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# **Roadmaps for river basin development**

**by**

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Contributions are most welcome - in English or in Bahasa Indonesia.

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## Acknowledgement

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## Summary

An action-oriented, IWRM-based river basin development roadmap is a powerful tool for social, economic and environmental progress. It can provide a clear and agreed sense of direction, illustrate the relations between various development initiatives, and assure that gaps and overlaps are sorted out. Also, the roadmap provides guidance on implementation.

The present paper introduces the rationale of development roadmaps, illustrated by two examples - a small one and a comprehensive one.

## **Acronyms and abbreviations**

APWF:	Asia-Pacific Water Forum
CRBOM:	Centre for River Basin Organizations and Management
IWRM:	Integrated water resources management
JICA:	Japan International Cooperation Agency
MDG:	Millennium development goal/goals
NARBO:	Network of Asian River Basin Organizations
NGO:	Non-governmental organization
PPTA:	Project preparatory technical assistance (ADB terminology)
RBO:	River basin organization
RETA:	Regional technical assistance (ADB terminology)
SEA:	Strategic social and environmental assessment
TA:	Technical assistance (ADB terminology)

## Glossary

**Action plan:** An operational description of '*what to do, who will do it, and when*'; and sometimes also '*how to do it*'; in order to reach a goal. An action plan can also contain a budget, and criteria and indicators for progress monitoring. It can be structured into an hierarchy of components and/or projects and/or outputs and/or activities and/or tasks. See also *strategy*

**Agenda 21 (Agenda for the 21st Century):** was passed by the UN Conference on Environment and Development (UNCED) in Rio de Janeiro, 1992 (with participation by 179 countries). It is a global programme for environmental restoration, preservation and social development, facing challenges such as global warming, pollution, biodiversity and the inter-related social problems of poverty, health and population. Article 18.9 of Agenda 21 deals with integrated water resources management: '*Integrated water resources management, including the integration of land- and water-related aspects, should be carried out at the level of the catchment basin or sub-basin. Four principal objectives should be pursued, as follows: (a) To promote a dynamic, interactive, iterative and multisectoral approach to water resources management, including the identification and protection of potential sources of freshwater supply, that integrates technological, socio-economic, environmental and human health considerations; (b) To plan for the sustainable and rational utilisation, protection, conservation and management of water resources based on community needs and priorities within the framework of national economic development policy; (c) To design, implement and evaluate projects and programmes that are both economically efficient and socially appropriate within clearly defined strategies, based on an approach of full public participation, including that of women, youth, indigenous people and local communities in water management policy-making and decision-making; (d) To identify and strengthen or develop, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation are a catalyst for sustainable social progress and economic growth.*'

**Dublin principles (from International Conference of Water and the Environment, Dublin 1992):**  
 (1) Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment; (2) water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels; (3) women play a central role in the provision, management and safeguarding of water; (4) water has an economic value in all its competing uses and should be recognised as an economic good

**Global Water Partnership (GWP):** An international network (established in 1996) of organisations involved in integrated water resources management: Governments of developing as well as developed countries, UN agencies, multilateral banks, professional associations, research organisations, the private sector and NGOs. The activities of GWP build on the Dublin Principles

**Incremental planning:** Planning in (small) steps, for example when development goals are unclear, uncertain, or in conflict with each other

**Indicator (for achievements under a development project):** A measure of compliance between actual and specified results (or '*outputs*'). Some authors suggest that indicators be '*important, plausible, sufficient, independent, verifiable, and precisely defined in terms of the nature, quality, quantity, and timing*' (Wiggins and Shields 1995, p. 3, after Coleman 1987). Unfortunately, operational indicators tend to be less relevant, while relevant indicators tend to be less operational. Also, the different actors in a project - such as the intended beneficiaries, a host organisation, an implementing agency, a donor agency, and a consultant - may have different views on relevance and value of the different achievements

- Initial environmental examination (IEE): A written report with an assessment of possible environmental impacts of a proposed development activity, with a view to determining whether such impacts are significant, and whether a more comprehensive EIA is required
- Integrated Water Resources Management (IWRM) (as defined by Global Water Partnership): A process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems
- Milestone: A major, visible achievement with a target date. Many outputs are also milestones
- Pilot projects Projects intended for full scale testing of new, potential solutions to complex problems - while demonstration projects are intended for confirming the site-specific, practical value of new technology (for example new crops or new cultivation routines)
- River basin: The catchment of a river
- Scenario: A possible future situation, which is the result of a (hypothetical) combination of events, developments and conditions. For example, a scenario can reflect '*business as usual*' (= no intervention); accelerated technological development; low and high development of irrigation systems; a series of dry years; and/or alternative modes of demand regulation and other intervention in water availability and water demands. For basinwide planning, a distinction (suggested by MRCS/WUP-A, 2003) may be made between a '*planning scenario*' of circumstances outside the control of the planning (climate, energy prices, population growth), and a '*development scenario*' of such circumstances + the related demand (of water) + interventions to meet this demand. The latter would comprise '*a unique combination of hydrological circumstances, demands, and interventions to try to meet those demands*'
- Sector planning: Planning for a specific source of income, like agriculture, fisheries, hydropower, industry, service, tourism, etc.
- Stakeholder: A person, group or institution that has a particular interest in an activity, project, programme or policy. This includes both intended beneficiaries and intermediaries, winners and losers, and those involved in, or excluded from the decision-making process. A key stakeholder is one who can significantly influence or who is otherwise important to the success of the activity, project, programme or policy
- Strategic: '*Long-term and goal-oriented*'
- Strategy: A conceptual framework plan for how to reach a goal; or a set of principles that will assist in reaching a goal. See also *action plan*
- Sustainability(1) (according to the UN World Commission on Environment and Development, the '*Brundtland Commission*', as reported in '*Our Common Future*'): Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs; (2) environmental sustainability means avoidance of irreversible conflicts with a desired state of the environment (for example groundwater being suited for drinking); (3) a donor agency considers a project as sustainable if it provides adequate benefits to the target group for a certain period of time (preferably many years) after project completion
- Synergy: Mutual stimulation or amplification of two parallel processes, whereby their joint (positive or negative) effect becomes larger than the sum of the effects of each individual process. The existence of synergy effects is a part of the background for integrated planning
- Thematic planning: Planning for a specific topic that affects different sectors, like water resources, the environment, education, public health, poverty alleviation, etc.
- Win-win solution: A solution (or strategy) where all stakeholders gain an advantage, and no stakeholders suffer a disadvantage (Examples: Reforestation of barren lands; recycling of waste)

## 1 Introduction

A roadmap describes a set of projects (or 'interventions', or 'development initiatives') that are needed to reach a goal – such as IWRM-related investments. An action-oriented, IWRM-based development roadmap is a powerful tool for social, economic and environmental progress. It can

- provide a clear and agreed sense of direction
- illustrate the relations between various development initiatives, and
- assure that gaps and overlaps are sorted out.
- Also, the roadmap can provide guidance on implementation.

## 2 Scope and approach

### *What?*

A roadmap is a concise, holistic, sequenced action plan.

### *Why?*

An action-oriented, IWRM-based river basin development roadmap is a powerful tool for social, economic and environmental progress. It can provide a clear and agreed sense of direction, illustrate the relations between various development initiatives, and assure that gaps and overlaps are sorted out. Also, the roadmap provides guidance on implementation.

