Approaches for Systematic Planning of Development Projects

<Water Pollution>

December 2007

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Foreword

Developing countries are facing a range of development issues, which are becoming more diverse and complex. In order to adequately address these issues, the Japan International Cooperation Agency (JICA) has been strengthening its country-specific and issue-specific approaches. As part of such efforts, JICA reorganized its headquarters in 2004 for more effective and efficient operations. In particular, JICA established thematic departments, which are designed to accumulate knowledge and expertise in each sector or on certain development issues and thus enhance the capacity to deliver technical assistance to developing countries. Further, as part of concrete efforts to enhance its capacity to deal with development issues, JICA is undertaking issue-specific Project Request Surveys, and producing Country Programs, Thematic Guidelines, and Knowledge Site (web database storing information and knowledge on JICA's activities). Still, wide differences remain within JICA on how to place development issues and program approaches in the proper context. In order to plan and implement cooperation activities that appropriately and accurately address the important issues for a particular country, it is necessary to identify the aspects that JICA should focus on, based on a basic understanding of the full scope of each development issue and effective approaches to addressing it, and in accordance with the situation of each country.

This study was conducted as part of efforts to strengthen the above mentioned issue-specific approaches, and is Phase IV of a program of study, following on from 3 phases conducted since 2001. The first 3 phases covered 11 development issues (Basic Education, Anti-HIV/AIDS Measures, Rural Development, Promotion of Small and Medium Enterprises, Poverty Reduction, Trade and Investment Promotion, Higher Education, Information and Communication Technology, Water Resources, Reproductive Health, Agricultural and Rural Development). Phase IV has focused on the 4 issues of "Urban and Regional Development," "Transportation," "Water Pollution," and "Air Pollution." It has systematically analyzed each development issue, identified effective approaches to achieving the development objectives, and also suggested priorities and considerations for JICA's future activities. We sincerely hope that reflecting the findings of this study in JICA's Thematic Guidelines and further strengthening issue-specific approaches will lead to more effective planning and implementation in future technical cooperation.

In conducting the study and preparing this report, a task force was set up comprising JICA staff, senior advisors, associate experts, technical support staff, and consultants. A considerable number of JICA staff members, as well as external experts, further contributed by offering valuable comments on the draft report. I would like to take this opportunity to acknowledge the efforts and contributions of all of these individuals.

October 2005

TAGUCHI Toru
Director General
Institute for International Cooperation
Japan International Cooperation Agency

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Outline of Study

1. Background and Purpose of the Study

This study is part of Phase IV of the study on Approaches for Systematic Planning of Development Projects launched in FY2001. The study was designed to enhance country-specific approaches by strengthening issue-specific approaches. In phases I to III, 11 development issues[1] were systematically analyzed and the effective approaches for them were identified. Furthermore, the study reviewed JICA's activities based on Development Objectives Charts and the findings were summarized as the reports "*Approaches for Systematic Planning of Development Projects*."

In response to many requests for similar systematization of other issues as well, 4 issues were selected in FY2004 for the phase IV study as a result of coordination with JICA's departments concerned: "Urban and Regional Development," "Transportation," "Water Pollution," and "Air Pollution." This report focuses on "Water Pollution."

The findings of this study are expected to be constructive in the following ways:

- To serve as basic information for formulating and revising Development Objectives Matrices for JICA Country Programs
- To serve as basic information for project formulation studies, and project and program formulation
- To serve as basic information for program evaluations and country-specific evaluations
- To serve as materials when JICA staff, study missions or experts explain JICA's views on development issues to recipient countries and other donors in the consultation process
- To be stored in the JICA's thematic database and shared within JICA with respect to views and approaches to development issues

2. Organization of this Report[2]

This report consists mainly of 3 chapters. As a preliminary step to considering effective approaches, Chapter 1 presents the basic ideas on the development issues, summarizing the current status, definitions, international trends in assistance, and trends in Japan's assistance. Chapter 2 provides an overall view of the possible components involved in water pollution on the basis of Development Objectives Charts, describes effective approaches and points for consideration, and explains JICA's activities. Chapter 3 focuses on JICA's priorities and considerations in relation to future cooperation efforts to address water pollution. As reference materials, the appendices describe the major activities of JICA and other donors, the state of water pollution by region, and the Basic Check List for the project formulation.

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[1] "Basic Education", "Anti-HIV/AIDS Measures", "Rural Development", "Promotion of Small and Medium Enterprises", "Poverty Reduction", "Trade and Investment Promotion", "Higher Education", "Information and Communications Technology", "Water Resources", "Reproductive Health", and "Agricultural and Rural Development".

[2] As the findings of the study are intended for use in developing JICA's Thematic Guidelines, the organization of this report is designed to be consistent with the standard organization of these guidelines.

3. Structure of the Development Objectives Chart

This study has come up with a Development Objectives Chart as shown below for each development issue, and each chart presents a comprehensive set of basic approaches to the issue[3]. The chart is designed to serve as a tool for gaining a crosscutting overview of each development issue and then exploring the policies, directions and components of JICA's activities.

