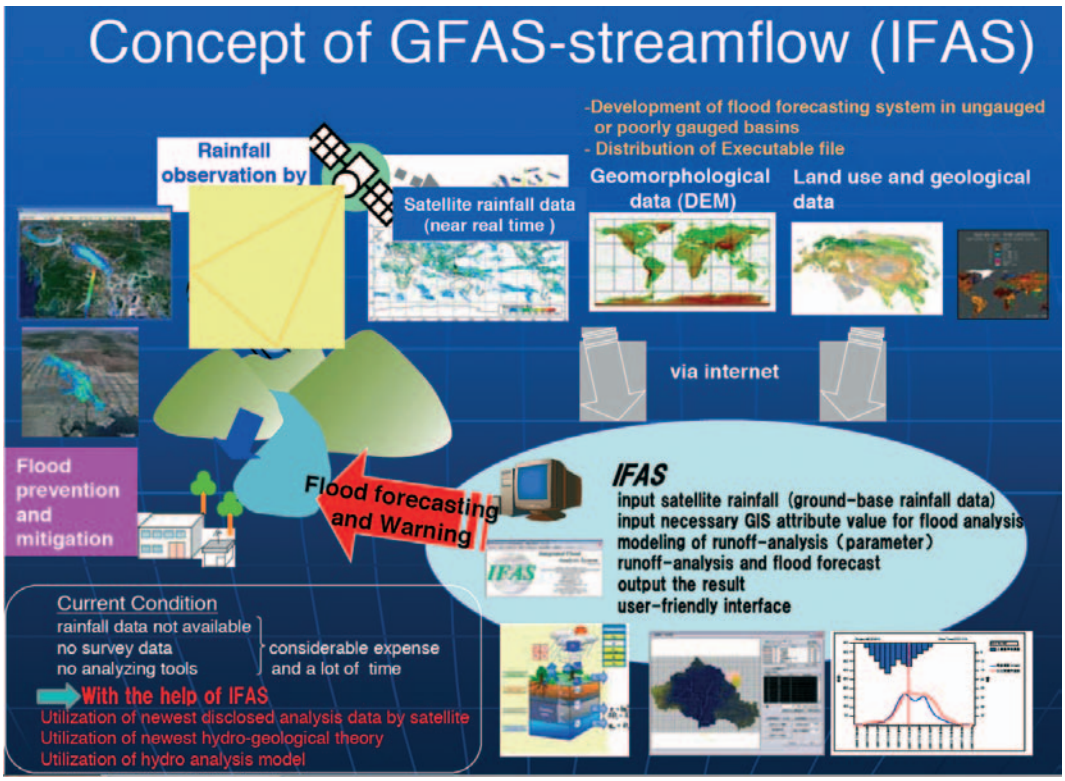



**Fig 6.2.1** Concept of GFAS-streamflow (IFAS)
[http://www.icharm.pwri.go.jp/]

## 6.3 TRAINING OF DISASTER CRISIS MANAGEMENT

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

**Fig 6.3.1**
[Source: Foundation of River & Basin Integrated Communications, Japan web site]

**Fig 6.3.2**
[Source: Hokkaido Regional Development Bureau's Ishikarigawa Development and Construction Department web site]

## 6.4 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.

**Fig 6.4.1** Joint Flood - fighting Drill in the Tone River Basin
[Source: Edogawa River Office web site]

## 6.5 WORKSHOPS FOR PREPARING APPROPRIATE HAZARD MAPS

Conducting workshops on how to prepare or utilize hazard maps targeting local flood and disaster managers will 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.

**Fig 6.4.2** Workshops for making hazard map
[Source: Public Works Research Institute ICHARM web site]



## 6.6 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 to life due to extreme hydrological events.
[http://www.apfm.info/index.htm]

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