### *How?*

The following steps may be considered, as relevant from case to case:

- Get an overview of existing documentation. Conduct a screening of study reports and other documents. Prepare a synthesis of management modalities, including the national socio-economic planning framework, and the role of the RBO (if any)
- Get an overview of information sources and stakeholders (with a particular view to identification of development opportunities and supportive development initiatives). Consider how to liaise with stakeholders
- Prepare a small activity list - a 'roadmap for the roadmap' - indicating what to do and who does what
- Identify, in consultation with informants and stakeholders, a vision for the basin, and a preliminary set of operational development goals in support of achieving the vision (cf. examples provided below). This will form a preliminary framework for the roadmap, the purpose being to provide a reference and a focus for the continued work
- Conduct a stakeholder consultation workshop on development priorities and scoping, facilitated in order to add 'open-mindedness' to the scoping process (looking ahead as much as over the shoulder)

- Adjust the draft framework and prepare a draft roadmap with specific development initiatives (structural as well as non-structural). Indicate implementing bodies - 'who does what?'. Please refer to the examples provided below
- Conduct a stakeholder consultation workshop for review of the draft, in support of its validity, adequacy, and implementation prospects. Adjust accordingly
- Check the roadmap for project cycle technicalities. Add these activities to the roadmap as required
- Prepare and circulate a final version
- Revise it when there is a need to do so

### ***Who?***

The roadmap can conveniently be prepared by the RBO (if one exists), or otherwise by a dedicated coordination body with a relevant government mandate. (If there is no RBO, creating one may be considered as an element of the roadmap).

A close dialogue must be maintained with institutional and individual stakeholders, possibly including the private sector.

Implementation of the roadmap can be facilitated by the RBO, but many of its specific elements will be implemented by sector agencies, de-central administrative bodies, and others - who should therefore be involved in the planning.

## **3 Guiding principles**

... as relevant from case to case:

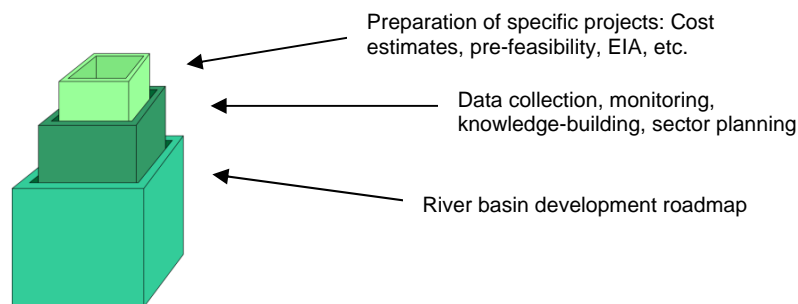
- An IWRM perspective is applied, emphasizing a holistic, cross-sector, balanced, and sustainable water allocation in accordance with national development policies and priorities
- The roadmap may cover short-term and medium-term development initiatives in support of a long-term perspective. Its recommendations should be action-oriented and practical, with a viable implementation framework
- A strategic social/environmental assessment (SEA) can be required for the whole set of development initiatives, as well as screening of specific interventions (and full-blown EIAs as required). These activities can be included in the roadmap as an element for subsequent implementation
- The roadmap should be revised regularly, to adapt to new challenges, new opportunities, and new knowledge
- A framework for progress monitoring can be prepared separately



## 4 Suggestions

... as relevant from case to case:

- Scoping can be supported by scenario analysis, by SWOT analysis (of strengths, weaknesses, opportunities and threats), and/or by logframe analysis. A logframe analysis is not adequate in itself, however, since it tends to overlook dormant (potential) development opportunities - it looks at the trees as much as the forest
- Consider both structural and non-structural development needs and opportunities, in an economic, social, environmental and institutional perspective, as relevant in the context
- Inevitably, many questions will emerge during the roadmap formulation. Are implementing bodies available or do they need to be identified - or even formed? Is there a need of additional data and knowledge? ... basic cost estimates? ... an over-all design and monitoring framework? ... a strategic social and environmental impact assessment? ... impact screening of individual projects? ... full EIAs for some of the projects? ... and pre-feasibility and feasibility studies? If so, please don't stop and wait, but add these activities to the roadmap. Like a Chinese box, the roadmap can include 'sub-roadmaps' for project cycle activities and for preparation of major development interventions



- Big and small (expensive and inexpensive) elements can be included side by side. Sometimes they can add value to each other, and small development initiatives can have large benefits
- Include priority initiatives, and only those, but don't spend too much time on a detailed ranking
- The roadmap should preferably be self-sustaining. Assumptions on developments that are external to the roadmap - such as major national or regional infrastructure projects - should be duly observed. If some initiative is particularly risky, a preparatory study may be considered. On the other hand, a master plan or a feasibility study (or a roadmap!) serve no purposes in themselves - their usefulness depends on tangible outcomes 'on the ground'
- Where possible, indicate an implementing organization 'up front' for the different roadmap elements. It will in many cases be someone else than the RBO. It could be a public agency, a private company, or an NGO

## 5 Thoughts to share

### *Institutions*

- 1 Integrated management is a useful supplement, rather than a replacement of existing sector management - with its wealth of expertise
- 2 Similarly, river basin management is a useful supplement, rather than a replacement of management at other (higher or lower) levels
- 3 Involve and/or build on existing institutions (including existing coordination bodies) and existing planning procedures
- 4 Develop clear roles, clear rules, and capable and resourceful bodies that collaborate with each other
- 5 Pursue harmony between management levels (basin level, national level, sub-basin level, province level, community level, and irrigation scheme level)
- 6 Prefer de-central decision-making, where this is reasonable considering the scale of the decision, and subject to practical (capacity and knowledge-base) constraints
- 7 Build and maintain confidence between institutions and stakeholders
- 8 Practice knowledge-building and knowledge-sharing, within and among river basins
- 9 Promote revenue generation and cost recovery, in pursuit of financial sustainability

### *Goals and policies*

- 10 Maintain a sense of direction, laid down in clear (although perhaps utopian) goals - perhaps independent from what is realistic in the short term. Example: 'Safe water for all'
- 11 Apply an IWRM perspective, emphasizing a holistic, cross-sector, balanced, and sustainable water allocation in accordance with national development policies and priorities
- 12 Note and exploit the powerful long-term synergies between economic growth, natural resource management and environmental management. Promote sustainable and transparent resource utilization - water, hydropower, forests, minerals, habitats, etc.
- 13 Seek balance between stakeholder interests: Upstream/downstream, instream/offstream, and local versus national interests (for example in connection with re-settlements)
- 14 Apply livelihood generation as a progress indicator in its own right (along with national economic growth, safe water and sanitation, poverty alleviation, etc). Pay particular attention to rural livelihoods
- 15 Prefer small steps to big ones, whenever the choice is open. There is always a risk of unexpected side effects

- 16 Involve the private sector with its powerful development agenda and potential. Apply gentle regulation to achieve a balance between immediate and long-term goals, and between private and public development priorities
- 17 Note the strong links between water resource management and land management. Promote zoning of land use, with a view to land ownership, land use potential, soil quality, access to water, habitat conservation, flood risk, pollution, and infrastructure
- 18 Consider the potential for development of tourism and recreation
- 19 Make regular reviews and updates of the development agenda, in timely response to new knowledge, new challenges, and new opportunities

### ***Management***

- 20 Practice openness, dialogue, and active stakeholder involvement throughout the formulation and implementation of development goals and policies
- 21 Promote gender mainstreaming
- 22 Reduce corruption and self-interest; pay attention to the powerless and minorities; promote transparency and predictability throughout the public administration
- 23 Don't rely on perfect knowledge about the future. Base decisions on the 'best available knowledge at the time when the decision must be made' - possibly involving the concept of '*Total Economic Value*'
- 24 Promote basinwide, real-time data management (flood levels, storage volumes, forest fires, etc)

## **References**

- ADB (Aug 08): Indonesia: Integrated Citarum Water Resources Management Project. Draft design and monitoring framework
- ADB (Jan 07): Indonesia: Integrated Citarum Water Resources Management Project. Report on roadmap and programme development, prepared by the Phase 3 Consultant Team for Ministry of Public Works, Directorate General of Water Resources
- CamboWP and CNMC (Mar 08): Piloting a river basin approach to IWRM in Eastern Cambodia (ADB-RETA 6325), Mid-term Progress Report prepared by Cambodia Water Partnership and Cambodia National Mekong Committee

## Appendix A: Example from the 4-Ps Basin, Cambodia

*This minimalistic indicative outline is from CamboWP and CNMC (Mar 08)*

### Notes

This framework highlights IWRM at the basin level. A suitable extent of harmony with the national, provincial and commune levels of planning (and their governing development policies) should be aimed at, and a steady convergence should be pursued in the course of time.