Development Objectives Chart (an excerpt)

Development Objectives	Mid-term Objectives	Sub-targets of Mid-term Objectives	Means and Methods of Achieving the Sub-targets
1. Developing the Capacities of the Government, Industry, Civil Society and Academia for Water Conservation and Pollution Control as part of their own Functions	1-1 Improving the Legal and Regulatory Framework	Formulating water management policy	○ Formulating environmental conservation policy (at the national and local levels) Emphasis on the need for environmental considerations in the national development program, etc. △ Sustained and incremental efforts over the long term

* The marks in the column "Means and Methods of Achieving the Sub-targets" indicate the status of JICA's efforts.
○: Representing one of the objectives of JICA's projects for which tangible outcomes have been achieved
△: Representing one of the components of JICA's projects
Unmarked: Representing an area JICA' projects have barely covered

Please note that these marks are only designed to give a rough indication of the level of JICA's experiences and resources and that blank marks do not indicate that items are inappropriate as components of JICA's projects. Yet if an unmarked item is included in a project, the project might become challenging.

"Development Objectives," "Mid-term Objectives," and "Sub-targets of the Mid-term Objectives" in the above chart represent the breakdown of each development issue.

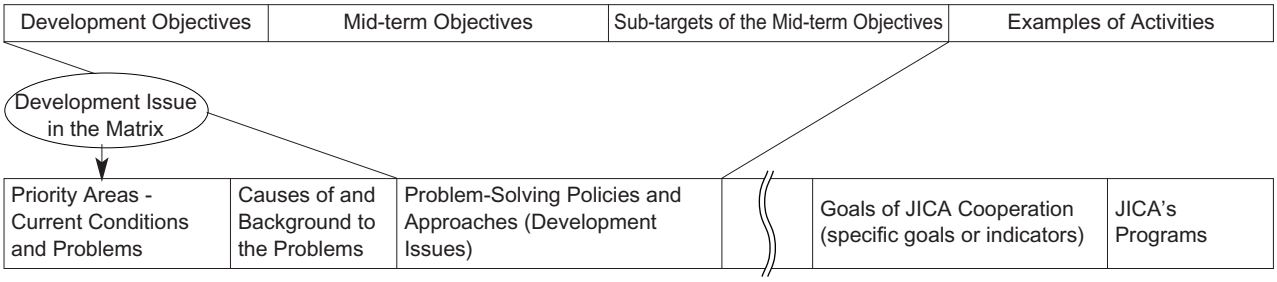
In this report, the complete Development Objectives Chart, which covers all items ranging from "Development Objectives" to "Means and Methods for Achieving the Sub-targets," appears later in this section. In addition, Chapter 2, which details the development objectives, presents the Development Objectives Chart that also includes examples of JICA's activities, providing a concrete image for the purposes of planning the cooperation projects.

The relationship between the Development Objectives Chart and the corresponding JICA Country Programs depends on the recipient country/region or the development issue in question, since the scope and scale of assistance is different. Yet this study assumes that the "Development Objectives" in the Chart corresponds to the "Priority Areas" in the Development Objectives Matrix of the JICA Country Program. Likewise, "Development Objectives", "Mid-term Objectives", and "Sub-targets of the Mid-term Objectives" in the Chart correspond to "Problem-Solving Policies and Approaches for Development Issues" in the Matrix. (The level of the Objectives in the Chart that corresponds to the Development Issues in the Matrix depends on the recipient country or sector.)

[3] In reality, the cause-and-effect relationships among the items comprising the Development Objectives Chart are not so linear, and more intertwined with each other. This Chart is designed to provide a general picture of the development issue by systematizing objectives and targets from a certain perspective.

Relationship between the Development Objectives Chart and the Development Objectives Matrix of the JICA Country Program

<Development Objectives Chart>



<JICA Country Program, Development Objectives Matrix>

4. Task Force (Water Pollution)

In this study a task force for each of the four development issues was set up. The four task forces drafted the report, and conducted a peer review of the drafts in plenary meetings of the study committee, jointly coordinating progress and content. The final study report was completed as a result of revisions of the draft articles based on comments received from JICA staff at the headquarters and overseas offices, experts, senior advisors and so on.

Task Force Members

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* The positions are as of March 2005.
* Please refer to the corresponding report in regards to tasks on the other 3 issues (Urban and Regional Development, Transportation, and Air Pollution).

Development Objectives Chart for Water Pollution (1)

Development Objective	Mid-term Objective	Sub-targets of the Mid-term Objectives	Means and Methods for Achieving the Sub-targets
1. Developing the Capacities of Government, Industry, Civil Society and Academia for Water Conservation and Pollution Control as part of their own Functions	**1-1 Improving the Legal and Regulatory Framework**	**Formulating water management policy**	○ Formulating environmental conservation policy (at national and local levels) Emphasis on the need for environmental considerations in the national development program, etc. △ Sustained and incremental efforts over the long term
		Developing an effective legal and regulatory framework	○ Revisions and developments to the legal and regulatory framework that are necessary for water environment management ○ Developing administrative instructions △ Setting appropriate environmental standards △ Setting appropriate effluent standards Establishing local ordinances △ Requiring environmental impact assessment △ Incorporating environmental considerations into environmental laws
		Strengthening integrated water management	△ Designating the competent ministry and soliciting support from other government offices concerned ○ Building a mechanism to coordinate different government offices △ Making a clear distinction in roles and functions between the central and local governments; transferring power and revenue sources to local governments
		Developing systems for appropriate enforcement of the regulations	○ Applying regulatory instruments (notification in writing on the discharge of effluent; supervision of pollution sources; compliance with effluent standards; on-site guidance; corrective orders; suspension of the discharge of effluent; penalties; etc.) ○ Applying economic instruments (taxes, charges, contributions, emissions trading, etc.) ○ Applying informational instruments (information disclosure, voluntary monitoring by businesses, reporting, etc.) ○ Applying procedural instruments (EIA, ISO 14000, etc.) △ Putting in place measures to ensure strict law enforcement (legal measures such as guaranteeing the status of inspectors and giving more power to them) Setting more stringent standards on items subject to national standards and newly imposing standards on other items in accordance with local ordinances △ Concluding pollution control agreements ○ Adopting the Pollution Control Manager System Putting in place Pollutant Release and Transfer Registers (PRTR) △ Providing subsidies and other incentives to wastewater treatment facilities Adopting integrated river basin management
	1-2 Improving the Institutional and Human Resources Framework	**Raising the awareness of policymakers**	○ Raising the awareness of high-ranking officials △ Promoting compliance △ Strengthening public relations and lobbying concerning environmental management Organizing environmental ministerial conferences △ Setting environmental conditionalities on development assistance
		Clearly defining duties within organizations	○ Developing an integrated administrative framework for water environment management △ Giving more power to the government office in charge of water quality management ○ Revising the government offices and defining duties clearly △ Taking financial measures and providing technical assistance to increase the executive capacity of local governments
		Improving coordination with other organizations	○ Improving coordination among the government offices and agencies concerned with water quality management ○ Improving coordination between the central and local governments Promoting exchanges among local governments △ Improving coordination between government and academia △ Organizing stakeholder meetings (liaison conferences)
		Developing the capacity of the government officials in charge (excluding water quality analysis and monitoring techniques)	○ Offering training in water quality management planning ○ Developing the capacity to supervise pollution sources (factories and other establishments) ○ Developing the capacity to analyze water quality data △ Offering training regarding the framework of environmental laws ○ Preparing technical manuals and thus standardizing operations
	1-3 Improving the Financial Framework	**Appropriate financial planning**	△ Developing a mechanism to finance the cost of building water pollution control facilities (allocating national, provincial and municipal expenditures) △ Securing tax revenues from tourism and factories and other establishments; introducing a system whereby the cost of a public works project for controlling specific pollution must be partly or totally borne by an establishment that causes or contributes to that pollution Reducing financial burden by shifting from centralized to decentralized wastewater treatment systems
		Studying cost recovery options	△ Establishing a law or regulation on cost recovery ○ Applying economic instruments, (taxes, charges, contributions, etc.) △ Establishing a charge structure and collection arrangements Establishing a financial accounting system
	1-4 Improving Scientific Knowledge on the Water Environment	**Building a framework for and improving the accuracy of water quality monitoring**	○ Developing plans for water quality monitoring of public waters (specifying what, where and how to monitor, and making the monitoring findings public) ○ Building a monitoring framework (including the provision, operation and maintenance of equipment, the assignment of technicians, and the securing of financial resources) ○ Ensuring monitoring accuracy management (data accuracy management and laboratory management) △ Offering training in analysis accuracy and quality control (QC) △ Developing analysis manuals and procedure documents Offering full training and guidance for achieving ISO 17025 certification Assessing the impact of water pollution on human health and local fisheries and agriculture ○ Making an inventory of pollution sources ○ Making a pollution map

Development Objectives Chart for Water Pollution (2)