Time horizons for planned achievements are not included but may be added if so desired. They are not necessary, though - a clear sense of direction is useful even if the time of arrival at the destination is uncertain.

### **Basin-level development priorities (preliminary)**

- Improved access to safe water and sanitation
- Support in many ways to water-dependent rural livelihoods, including coordinated development of water, agriculture and fisheries
- Infrastructural development and trade facilitation
- Hydropower development
- Tourism development
- Support to risk preparedness and management: Floods, drought, pests, climate variability
- Human resources development; consolidation and expansion of management capacity at the province level, the commune level, and the water user group level
- A functional framework and modalities for basin-level IWRM

### **Management framework and modalities**

<b>Subject</b>	<b>Status</b>	<b>Target</b>
Basinwide IWRM development priorities	In preparation	Priorities discussed, amended and endorsed during public consultations  Priorities agreed among institutional stakeholders
Inter-sector coordination at province level	Coordination body functional for each province	IWRM aspects mainstreamed into the province-level inter-sector coordination
Basin-level coordination (between provinces)	Minimal; conducted on an ad hoc basis	Functional modality established for IWRM-based basin-level coordination
De-central capacity for planning and management	Scope for consolidation at all levels; efforts to this respect in progress	Improvements at province level, including improved linkages with the local levels  Improvements at commune level  Improvements at the water user group level

<b>Subject</b>	<b>Status</b>	<b>Target</b>
De-central capacity for public participation	Functional at commune level; scope for consolidation	Improved dialogue with the private sector (at province and commune level)  Improved awareness of potential IWRM-related benefits
... and more??		

### ***IWRM-based development***

<b>Subject</b>	<b>Status</b>	<b>Target (to be elaborated)</b>
Coverage of safe water & sanitation	Low, particularly in remote rural areas	Visible improvements over-all Visible improvements in remote areas
Rural livelihoods and income generation	Widespread poverty; clear scope for development	Visible improvements within value generated; diversification; and access to markets  Visible improvements in remote areas
Reduced risk exposure	Floods are an occasional problem, but drought and 'social shocks' (including health) are more severe	Visible improvements over-all Visible improvements in remote areas
Infrastructure and trade	Significant progress in recent years	Improved coverage of remote areas Increased cross-border trade (and tourism)
Tourism	Some income generated; attractive potential for further development (related to improved infrastructure and reflecting international trends)	Expansion (in terms of livelihoods and value generated)
... and more??		

### ***Supporting basin-level development programmes/projects***

<b>Title</b>	<b>Implementing agency</b>	<b>Scope and benefits</b>
.....	.....	.....
.....	.....	.....
.....	.....	.....

## Appendix B: Example from Citarum River Basin, Indonesia

*This more comprehensive example is a slightly edited version of Annex 2 of ADB (Jan 07). The Citarum roadmap builds on an existing master plan and a set of preparatory studies*

### **Foreword**

The development of a roadmap for the Citarum River Basin has followed the basic methodology of strategic planning.

Fundamentally, the approach has been to ask the following three questions:

- Where do we want to go (with water resource management in the basin)?
- Where are we now (that is, what are the existing issues/problems)?
- How can we get from where we are now to where we want to go (the 'road' we need to take)?

The key issues are well documented in a variety of documents produced in the last decade. The problems are numerous and cover a variety of areas, including deterioration of water quality, deforestation and degradation of upland catchments, mining of groundwater, and degradation of water control infrastructure. These problems have severe economic and social consequences to the people of the basin.

The roadmap itself is simply a set of strategies (and projects/actions to implement those strategies) that define the path between the present situation with respect to water resources in the basin and the desired outcomes (or vision) for the future – that is, what needs to be done to achieve the objectives. This has been achieved using the following 'vision-oriented' approach:

- Reaffirm and more clearly define a shared vision for the future of the basin (to 2020);
- Compare the status of water resources in the basin to the vision, in order to identify the strategic direction that needs to be taken (the 'road' so to speak);
- Formulate objectives in a number of key areas that would, if achieved, lead to fulfilment of the vision;
- Develop, for each key area, a set of interventions (projects and activities) that would, if successfully implemented, achieve the objectives.

Close to 70 interventions have been identified as necessary for the achievement of the objectives (and hence the vision) for the Citarum River Basin. These have come from a variety of sources. The costs that have been assumed for each these come from those sources (factored into 2006 dollar terms) and can only be considered as indicative.

### **Vision for the year 2021**

*'The government and communities working together for clean, healthy and productive catchments and rivers, bringing sustainable benefits to all people of the Citarum River Basin.'*



### Strategic framework

A strategic framework was developed in consultation with a broad range of basin stakeholders to ensure that an integrated approach to the formulation of the roadmap would be ensured. This is represented in the 'house' diagram (below), where the vision for the basin is supported by activities in a number of key areas, five of which are seen to be 'pillars', with a foundation of two cross-cutting key areas – the 'foundation'.



### Key areas

Key area	Definition	Objectives
Institutions and planning for IWRM	<p>In the definition of this key area, the term '<i>institution</i>' is used in its broadest sense, that is, dealing with organizations, as well as legislation, policies and other protocols that define the relations among those organizations.</p> <p>IWRM-based river basin planning is seen as a mechanism for promulgating and implementing policies of government, and as such is included in this key area. Accordingly, the following activities are included:</p> <ul style="list-style-type: none"> <li>• Organization restructuring;</li> <li>• Organizational capacity building;</li> <li>• Policy development;</li> <li>• Implementing the legislative framework;</li> <li>• Planning for IWRM;</li> <li>• Regulation (such as licensing of water utilisation and wastewater discharge);</li> <li>• Setting of water tariffs;</li> <li>• Institutions for participatory irrigation management.</li> </ul>	<ul style="list-style-type: none"> <li>• Effective organizational frameworks, clearly defined responsibilities and working partnerships with other stakeholders in place, encompassing both '<i>in-stream</i>' and '<i>off-stream</i>' aspects.</li> <li>• An effective coordination mechanism for water resources management.</li> <li>• Harmonious and comprehensive legal framework for effective water resources management.</li> <li>• Transparent, effective and holistic water resources planning mechanisms linked to spatial planning, and inclusive of stakeholder needs and aspirations</li> <li>• Effective regulatory (licensing) mechanisms in place and operating for surface and groundwater utilisation and wastewater discharge (including tariffs).</li> <li>• Agencies concerned with water management to have appropriate technology for effective and sustainable water resource management.</li> <li>• Decision makers, technical experts and other key stakeholders to have the capacity to effectively carry out their responsibilities with regard to water resources planning and management, including EIA procedures</li> </ul>