Development Objective	Mid-term Objective	Sub-targets of the Mid-term Objectives	Means and Methods for Achieving the Sub-targets
		Promoting the accumulation and utilization of water quality data and the disclosure of related information	○ Designing and utilizing monitoring databases; offering training for these purposes ○ Putting the findings of monitoring analysis to good use for water quality management measures △ Forming a study group on water quality management measures △ Making arrangements for regular reporting; holding consultations with stakeholders △ Publishing an environmental white paper; preparing a state of the environment report ○ Making relevant information available on a website
	1-5 Developing the Environmental Management Capacity of Industry	**Building and strengthening corporate environmental management systems**	○ Promoting environmental management activities in production processes (5S, energy saving, CP, EOP equipment, etc.) ○ Promoting in-house instruments for environmental management (environmental auditing, environmental performance evaluation, state of the environment reporting, ISO 14000 certification, the Pollution Control Manager System, etc.) ○ Encouraging voluntary monitoring by businesses, making reporting arrangements, providing incentives (preferential taxes, subsidies, soft loans, eco-logos, etc) △ Establishing a framework for the authorities to check how corporate environmental management systems are operated; building a system for fairly evaluating corporate efforts and performance △ Promoting cooperation among businesses (sharing information and experiences through trade organizations, business associations, etc.) Establishing an industrial association for environmental conservation (tasked with introducing pollution control technologies, designing treatment systems and introducing operation and maintenance consultants) Building mechanisms, including those for financing and technical advice, to encourage businesses to make investments in water pollution control △ Providing information to citizens
		Encouraging private participation in environmental management and promoting environmental conservation industries	Acquiring expertise in determining the scope and content of outsourcing and supervising private contractors Promoting private participation in environmental analysis (with, for example, the environmental measurers certification system) △ Promoting ISO 14000 ○ Promoting CP △ Developing a lending facility that features preferential interest rates for environment-related projects Introducing preferential tariffs for wastewater treatment equipment Promoting environmental business with the strict enforcement of laws and regulations for water pollution control
	1-6 Developing the Water Pollution Control Capacity of Civil Society	**Raising public awareness concerning the conservation of water environments**	○ Making water quality monitoring data available to the public △ Publishing environmental white papers; state of the environment reports △ Public awareness raising by the mass media Presenting and explaining government policies on websites △ Providing environmental education at school Promoting environmental education (on health impact assessment, environmental pollution, ecosystems, etc. in the context of water pollution), including developing teaching materials and establishing teaching methods ○ Organizing community based workshops on environmental education Promoting green purchasing Disclosing health impact data and taking necessary action △ Publicizing a list of pollution sources
		Developing the environmental management capacity of community-based organizations	△ Encouraging voluntary activities by citizens, including river cleanups Environmental monitoring by citizens; providing basic water monitoring kits ○ Seeking the greater engagement of neighborhood community associations (including organizing environmental seminars) △ Training leaders Networking △ Promoting low-cost sanitation units to improve living standards △ Providing hygiene education for appropriate wastewater treatment
		Strengthening water conservation and pollution control measures that accommodate local and cultural characteristics	Understanding local religions and customs ○ Assessing topography and hydrological characteristics △ Assessing population density and land-use patterns ○ Civil society's efforts to reduce the water pollution load Developing and promoting on-site treatment technologies
	1-7 Developing the Water Pollution Control Capacity of Academia	**Developing research capabilities**	○ Building a framework in which groups of environmental scientists and engineers support the government sector △ Putting scientific knowledge to good use for water pollution control Establishing water pollution simulation techniques ○ Developing the capacity to elucidate water pollution mechanisms Improving techniques to identify water pollution sources and strengthening the capacity to elucidate causal relationships between such sources and health and other hazards Assessing the impact of water pollution on local fisheries and agriculture
		Providing information to and seeking more engagement with government, industry and civil society	Organizing seminars and workshops ○ Gathering and making public technical information on water pollution control

Development Objectives Chart for Water Pollution (3)

Development Objective	Mid-term Objective	Sub-targets of the Mid-term Objectives	Means and Methods for Achieving the Sub-targets
2. Developing the Capacity for Water Conservation and Pollution Control according to the Types of Bodies of Water	**2-1 Developing the Capacity for Water Conservation and Pollution Control of Rivers**	**Designating uses and setting the levels of water quality conservation for rivers**	△ Holding public hearings and assessing the current water quality ○ Conducting monitoring to assess the current water quality ○ Surveying land use patterns and economic activities in the basin △ Surveys using satellite images ○ Identifying appropriate uses of the river ○ Setting the levels of water quality conservation
		Considering options that accommodate the characteristics of river basins and existing water pollution	○ Identifying major causes of pollution (domestic wastewater, industrial/commercial wastewater, etc.) △ River surveys (flow rates and velocities, and environmental capacities) △ Studying pollution characteristics according to the flow rate and velocity ○ Appropriate enforcement of regulations (Mid-term Objective 1-1) ○ Building and strengthening corporate environmental management systems (Mid-term Objective 1-5) Coordination with other government offices in charge of different types of pollution △ Introducing off-site treatment systems for domestic wastewater (sewerage) △ Introducing on-site units for primary wastewater treatment (septic tanks, domestic wastewater treatment tanks, etc.) Increasing education and awareness about the appropriate use of pesticides and fertilizer management △ Considering options that accommodate the land use pattern in the basin ○ Identifying pollution sources that need to be addressed as a priority △ Considering the cost-effectiveness of pollution load reduction options Considering options for controlling pollution caused by natural disasters associated with tributaries (flooding, etc.) Considering options for controlling natural pollutants Considering options according to the size of the river
		Considering options that accommodate the stage of development of the recipient countries and regions	○ Considering pollution load reduction options that accommodate different stages of economic development △ Considering pollution load reduction options that accommodate the local climate (tropical, temperate, etc.) Considering options according to the local population density
	2-2 Developing the Capacity for Water Conservation and Pollution Control of Groundwater	**Designating uses and setting the levels of water quality conservation for groundwater**	△ Identifying local users and uses of groundwater ○ Identifying major causes of pollution ○ Conducting monitoring to assess the current water quality △ Surveying local land use patterns and economic activities △ Setting the levels of water quality conservation
		Considering options that accommodate the characteristics of groundwater basins and existing water pollution	○ Considering options according to water use Surveying soil contamination around polluted groundwater bodies △ Identifying the direction of groundwater flows Controlling point-source pollution Education and awareness building concerning appropriate fertilizer management
		Considering options that accommodate the stage of development of the recipient countries and regions	○ Imposing regulations on pollution sources Appropriate treatment of pumped water Shielding off or detoxifying contaminated soils △ Seeking alternative water sources
	2-3 Developing the Capacity for Water Conservation and Pollution Control of Lakes	**Designating uses and setting the levels of water quality conservation for lakes**	○ Studying the pollution characteristics of inflowing rivers ○ Conducting monitoring to assess the current water quality ○ Surveying land use patterns and economic activities in the basin Surveys using satellite images △ Identifying the uses of lakes ○ Assessing the inflowing pollution loads △ Studying the main causes of pollution ○ Assessing horizontal and vertical variations in water quality △ Assessing the sediment ○ Setting the levels of water quality conservation
		Assessing the hydrological characteristics of lakes	○ Assessing hydrological and hydraulic characteristics (the catchment area, planar shape, cross-sectional shape, capacity, water retention time, water level fluctuations, inflowing and outflowing rivers, water budget, water cycle, etc.) Assessing vertical characteristics (seasonal variations, discontinuity layers, etc.) Classifying water bodies into fresh, salt and brackish ones and assessing seasonal variations for each type
		Considering options that accommodate the characteristics of basins and existing water pollution	○ Identifying major causes of pollution (domestic wastewater, industrial/commercial wastewater, etc.) ○ Appropriate enforcement of regulations (Mid-term Objective 1-1) ○ Building and strengthening corporate environmental management systems (Mid-term Objective 1-5) Introducing the concept of total pollutant load control of organic pollutants △ Introducing off-site treatment systems for domestic wastewater (sewerage) △ Introducing on-site units for primary wastewater treatment (septic tanks, domestic wastewater treatment tanks) Education and awareness building about the appropriate use of pesticides and fertilizer management ○ Identifying pollution sources that need to be addressed with priority Considering the cost-effectiveness of pollution load reduction options
		Considering options that accommodate the stage of development of the recipient countries and regions	○ Considering pollution load reduction options that accommodate different stages of economic development Considering pollution load reduction options that accommodate the local climate (tropical, temperate, etc.) Measures for lake water purification (total pollutant load control of COD, vegetation-assisted water purification, etc.)

Development Objectives Chart for Water Pollution (4)

Development Objective	Mid-term Objective	Sub-targets of the Mid-term Objectives	Means and Methods for Achieving the Sub-targets
	2-4 Developing the Capacity for Water Conservation and Pollution Control of Enclosed Coastal Seas	**Designating uses and setting the levels of water quality conservation for enclosed coastal sea**	△ Surveys of local fisheries and other economic activities △ Surveys to identify users of the sea ○ Assessing the pollution load from the basin Setting the levels of water quality conservation
		Assessing the hydrographic characteristics of enclosed coastal seas	○ Coastal monitoring and tidal current measurement △ Assessing the depths and flow rates of the target coastal sea △ Assessing the geographical enclosed index
		Considering options that accommodate the characteristics of basins and existing water pollution	○ Identifying the main causes of pollution ○ Considering the introduction of total pollutant load control for the basin as a whole ○ Taking measures to protect mangrove forests, etc. Considering measures to cope with ship accidents △ Assessing the land use characteristics of the inflowing river basin
		Considering options that accommodate the stage of development of the recipient countries and regions	○ Considering pollution load reduction options that accommodate different stages of economic development △ Considering appropriate options to control pollution from the inflowing river basin △ Measures to reduce the pollution load generated by internal factors

○: Represents one of the objectives of JICA's projects for which tangible outcomes have been achieved
△: Represents one of the components of JICA's projects
Unmarked: Represents an area that JICA' projects have barely covered

Overview of Effective Approaches for Water Pollution: Executive Summary

1. Overview of Water Pollution

1-1 The State of Water Pollution

Water pollution has a direct impact on human health, the natural environment and ecosystems. In fact, the conservation of water quality is essential to sustaining life.