<b>Key area</b>	<b>Definition</b>	<b>Objectives</b>
Water resource development and management	<p>This key area includes those activities that are related to exploiting water resources – that is, increasing water availability to authorised users, and operating and maintaining the infrastructure developed in the process. The main activities included are:</p> <ul style="list-style-type: none"> <li>• Project planning, including '<i>master planning</i>' (that is, planning that focuses on development of infrastructure, and distinct from broader basin planning);</li> <li>• Construction of infrastructure for storing and delivering water (including reservoirs, canals and pipeline systems);</li> <li>• Operation and maintenance of infrastructure;</li> <li>• Promoting efficient and effective utilization of water;</li> <li>• Drilling of wells for use of groundwater.</li> </ul>	<ul style="list-style-type: none"> <li>• New or improved sources of water for domestic, irrigation, industry, hydropower, aquaculture, leisure and other uses developed, consistent with water availability and sustainability.</li> <li>• For all people in the basin to have access to adequate water supply and sanitation.</li> <li>• All water supply infrastructure capable of operating at design capacity.</li> <li>• Sustainable asset management practices in place for all water-related infrastructure.</li> </ul>
Water sharing	<p>This key area is often overlooked, particularly where water resources are plentiful. It covers the process of establishing and protecting water rights and allocating water among competing uses and users, as well as setting priorities for water entitlement during times of shortage. It does not include water use registration and licensing, which is a regulatory mechanism, and thus comes under the key area for Institutions and Planning for IWRM.</p>	<ul style="list-style-type: none"> <li>• An equitable water sharing arrangement among the upper and the lower basin and transboundary water resources (water supply to Jakarta).</li> <li>• Clearly defined water utilization rights for all authorised water users.</li> <li>• All conflicts over utilisation of the water resources of the basin resolved quickly and satisfactorily.</li> </ul>
Environmental protection	<p>In this key area are included activities for the protection of the environment (that have an impact on water management), such as rivers, lakes, wetlands, forests and other natural ecosystems, and rehabilitation (enhancement) of already degraded environments (aquatic and terrestrial).</p> <p>Out of all the key areas, this one probably is the most difficult to define clearly, as environmental protection and enhancement normally must be achieved by a combination of structural and non-structural measures that may include infrastructure (for instance, wastewater treatment plants), improved institutional (regulatory) arrangements, community participation, and so on.</p> <p>Enhancement of environment management capacity in the organizations charged with this responsibility is included under the institutional key area.</p> <p>Water quality and environmental monitoring and research activities are included in '<i>Data, Information and Decision Support</i>'.</p> <p>Provisions for mitigating the potential adverse effects of specific projects are built into the projects themselves.</p> <p>Legislation and other regulatory processes aimed at minimising adverse impacts come under '<i>institutions</i>'.</p>	<ul style="list-style-type: none"> <li>• Comprehensive land use plans in place, and adhered to, in order to minimise the impacts of human activities on the environment.</li> <li>• Forest protection measures in place and have no further reduction in the existing forest area.</li> <li>• Priority catchments improved through reforestation and adoption of appropriate land use and agricultural practices to minimize erosion.</li> <li>• Maintained and, where possible, enhanced biodiversity, without further degradation.</li> <li>• Minimal pollution from domestic, industrial and agricultural sources entering the waterways of the basin.</li> <li>• Adequate water share for ecological maintenance (environmental flows), for example, minimum dry season flow to prevent salinity intrusion, sedimentation and pollutant accumulation near coastal areas, and protect river and coastal fisheries.</li> </ul>
Disaster management	<p>In this context, '<i>disaster</i>' includes only those disasters related to water, such as floods and mud flows.</p>	<ul style="list-style-type: none"> <li>• Effective disaster preparedness plans for floods and mud flow events.</li> <li>• Appropriate works in place to minimise the physical impacts of floods and mud flow events.</li> <li>• Effective drought management plans.</li> </ul>



<b>Key area</b>	<b>Definition</b>	<b>Objectives</b>
Community empowerment	<p>Involvement of the community in planning and implementation, monitoring and evaluation of IWRM activities is essential. It may be considered as a 'foundation' key area, as it supports the five 'pillar' key areas described above. There is a strong feeling among stakeholders that empowerment of the community to participate should be an important theme. In this context, community empowerment includes:</p> <ul style="list-style-type: none"> <li>• Education and awareness raising (capacity building);</li> <li>• Dissemination of information about water resource management and related activities;</li> <li>• Facilitation of participation of the community in water planning and management; and</li> <li>• Developing community-based 'self-help' programs and specific projects to provide local improvement in water supply, the environment, water quality and so on.</li> </ul>	<ul style="list-style-type: none"> <li>• A high level of awareness of local communities about conservation, utilisation and protection of natural resources.</li> <li>• Local communities to have the opportunity and forum to participate meaningfully in the planning and management of the water resources of the basin.</li> <li>• Enabling conditions (institutional, financial and capacity) in place for local community involvement in provision of local water supply and sanitation services, watershed management and waste management</li> </ul>
Data and information	<p>This key area is another 'foundation' key area, as data is fundamental to all aspects of decision-making in water resource planning and management. It includes:</p> <ul style="list-style-type: none"> <li>• Monitoring and other data collection;</li> <li>• Data archiving and management;</li> <li>• Data sharing and dissemination among government agencies, research establishments and so on, and providing public access to data.</li> <li>• Research within cause-effect relationships, and development of new technologies for water conservation and environmental protection.</li> <li>• Decision support tools, including GIS systems, hydrologic and hydraulic models, and other analytical tools.</li> </ul>	<ul style="list-style-type: none"> <li>• A comprehensive database on land and water resources accessible to all that need it to facilitate sustainable management of the basin's water resources.</li> <li>• Implementation of community participatory methods for data collection and verification.</li> <li>• Effective arrangements for 'custodianship' of the different water and catchment related datasets.</li> <li>• Effective data sharing arrangements among agencies within the basin and with central agencies.</li> <li>• Suitable models and decision support tools developed and operational to assist rational decision making about water resource management.</li> <li>• Research programs in place to fill knowledge gaps about water-related processes and scenarios.</li> </ul>

### **Proposed interventions**

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
Institutions and planning for IWRM	1.1 Institutional strengthening for integrated water resources management	<ul style="list-style-type: none"> <li>• Assistance in establishing apex management body (Citarum Basin Water Resources Council) and support unit(s), for improved coordination and policy development.</li> <li>• Ongoing support and capacity building for the Council and support unit(s).</li> </ul>	1.8	PPTA Phase 3
	1.2 Policy development for appropriate water pricing, water allocation and balanced stakeholder participation	<ul style="list-style-type: none"> <li>• Review of current water pricing policies and development of new pricing structures that better reflect cost of delivery and provide incentives for rational water use.</li> <li>• Review of current policy instruments for water allocations among water uses (across sectors and upstream/downstream).</li> <li>• Review of current policies on stakeholder (and particularly, community) participation in planning and management of water resources and in development of new policies and mechanisms</li> </ul>	0.8	PPTA Phase 3
	1.3 Development of an enhanced Citarum River Basin Plan for IWRM	<ul style="list-style-type: none"> <li>• Review of existing plans for water resources development and management.</li> <li>• In collaboration with stakeholders, development of a strategic river basin plan that will facilitate improved and more integrated water resource management.</li> <li>• Development and implementation of a mechanism for monitoring the implementation of the river basin plan.</li> </ul>	0.9	PPTA Phase 3

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
	1.4 Improvements to organizational capacity for environmental assessment	<ul style="list-style-type: none"> <li>Preparation of guidelines, and training of project planners and stakeholders.</li> <li>Capacity building for managers and technical staff.</li> </ul>	0.5	PPTA Phase 3
	<b>Estimated total cost</b>		<b>4.0</b>	
Water resource development and management	2.1 Upgrading of water source for irrigation (Upper Cipunegara)	<ul style="list-style-type: none"> <li>Construction of a dam and reservoir.</li> <li>Rehabilitation of the existing irrigation system.</li> <li>Construction of a diversion weir and a diversion tunnel to convey water to a point upstream of the reservoir to increase inflows.</li> <li>Possible small-scale hydropower development.</li> <li>Strengthening of institutions for Participatory Irrigation Management.</li> <li>Development of plans for improved management of the watershed upstream of the reservoir.</li> </ul>	60.0	PPTA Phase 1 Sub-Project #9
Water resource development and management (continued)	2.2 Upgrading of water source for irrigation (Cipancuh)	<ul style="list-style-type: none"> <li>Construction of the Cipancuh Dam and auxiliary structures.</li> <li>Strengthening of institutions for Participatory Irrigation Management.</li> <li>Development of plans for improved management of the watershed upstream of the reservoir.</li> </ul>	65.7	PPTA Phase 1 Sub-Project #10
	2.3 Upgrading of water source for irrigation (Ciherang)	<ul style="list-style-type: none"> <li>Construction of the Telagaherang Dam and auxiliary structures.</li> <li>Rehabilitation of the existing irrigation water distribution system.</li> <li>Strengthening of institutions for Participatory Irrigation Management.</li> <li>Development of plans for improved management of the watershed upstream of the reservoir.</li> </ul>	56.4	PPTA Phase 1 Sub-Project #11
	2.4 Cisankuy irrigation improvement	<ul style="list-style-type: none"> <li>Improved (more efficient) operation of Cisankuy Reservoir.</li> <li>Improved cropping patterns in the Cisankuy area, to save water.</li> </ul>	65.5	Master Plan 1997
	2.5 Raising of Cirata Dam	<ul style="list-style-type: none"> <li>Undertake feasibility study.</li> <li>Do detailed engineering design.</li> <li>Construct dam and associated works.</li> </ul>	20.1	Master Plan 1997
	2.6 Investigation of bulk water supply options for Bandung urban area	<ul style="list-style-type: none"> <li>A stakeholder-driven selection process of options to improve the bulk water supplies to Bandung to meet the demand to 2025.</li> <li>Rapid surveys and pre-feasibility studies (review and update any previous feasibility studies) to produce a short-list of the most viable options.</li> <li>Preparation of subproject appraisal reports with detailed feasibility studies (including costing, environmental impact assessment, and resettlement action plans, etc).</li> </ul>	1.2	PPTA Phase 3
	2.7 Implementation of preferred bulk water supply alternatives for Bandung urban area	<ul style="list-style-type: none"> <li>Detailed engineering design on selected option(s).</li> <li>Preparation of tender documents; contract awards.</li> <li>Construction and commissioning.</li> </ul> <p>(Costs assumed to be accounted for in schemes proposed below)</p>	0	PPTA Phase 3
	2.8 Upgrading of water source for Bandung and other uses by inter-basin transfer	<ul style="list-style-type: none"> <li>Construction of Cibutarua Weir</li> <li>Construction of Santosa Reservoir.</li> <li>Construction of a 4.5 km diversion tunnel.</li> <li>Construction of a reservoir upstream of Tamiang Cangkir Weir, needed to compensate irrigation downstream of Cibutarua Weir.</li> <li>Development of an inter-district agreement regarding cost allocation for diverted water.</li> </ul>	190.0	PPTA Phase 1 Sub-Project #11

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
Water resource development and management (continued)	2.9 Development of the surface water of the upper catchment of the Cikapundung River	<ul style="list-style-type: none"> <li>Review of previous investigations into construction of five reservoirs in the upper catchment of the Cikapundung River to enhance surface water availability for Bandung and surrounding area.</li> <li>Undertake feasibility study of preferred option.</li> <li>Do detailed engineering design.</li> <li>Construct dams and associated works.</li> </ul>	34.7	Master Plan 1997
	2.10 Construction of Sukawana Reservoir on the Cimahi River	<ul style="list-style-type: none"> <li>Review of previous investigations into construction of Sukawana Reservoir on the Cimahi River.</li> <li>Undertake feasibility study.</li> <li>Do detailed engineering design.</li> <li>Construct dam and associated works.</li> </ul>	7.2	Master Plan 1997
	2.11 Investigation of bulk water supply options for Bekasi and Karawang	<ul style="list-style-type: none"> <li>A stakeholder-driven selection process of options to improve the bulk water supplies to Bekasi and Karawang to meet the demand to 2025.</li> <li>Rapid surveys and pre-feasibility studies (review and update any previous feasibility studies) to produce a short-list of the most viable options.</li> <li>Preparation of subproject appraisal reports with detailed feasibility studies (including costing, environmental impact assessment, and resettlement action plans, etc).</li> </ul>	1.0	PPTA Phase 3
	2.12 Implementation of preferred bulk water supply alternatives for Bekasi and Karawang	<ul style="list-style-type: none"> <li>Detailed engineering design on selected option(s).</li> <li>Preparation of tender documents; contract awards.</li> <li>Construction and commissioning.</li> </ul>	50.0	PPTA Phase 3
	2.13 Development of an action plan for sustainable groundwater management in the basin	<ul style="list-style-type: none"> <li>Review and document available information.</li> <li>Review previous studies.</li> <li>In conjunction with the bulk water supply options study, prepare an action plan for effective and sustainable groundwater management.</li> <li>Review existing regulatory instruments for groundwater management and recommend improvements, including mechanisms for compliance management (enforcement).</li> </ul>	0.6	Master Plan 1997 (modified by PPTA Phase 3)
	2.14 Implementation of the action plan for sustainable groundwater management in the Citarum River Basin	[Depends on outcomes of the action plan development study – costs indicative only]	5.0	PPTA Phase 3
	2.15 Improved implementation of regulations for sustainable groundwater management in Bandung	<ul style="list-style-type: none"> <li>Review of existing regulatory framework.</li> <li>Evaluation of existing implementation of regulation and identification of deficiencies.</li> <li>Development of strategies and an action plan for improved effectiveness of regulation of groundwater use.</li> <li>Development of a monitoring mechanism.</li> <li>Capacity building of involved agencies.</li> </ul>	0.6	PPTA Phase 3
	2.16 Improvement of raw water supply for Bandung	<ul style="list-style-type: none"> <li>Provision of new intake and conveyance facilities.</li> <li>Review of current water pricing policies and development of new pricing structures that better reflect cost of delivery and provide incentives for rational water use.</li> </ul>	32.8	PPTA Phase 1 Sub-Project #18
	2.17 Rehabilitation of the West Tarum Canal for improved water resource utilization	<ul style="list-style-type: none"> <li>Detailed engineering design.</li> <li>Removal and disposal of sediments from the canal bed, strengthening of embankments.</li> <li>Separation of Cikarang and Bekasi river flows from the main canal through construction of by-passes (inverted siphons).</li> <li>Capacity building for improved management and operation.</li> <li>Implementation of stakeholder-driven selection process of water supply and sanitation options.</li> </ul>	41.4	PPTA Phase 1 Sub-Project #13 (revised during Phase 3)

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
Water resource development and management (continued)	2.18 West Tarum Canal 2 Project	<ul style="list-style-type: none"> <li>Review of previous investigations into options for piping water from Jatiluhur Reservoir to Jakarta.</li> <li>Feasibility study of preferred option.</li> <li>Detailed engineering design.</li> <li>Construction.</li> </ul>	860.0	Master Plan 1997
	2.19 Irrigation Modernisation – West Tarum Canal	<ul style="list-style-type: none"> <li>Rehabilitation of canal network (secondary and tertiary canals) and water control structures.</li> <li>Installation of off-take measurement apparatus.</li> <li>Strengthening of institutions for Participatory Irrigation Management among farmers.</li> </ul>	50.9	PPTA Phase 1 Sub-Project #4
	2.20 System Service Improvement and Irrigation Modernisation – East Tarum Canal	<ul style="list-style-type: none"> <li>Rehabilitation of the East Tarum Canal, including removal and disposal of sediments, and repair and strengthening of embankments.</li> <li>Rehabilitation of secondary and tertiary canals and water control structures.</li> <li>Installation of off-take measurement apparatus.</li> <li>Strengthening of institutions for Participatory Irrigation Management among farmers.</li> </ul>	126.2	PPTA Phase 1 Sub-Projects #2 and #5
	2.21 System Service Improvement and Irrigation Modernisation – North Tarum Canal	<ul style="list-style-type: none"> <li>Rehabilitation of the North Tarum Canal, including removal and disposal of sediments, and repair and strengthening of embankments.</li> <li>Rehabilitation of secondary and tertiary canals and water control structures.</li> <li>Installation of off-take measurement apparatus.</li> <li>Strengthening of institutions for Participatory Irrigation Management among farmers.</li> </ul>	95.1	PPTA Phase 1 Sub-Projects #3 and #6
	2.22 Development of strategies and options for demand management and water conservation with respect to industrial and domestic use	<ul style="list-style-type: none"> <li>Development and implementation of strategies and actions for water conservation awareness raising among the community and industries.</li> <li>Development and implementation of strategies and actions for industrial water recycling (including regulatory and technological measures), and assistance to industries to install recycling technology.</li> <li>Development and implementation of strategies and actions for minimisation of losses.</li> <li>Review of current water pricing policies and development of new pricing structures that better reflect cost of delivery and provide incentives for rational water use.</li> </ul>	0.5	PPTA Phase 3
	2.23 Development of improved asset management and O&M procedures for hydraulic infrastructure	<ul style="list-style-type: none"> <li>Development of an asset register and monitoring system for hydraulic infrastructure and a system for prioritization of maintenance activities.</li> <li>Introduction of clear and accountable operating plans for the water delivery.</li> </ul>	1.0	PPTA Phase 3
	2.24 Rajamandala Run-of-River Power Plant (Citarum River below Saguling Reservoir)	<ul style="list-style-type: none"> <li>Review of previous investigations.</li> <li>Feasibility study of preferred option.</li> <li>Detailed engineering design.</li> <li>Construction.</li> </ul>	164.3	Master Plan 1997
	2.25 Curug Run-of-River Power Plant	<ul style="list-style-type: none"> <li>Review of previous investigations.</li> <li>Feasibility study of preferred option.</li> <li>Detailed engineering design.</li> <li>Construction.</li> </ul>	6.0	Master Plan 1997
<b>Estimated total cost</b>			<b>1936.2</b>	