In the developing world, water pollution is more acute than ever. More and more wastewater from domestic and industrial sources is discharged untreated into public waters as a result of rapid economic and population growth. Deteriorating water quality, in turn, is increasing health risks. Yet efforts to control water pollution in developing countries are often inadequate, due mainly to institutional and organizational constraints and limited financial and human resources.

1-2 Definition of Water Pollution

In this report, water pollution refers to the deterioration in the water quality of public waters that results mainly from human activities and impacts on the health and the living environment of residents and other water uses, as well as on human consumption. The report focuses on freshwater bodies – running waters (rivers, waterways, etc.), groundwater bodies and lakes – plus bays, which are enclosed coastal seas. Emphasis is not placed on water utilization or flood control as they are discussed in another JICA report entitled "*Approaches for the Systematic Planning of Development Projects: Water Resources*."

1-3 International Aid Trends

Traditionally, development assistance in the water sector has focused on physical infrastructure development mainly for irrigation and hydropower. In recent years, however, donors increasingly stress the need for knowledge-based support, especially in public awareness building concerning water and in environmental management as a whole.

There have been some developments that are of particular importance to water pollution control in recent years. In 2000, the United Nations Millennium Summit set out the target of halving the proportion of people without sustainable access to safe drinking water by 2015 as part of the Millennium Development Goals (MDGs). The World Summit on Sustainable Development (WSSD) in September 2002 established the target of halving the proportion of people without access to basic sanitation by the year 2015, among others. In 2003, the Third World Water Forum (WWF3) held in Japan announced the "Portfolio of Water Actions", a list of water-related projects by donors.

1-4 Trends in Japan's Assistance

Japan has consistently regarded pollution control – including the control of water pollution – as a key focus of its ODA in the environmental sector.

At a United Nations General Assembly Special Session (UNGASS-19) in 1997, Japan announced the Initiatives for Sustainable Development (ISD) toward the 21st Century. ISD identified water issues as a focal area and stressed the need for knowledge-based assistance for the conservation of water quality. ISD was developed into the Eco-ISD in 2002, which covered the sustainable supply of safe drinking water and the provision of sanitary facilities, among other focal areas. In addition, the revised Medium-Term Policy on ODA, announced in February 2005, identified pollution control, including the control of water pollution, as a key focus of Japan's ODA in the environmental sector.

Japan proactively addresses water pollution and other water issues in developing countries through technical cooperation and grant aid by the Japan International Cooperation Agency (JICA) and the ministries concerned, and through loan aid by the Japan Bank for International Cooperation (JBIC). Japan's ODA in the area of water resources and sanitation averaged 1 billion US dollars annually for the 3-year period between 1999 and 2001, accounting for about one third of the total ODA in the world in this area. This has made Japan the biggest donor in this sector among the bilateral and multilateral donors.

2. Effective Approaches for Water Pollution

2-1 Purposes of Water Pollution Control

Clean water is essential from many aspects, including the maintenance of human health and human life itself, economic activities and conservation of the natural environment. For this reason, pollution control and the conservation of water quality are of particular importance. However, investment and public interest in water pollution control are rather limited in many developing countries. It is important for them to do what they can do to conserve water quality and control water pollution, in terms of both preventive and after-the-fact measures. Donors, for their part, should provide effective assistance to support such efforts.

To address water pollution in developing countries in a holistic manner, this report focuses on 2 aspects: (i) promoting water conservation and pollution control through strengthening the capacities – the government, industry, civil society and academia (capacity development of the key actors); and (ii) taking effective action that accommodates the characteristics of different types of public waters. Specifically, the report has established 2 development objectives as described below.

2-2 Effective Approaches for Water Pollution

Development Objective 1: Developing the Capacities of the Government, Industry, Civil Society and Academia for Water Conservation and Pollution Control as part of their own Functions

The promotion of environmental management requires an understanding of the roles and capacities of the 4 key actors – the government, industry, civil society and academia – and their interrelationships, thus making the most of their capacities. The relationships among these actors are subject to constant change according to the socioeconomic conditions. Likewise, their roles vary depending on the stage of development of developing countries. It is important that development assistance planners carefully consider which actor to focus on and when, in order to produce maximum outcomes in developing the capacity of the society as a whole to deal with water conservation and pollution control.

For the government sector, it is helpful to address the three types of framework – legal and regulatory, institutional and human resources, and financial. Weaknesses in these frameworks constitute a major constraint on water conservation and pollution control in developing countries.

Improving the Legal and Regulatory Framework.

The first step is to secure policy commitments regarding water pollution control from the central government and other authorities to ensure that water pollution control is given priority in relation to other issues. Another important requirement is to establish practical and effective laws and standards that accord with the conditions of the recipient countries. The process of pursing this goal itself will help the government sector to develop its law enforcement capacity. In fact, an effective law enforcement system is much needed in developing countries, which often have a weak record in the implementation of laws. Such a system should ensure that these policy and

legal frameworks facilitate the implementation of regulations and other environmental management measures and thus produce tangible outcomes in water conservation and pollution control.

Improving the Institutional and Human Resources Framework.

Raising the awareness and motivation of government leaders is essential. Some of the avenues to the smooth implementation of water conservation and pollution control are: establishing an integrated administrative framework for water management through a clear definition of the duties of counterpart organizations and other organizations, and better coordination among them; and the standardization of operations. In general, developing the capacity for water quality and environmental management of local governments responsible for regulation implementation and supervising and monitoring of water pollution control are the keys to ensuring proper law enforcement and implementation. Donors can support such capacity development by, for example, providing training for these local governments and their personnel. In providing training, donors are required to ensure that intellectual assets will accumulate at the organizational level rather than at the individual level.

Improving the Financial Framework.

Developing countries often lack the financial resources for both initial investment in, and the operation and maintenance costs of, water pollution control facilities. This means that options that require a large amount of funds may not be viable in developing countries. It is therefore necessary to build a sustainable financial base by establishing an appropriate cost recovery system based on the Polluter Pays Principle and an accurate assessment of the ability to pay.

Improving Scientific Knowledge on the Water Environment.

A monitoring framework for assessing water pollution and taking appropriate regulatory measures is essential for developing a water pollution control policy. Basic data collected through the monitoring process should be organized into a database and properly analyzed. Such data and the findings of such an analysis should be presented in a state of the environment report or a white paper on the environment, so that they will be put to good use for water quality management measures. Information regarding water pollution should be made public to ensure that citizens, research institutions and businesses have access to it.

Developing the Environmental Management Capacity of Industry.

Building the environmental management capacity of industry will greatly contribute to pollution control since this sector is the main source of water pollution. Small and medium-sized enterprises (SMEs) often have poor access to human, financial and information resources, and tend to disregard the need for environmental management or conservation. Technical assistance through government entities and trade organizations is effective in promoting appropriate technologies. It is too much to expect that voluntary activities by businesses alone will improve the environment. In this context, a two-pronged approach that involves both auditing by the authorities and reporting to them provides a tool to build a workable framework for corporate environmental management. Promotion and capacity building of private monitoring firms and environmental conservation industries are helpful both in complementing the capacity of the government sector and in disseminating tools for corporate environmental management.

Developing the Water Pollution Control Capacity of the Civil Society.

Raising the environmental awareness of local communities through information campaigns and environmental education provides a basis for building a strong public consensus for environmental conservation and increasing social pressure on pollution dischargers. Such pressure sometimes has more impact on the reduction of water pollution than governmental regulations. Environmental education and awareness programs that focus on local communities in their capacity as pollutant dischargers provide another viable tool for donors. Yet environmental education will not produce tangible results in the short term. Donors should support it over the mid-term to long term. Other support for water pollution control should also take into account local and cultural characteristics.

Developing the Water Pollution Control Capacity of Academia.

Research institutions are also essential for development assistance in water pollution control. They should have the capacity not only to conduct basic research and promote interdisciplinary research activities on their own, but also to meet such requests from the government, industry and civil society sectors. In fact, such institutions are required to provide the scientific knowledge and expertise to allow these three sectors to assess environmental and health impacts. To this end, coordination should be improved among academic societies, public research institutions and government offices.

Development Objective 2: Developing the Capacity for Water Conservation and Pollution Control according to the Types of Bodies of Water

Donors should consider water conservation and pollution control measures that accommodate the characteristics of the target bodies of water. In addition, the concept of integrated river basin management is of crucial importance for any development programs or projects. This concept is aimed at maintaining the cycle of clean water within the entire basin by taking a holistic approach to pollution sources and pollution loads from the headwaters to the downstream reaches.

Rivers.

Water conservation and pollution control for rivers start with setting the level of water quality conservation for each use of a river. The optimal approach to water quality control depends on the physical characteristics of the river, including the flow rates and velocities. This also varies according to the pollution source (industrial, agricultural and domestic) and the stage of socioeconomic development, and so do appropriate technologies for rivers. It is therefore essential to identify pollution sources and pollutants and calculate pollution loads.

Groundwater Bodies.

Unlike surface water, groundwater is usually inaccessible to direct human observation. For this reason, problems with groundwater bodies often remain unnoticed. In addition, it is difficult to identify and address pollution sources and restore the water quality. Groundwater provides the most appropriate source of drinking water in many developing countries. For this reason, groundwater should be conserved so that its quality meets the criteria for potable water. Once a groundwater body is contaminated, restoring the water quality, if it is possible, requires huge amounts of money and state-of-the art technologies. This may not be a viable option for developing countries. Prevent of such contamination is essential.

Lakes.

Lakes tend to accumulate pollutants since the inflowing water stays in such closed water areas. Once a lake is polluted, it is not an easy task to improve the water quality. Water quality control measures should be tailored for each lake. This is because the pollution load and the optimal control option greatly differ depending on a number of factors, including the land use and economic activities around the lake and the rivers that flow into and from them.

Enclosed coastal seas (bays, estuaries, etc.)