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
Water sharing	3.1 Review of allocation priorities and optimization of operating rules for key sub-basins, including the operation of the river/reservoir system as a whole	<ul style="list-style-type: none"> <li>Review of the effectiveness of existing water sharing arrangements (including water exported to Jakarta).</li> <li>Development of an updated policy for water sharing among water users in the basin, as well as Jakarta, including an effective conflict/dispute resolution mechanism.</li> <li>Determination of environmental flow requirements to maintain water quality, as well as flushing flows for sediment and salinity reduction in lower reaches.</li> <li>Development of updated and appropriate operating rules for key sub-basins, including the operation of the river / reservoir system as a whole.</li> <li>Review of allocation priorities and clear procedures for sharing water during drought</li> </ul>	0.9	PPTA Phase 3
<b>Estimated total cost</b>			<b>0.9</b>	
Environmental protection	4.1 Development and implementation of conservation action plans for model conservation villages	<ul style="list-style-type: none"> <li>Select model conservation villagers.</li> <li>Appoint and educate conservation village mentors.</li> <li>Mentors to assist with (i) village conservation action plans; (ii) village and community nurseries; (iii) reforestation of village lands and Perum Perhutani lands; (iv) implementation of other aspects of the conservation village action plans (sanitation, household pollution etc); and (v) tenure arrangements with Perum Perhutani.</li> </ul>	0	PPTA Phase 3
	4.2 Watershed management community educational programme	<ul style="list-style-type: none"> <li>Prepare and implement the programme, involving conservation village mentors and NGOs.</li> </ul>	0	PPTA Phase 3
	4.3 Productive Reforestation (1): Spatial planning for reforestation	<ul style="list-style-type: none"> <li>Review existing laws relating to protection of forests in upper catchment areas.</li> <li>Review existing mosaic of spatial plans, and recommend a process for greater integration of these plans.</li> <li>Establish a small group of specialists to assist with de-central spatial planning.</li> <li>Identify priority areas for rehabilitation by reforestation.</li> </ul>	30.0	PPTA Phase 1 Sub-Project #7 (enhanced during Phase 3)
	4.4 Productive Reforestation (2): Implementation	<ul style="list-style-type: none"> <li>Review and report on the appropriate reforestation methods that can provide sustainable crops to enhance livelihoods for villagers.</li> <li>Institutional strengthening for coordination.</li> <li>Development of effective land use controls with incentives.</li> <li>Implementation of effective compliance management (enforcement).</li> <li>Establishment of a farm credit system.</li> <li>Training and community development.</li> </ul>	0	PPTA Phase 3
	4.5 Improvement to village land tenure arrangements with Perum Perhutani	<ul style="list-style-type: none"> <li>Broker contracts between villagers and Perum Perhutani that provide long tenure, prevent erosion, and provide farmers with a standing crop.</li> <li>Advise villagers of the most appropriate reforestation techniques.</li> </ul>	0	PPTA Phase 3
	4.6 Alternative livelihoods for displaced upland forest villagers	<ul style="list-style-type: none"> <li>Conduct a field survey of the upland villagers (38,000 families) displaced under the program '<i>Larangan tumpang sari di kemiringan &gt;42 degrees, 20 May 2003</i>', to ascertain suitable sustainable alternative livelihoods.</li> <li>Broker preferences for this group of villagers for Perum Perhutani lands and facilitate preferred livelihoods on this leasehold land.</li> </ul>	0	PPTA Phase 3

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
Environmental protection (continued)	4.7 Protected area management	<ul style="list-style-type: none"> <li>Develop conservation management action plans for the selected protected areas through stakeholder forums.</li> <li>Conduct rapid biodiversity surveys.</li> <li>Conduct habitat mapping.</li> <li>Conduct village resource utilization survey.</li> <li>Establish village conservation groups and involve these groups in collaborative management of the protected areas.</li> </ul>	0	PPTA Phase 3
	4.8 Alternative finance mechanisms for sustainable community watershed management activities	<ul style="list-style-type: none"> <li>Review Payment for Environmental Services (PES) practices in Indonesia.</li> <li>Develop an action plan for implementation of PES in the basin and modify the plan following stakeholder review.</li> <li>Review options for micro-credit facilities.</li> </ul>	0	PPTA Phase 3
	4.9 Riparian zone management to reduce sediment loads in rivers	<ul style="list-style-type: none"> <li>Determine vegetation floristics and structure most effective in reducing stream sedimentation.</li> <li>Determine width of zone required to minimize sediment loads.</li> <li>Identify critical river reaches that contribute high sediment loads to the river.</li> <li>Identify land use practices of local farmers that affect erosion and sedimentation (for example, stock grazing on river banks).</li> <li>Develop action plans for improved riparian management in pilot (critical) river reaches.</li> <li>Implement pilot vegetation plantings and improved land management practices according to action plans developed.</li> <li>Implement improved management in other critical riparian zones across the basin.</li> </ul>	0	PPTA Phase 3
	4.10 Integrated erosion management for Upper Bekasi River, Upper Citarum River and Upper Cipunegara River	<ul style="list-style-type: none"> <li>Development and implementation of effective land use controls in steep slope areas and incentive systems for farmers to adopt sustainable agricultural practices.</li> <li>Erosion and landslide control works in critical areas, including construction of hillside works (planting, terracing, grass coverage, drainage channels, retaining walls, and so on).</li> </ul>	20.0	Part of PPTA Phase 1 Sub-Project #14
	4.11 Development and (initial) implementation of a River Quality Improvement Action Strategy Plan for the entire basin	<ul style="list-style-type: none"> <li>Prepare strategic options for the River Quality Improvement Action Strategy including technical, institutional, and legal aspects and focusing on both incentive and enforcement measures, and drawing lessons from existing programs.</li> <li>Raise awareness of the issues and possible solutions at political levels and within industry and communities and generate commitment for implementation of the Strategy</li> <li>Based on the content of the agreed Action Plan, implement investment, institutional strengthening and compliance components.</li> </ul>	0	PPTA Phase 3
	4.12 Development and (initial) implementation of a Water Pollution Control Plan for the Bandung area	<ul style="list-style-type: none"> <li>Data collection and mapping.</li> <li>Institutional aspects, regulations, law enforcement.</li> <li>Improvements in the operation and efficiency of existing WWTPs (and factories and hospitals).</li> <li>Waste disposal awareness program.</li> <li>Construction of pilot community sanitation centres, simplified community sewerage systems, and school sanitation systems.</li> <li>Capacity building.</li> <li>Development of water pollution control plan and investment projects.</li> </ul>	0	PPTA Phase 3

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
Environmental protection (continued)	4.13 Sewerage and wastewater treatment upstream of Saguling Reservoir	<ul style="list-style-type: none"> <li>Detailed engineering design for the rehabilitation of existing sewerage and wastewater treatment facilities, and for the construction of new facilities.</li> <li>Preparation of tender documents; contract awards.</li> <li>Construction and commissioning.</li> </ul>	325.0	Master Plan 1997
	4.14 Development and (initial) implementation of a Water Pollution Control Plan for the Bekasi and Karawang areas	<ul style="list-style-type: none"> <li>Data collection and mapping.</li> <li>Institutional aspects, regulations, law enforcement.</li> <li>Improvements in the operation and efficiency of the existing WWTPs (factories and hospitals).</li> <li>Waste disposal awareness program.</li> <li>Construction of pilot community sanitation centres, simplified community sewerage systems, and school sanitation systems.</li> <li>Capacity building.</li> <li>Development of water pollution control plan and investment projects.</li> </ul>	0	PPTA Phase 3
	4.15 Development and implementation of a solid waste management strategy and action plans for the Bandung, Bekasi, Cikarang and Karawang areas	<ul style="list-style-type: none"> <li>Implementation of improved enforcement, and strengthening of regulatory mechanisms as required.</li> <li>Public education on waste disposal issues.</li> <li>Establishment of equitable and effective cost sharing mechanisms for collection and disposal of solid waste.</li> <li>Establishment of separated collection systems and improved recycling processes for solid waste.</li> <li>Development of appropriate land-fill areas and practices for disposal of nonrecyclable waste.</li> <li>Establishment of monitoring for land-fill areas and recycling stockpiles.</li> </ul>	13.7	PPTA Phase 1 Sub-Project #17
	4.16 Introduction of System Rice Intensification (SRI) practices in the upper and lower basin to conserve water and improve productivity	<ul style="list-style-type: none"> <li>Participatory Rural Appraisal.</li> <li>Training of Trainers.</li> <li>Training for farmers.</li> <li>Implementation of SRI in demonstration plots.</li> <li>Farmer empowerment.</li> <li>Production and distribution of organic fertilizer.</li> <li>Acquisition and distribution of decomposer kits.</li> <li>Acquisition and distribution of selected seeds.</li> <li>Monitoring and reporting.</li> </ul>	4.2	PPTA Phase 3
	4.17 Improvement in water quality in Saguling, Cirata and Jatiluhur Reservoirs through management of fish farming and other polluting activities	<ul style="list-style-type: none"> <li>Identify sources and extent of pollution.</li> <li>Determine the economic impacts of pollution on other uses of water (such as hydropower).</li> <li>Identify actions needed to reduce pollution.</li> <li>Identify possibilities for alternative livelihoods for fish farmers and others that may be impacted by polluting control measures.</li> <li>Develop and implement an action plan for reducing pollution.</li> </ul>	2.0	PPTA Phase 3
	4.18 Integrated coastal zone management strategy and action plan for Citarum coastline		0.6	PPTA Phase 3
	4.19 Implementation of ICZM Action Plan	[Depends on outcomes of the action plan development study]	20.0	PPTA Phase 3
	<b>Estimated total cost</b>			<b>415.5</b>

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
Disaster management	5.1 Integrated management of water-related disasters (basinwide)	<ul style="list-style-type: none"> <li>Review effectiveness of existing disaster management strategies and coordination arrangements and recommend on improvements.</li> <li>Development and implementation of effective land use controls in disaster prone areas.</li> <li>Relocation of households in disaster prone areas.</li> <li>Development and implementation of effective controls on sand and gravel extraction.</li> <li>Public awareness campaigns.</li> <li>Institution strengthening.</li> <li>Establishment of a flood forecasting system.</li> <li>Develop contingency plans for industrial accidents affecting contamination of the river system,</li> </ul>	40.0	PPTA Phase 1 Sub-Project #8
	5.2 Cipunegara Sub-Basin flood management	<ul style="list-style-type: none"> <li>Investigate flood management options for the Cipunegara Sub-Basin</li> <li>Develop recommendations for flood management and mitigation of flood impacts</li> <li>Implement recommendations</li> </ul>	10.0	PPTA Phase 3
	5.3 Bekasi Sub-Basin flood management	<ul style="list-style-type: none"> <li>Investigate flood management options for the Bekasi Sub-Basin</li> <li>Develop recommendations for flood management and mitigation of flood impacts</li> <li>Implement recommendations</li> </ul>	10.0	PPTA Phase 3
Disaster management (continued)	5.4 Disaster (mud flow and landslide) management for Upper Bekasi River, Upper Citarum River and Upper Cipunegara River	<ul style="list-style-type: none"> <li>Development and implementation of mud flow and landslide forecasting and warning/evacuation measures.</li> <li>Relocation of dwellings from disaster-prone areas.</li> <li>Enhancement of public awareness.</li> </ul>	13.4	Part of PPTA Phase 1 Sub-Project #14
	5.5 Strategic options for flood mitigation in Bandung	<ul style="list-style-type: none"> <li>Review past flood mitigation studies.</li> <li>Develop new flood mitigation measures if necessary.</li> <li>Update recommendations on appropriate flood mitigation measures.</li> </ul>	0.3	PPTA Phase 3
	5.6 Implementation of recommended options for flood mitigation in Bandung	[Depends on outcomes of the strategic options study]	20.0	PPTA Phase 3
	5.7 Review of dam safety for dams in the basin	<ul style="list-style-type: none"> <li>Review current standards for dam safety in Indonesia.</li> <li>Review current institutional arrangements.</li> <li>Review all dams subject to dam safety requirements with regard to compliance with safety standards and make appropriate recommendations for improvement.</li> </ul>	1.2	PPTA Phase 3
<b>Estimated total cost</b>			<b>94.9</b>	
Community empowerment	6.1 Development of a strategy for improved participation in water resources policy development, planning and management	<ul style="list-style-type: none"> <li>Identification of key stakeholders.</li> <li>Identification of messages and knowledge that need to be communicated.</li> <li>Preparation of a community participation strategy.</li> <li>Development of an action plan, including school education as a key element.</li> </ul>	1.5	PPTA Phase 3
	6.2 Implementation of the Information, Awareness and Education Strategy	[Depends on outcomes of the development study]	1.0	PPTA Phase 3



<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>
	6.3 Support for community- and NGO-driven initiatives for water supply and sanitation for rural and peri-urban communities	<ul style="list-style-type: none"> <li>• Identification of potential NGOs who can facilitate community participation in all project cycles.</li> <li>• Assessment of community needs.</li> <li>• Formation of community implementation teams.</li> <li>• Community problem identification and analysis of technical options.</li> <li>• Provision of skills training based on communities' priorities, assets and needs to generate income and employment opportunities</li> <li>• Provision of access to capital and markets to directly implement skills acquired</li> <li>• Formulation of community action plans and proposals.</li> <li>• Disbursement of funds and construction of approved schemes.</li> <li>• O&amp;M of completed schemes, and socialization and training support on hygiene behavioural change</li> <li>• Facilitate the implementation of identified health, water and sanitation related projects/programs.</li> </ul>	10.5	PPTA Phase 3
	6.4 Establishment of, and ongoing support for a Stakeholder Forum for Bandung Sub-Basin under Citarum Basin Water Resources Council or Citarum Balai Besar	<ul style="list-style-type: none"> <li>• Work with the Citarum Basin Water Resources Council or Citarum Balai Besar to determine the composition and mandate of the stakeholder forum.</li> <li>• Legally and practically establish the forum.</li> <li>• Provide ongoing support (financial and advisory) to the forum for up to two years.</li> </ul>	0.3	PPTA Phase 3
<b>Estimated total cost</b>			<b>13.3</b>	
Data and Information	7.1 Improved water quality monitoring in rivers and reservoirs	<ul style="list-style-type: none"> <li>• Delineate water quality management areas (e.g., by sub-basins) based on predominant land use and nature of water quality concerns; identify key quality parameters for each area; incorporate into existing clean rivers program.</li> <li>• Develop a plan for water quality monitoring in each water quality management area - ensuring that water quality monitoring data are actually used to support improvement programs ( e.g., regulatory enforcement, incentives, community awareness/participation).</li> <li>• Develop guidelines for water and sediment sampling, laboratory analysis, reporting and data banking.</li> <li>• Establish a laboratory accreditation scheme (with a reference laboratory to conduct audits); attract private sector investments in laboratory services.</li> <li>• Undertake capacity building for key laboratories.</li> </ul>	0	PPTA Phase 3
	7.2 Improvements to groundwater monitoring network in the Bandung area	<ul style="list-style-type: none"> <li>• Provision of monitoring equipment, increasing the network of monitoring wells (60 additional wells are estimated to be needed).</li> <li>• Improvement to groundwater database(s) and computer models.</li> </ul>	3.0	PPTA Phase 3
	7.3 Improvements to water and natural resource data management and dissemination	<ul style="list-style-type: none"> <li>• Review existing database arrangements in the various agencies.</li> <li>• Recommend improvements to data management, including: institutional arrangements (introduction of the 'custodianship' concept); data management policy; and introduction of new technology.</li> <li>• Recommend improvements to policies and processes for data sharing and dissemination, including the establishment of a publicly accessible website where data can be accessed.</li> </ul>	0.5	PPTA Phase 3

<b>Key area</b>	<b>Intervention</b>	<b>Main outputs/activities</b>	<b>Cost mio USD</b>	<b>Source</b>	
Data and Information (continued)	7.4 Land degradation and biodiversity database	<ul style="list-style-type: none"> <li>• Provide necessary hardware and software, and training in their use.</li> <li>• Establish comprehensive Land Degradation and Biodiversity database files that are compatible with requirements of the CRB Council and other natural resource managers.</li> <li>• Develop suitable Internet based data access systems.</li> </ul>	0	PPTA Phase 3	
	7.5 Development of an on-line flow forecasting system on unregulated rivers	<ul style="list-style-type: none"> <li>• Undertake hydrologic investigations to confirm operational and economic benefits of flow forecasting.</li> <li>• Determine key sites for forecasting.</li> <li>• Examine technological options.</li> <li>• Acquire and/or develop hardware and software.</li> <li>• Install system and commission.</li> <li>• Provide training to system operators to maximize benefits from the system.</li> </ul>	1.6	Master Plan 1997	
	7.6 Establishment of an annual 'state of the basin' report	<ul style="list-style-type: none"> <li>• Review of 'state of the basin' reporting procedures in other countries.</li> <li>• Development and implementation of an appropriate process to produce and disseminate a 'state of the basin' report to identify problem areas, causes and effects, and needed remedies</li> </ul>	0.3	PPTA Phase 3	
	7.7 Development of an integrated water quality and quantity model for basin planning studies, and a decision support tool for improved policy and decision making	<ul style="list-style-type: none"> <li>• Identify potential software systems suited for an integrated river basin water quantity/quality model, and select the most suitable one.</li> <li>• Assemble data, develop the model, calibrate and verify.</li> <li>• Design and implement a decision support tool for use by relevant agencies for policy and planning, that uses the water quantity/quality model as a key element for analysing scenarios.</li> </ul>	0.6	PPTA Phase 3	
	7.8 Institutional strengthening and capacity building of water research organizations	<ul style="list-style-type: none"> <li>• Identify key research institutions, including universities, government institutes and so on, working in the field of water research, particularly for the Citarum River Basin.</li> <li>• Undertake a needs analysis for capacity building, both for human resources development and technology, required to undertake efficient water-related research.</li> <li>• With the selected organizations, identify critical knowledge gaps related to the Citarum River Basin.</li> <li>• Prepare and implement appropriate training programs in selected organizations.</li> <li>• Procure and install appropriate new technology.</li> </ul>	3.0	PPTA Phase 3	
	7.9 Benchmarking of water and natural resource data collection and management agencies	<ul style="list-style-type: none"> <li>• Identify key water and natural resource data collection and management agencies.</li> <li>• Review best practices from agencies overseas for data collection, management and dissemination.</li> <li>• Benchmark identified agencies against best practices.</li> <li>• Make appropriate recommendations for improvements of data collection, management and dissemination.</li> </ul>	0.6	PPTA Phase 3	
	<b>Estimated total cost</b>			<b>9.6</b>	

## Appendix C: Scoping check list

*The following is a general long-list of aspects to consider in connection with IWRM-based river basin development, as relevant from case to case*

- |                      |  |
|----------------------|--|
| <b>Context</b>       | <ul style="list-style-type: none"> <li><input type="checkbox"/> Applicable national development policies/ priorities (5-years plans, sector plans, ...)</li> <li><input type="checkbox"/> International collaboration (in case of transboundary river basins)</li> <li><input type="checkbox"/> Existing development studies and sector plans (including feasibility and impact studies)</li> <li><input type="checkbox"/> Any parallel development efforts - including infrastructure (roads, railways, airports, harbours, ... )</li> </ul>  |
| <b>Sectors</b>       | <ul style="list-style-type: none"> <li><input type="checkbox"/> Domestic and industrial water supplies (urban and rural)</li> <li><input type="checkbox"/> Sanitation and sewage treatment (urban and rural)</li> <li><input type="checkbox"/> Irrigated agriculture</li> <li><input type="checkbox"/> Hydropower</li> <li><input type="checkbox"/> Inland fisheries</li> <li><input type="checkbox"/> Inland waterways and navigation</li> <li><input type="checkbox"/> Water-related tourism and recreation</li> </ul>   |
| <b>Services</b>      | <ul style="list-style-type: none"> <li><input type="checkbox"/> Water allocation (general and operational), balancing demand and availability</li> <li><input type="checkbox"/> Water-sharing facilitation, including dispute resolution</li> <li><input type="checkbox"/> Flood management (including forecasting and operational warning)</li> <li><input type="checkbox"/> Drought management</li> <li><input type="checkbox"/> Salinity control</li> <li><input type="checkbox"/> Waste and sewage disposal (urban and rural)</li> <li><input type="checkbox"/> Storage capacity, flow regulation (structural and operational) (for example coordinated reservoir operation), intra-basin and inter-basin diversion</li> <li><input type="checkbox"/> Groundwater development and management</li> <li><input type="checkbox"/> Environmental management (water quality, aquatic habitats and ecosystems)</li> <li><input type="checkbox"/> Contingency planning for spills and accidents</li> <li><input type="checkbox"/> Land management (headwater areas, uplands, wetlands, floodplains, forests, protected areas, zoning, land ownership)</li> <li><input type="checkbox"/> Morphological management (erosion and sedimentation, bank protection)</li> <li><input type="checkbox"/> Climate change preparedness and climate proofing</li> </ul> |
| <b>Themes</b>        | <ul style="list-style-type: none"> <li><input type="checkbox"/> Efficiency of water-related production systems (such as irrigated agriculture, fisheries)</li> <li><input type="checkbox"/> Institutional aspects, inter-sector coordination, decentralization, capacity-building, management skills, decision process, quality management, public participation</li> <li><input type="checkbox"/> Monitoring, knowledge base, decision-support tools, dissemination to water users</li> <li><input type="checkbox"/> Poverty reduction and livelihood generation</li> <li><input type="checkbox"/> Gender aspects</li> </ul>  |
| <b>Miscellaneous</b> | <ul style="list-style-type: none"> <li><input type="checkbox"/> Soil and water conservation</li> <li><input type="checkbox"/> Industrial effluents, agro-chemicals</li> </ul>  |

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