The pollution of enclosed coastal seas is primarily caused by pollution loadings from the inflowing rivers and other land-based sources. Pollution control of these large water bodies should take an integrated approach to address a wide spectrum of issues. This makes it more practical to have an overall picture of the pollution of the target area first and address these issues in order of priority. Attention should also be given to the fact that different levels of water quality conservation are set for different uses, including fisheries, leisure and transport.

3. Directions of JICA's Cooperation

3-1 Guiding Principles of JICA's Cooperation in Water Pollution Reduction

(1) Target-setting and phasing-in of JICA's cooperation in line with the stage of development and priority needs of the recipient countries

Water pollution control requires the application of a variety of measures to address a wide range of issues. Sustainable implementation of these measures without external assistance is a challenge for developing countries since they often lack the financial and human resources and institutional capacities. It is therefore important for JICA to identify problems arising from water pollution and give priority to those that require urgent attention. Available resources, which are often limited, should then be mobilized to address the prioritized problems for the sake of aid efficiency. In addition, JICA should consider a portfolio of development interventions that is designed to ensure that their outcomes will be sustainable according to the stage of development of the recipient countries. In this context, appropriate technologies deserve special attention.

(2) Developing the capacities of the key actors to enhance the pollution control capacity of the society as a whole

Four major actors – government, civil society, industry and academia – are involved in water pollution control. The key to improving aid effectiveness is to determine how best to develop the capacities of these four actors for increasing the capacity of the society as a whole to control water pollution. To achieving this end (i.e., to implement assistance activities centered on supporting Capacity Development), it is important to gauge the capacities of these actors and encourage ownership by the recipients.

(3) Considering the optimal portfolio of development interventions based on Capacity Assessment

To pursue the optimal portfolio of development interventions, it is crucial to identify, through the Capacity Assessment process, the weaknesses in the capacity of the recipient that pose as an obstacle to solving the target problem in each aid project. Effective and efficient assistance will result from determining the portfolio of development interventions based on such capacity assessment while sharing with the recipient country the awareness of how to ensure that assistance is most effective in developing the water pollution control capacity of the society as a whole.

(4) Strengthening water environment administration and water quality management capacity based on environmental science and technology

Accurate environmental information and scientific expertise in pollution control provide a basis for implementing reliable water environment administration, considering pollution control options, and increasing the capacity for water quality control.

Technology transfer designed to develop the capacity to provide environmental scientific expertise has been one of the focused areas of Japan's assistance. It will continue to be an important part of the country's international cooperation in water pollution control.

3-2 JICA's Priorities and Considerations

(1) Support for strengthening the capacity for formulating water sector policies and environmental management programs

It is important to improve the executive capacity of the government sector and put in place an effective legal and regulatory framework. To this end, JICA should support developing countries in putting science-based data to good use in the formulation of water quality policies and water quality management programs.

(2) Organization and institution building and supporting capacity development for water environment management

JICA should implement technology transfer projects designed to ensure that individual capacity development will not stop at the individual level but will rather be part of organization and institution building. It should support the public sector in developing countries in improving the capacity of society as a whole for water conservation and pollution control through such means as: providing a forum for decision-making and cross-sectoral coordination to ensure an integrated administrative framework for water management; making relevant information accessible to citizens; and encouraging businesses to improve their environmental management capacity.

(3) Upgrading the levels of environmental science and technology in the area of the water environment

In developing countries where environmental management administration is still in its development stages, it is essential to upgrade the levels of environmental science and technology, which provides a basis for public administration in the management of the water environment and water quality. JICA assistance in water pollution control thus focuses on this area. Due to their necessity and importance, special emphasis should be placed on: monitoring techniques, techniques for disseminating environmental information, low-cost technologies, industrial pollution control technologies, and technologies that provides a basis for environmental strategies and policies.

(4) Timely implementation of priority measures for water pollution control

Water pollution occurs where people live, and its hazards spread to wider areas. If project planners look at water pollution hazards only in the local context, they may overlook more serious hazards elsewhere in the recipient country or give low priority to pollution control measures that need to be taken more immediately. This points to the need for the quantitative assessment of water pollution and its hazards and for the timely planning and implementation of projects to address priority issues based on such an assessment.

(5) Partnership with other donors for synergies

Integrated water pollution control requires the mobilization of considerable resources. This makes it essential that resources be used efficiently, especially for water pollution control in large cities. This can be achieved by improving coordination with other donors or even forging partnerships with them.

(6) Program Based Approach involving a range of aid modalities

The key to improving aid effectiveness is to determine how best to combine different aid schemes into one integrated portfolio as if they are part of a single assistance program (program approach) according to the character and features of the development issue to be addressed. JICA should also improve coordination with loan and grant aid programs, as well as other programs of the agencies affiliated with the Ministry of Economy, Trade

and Industry of Japan – including the Japan External Trade Organization (JETRO) and the New Energy and Industrial Technology Development Organization (NEDO) – to pursue more coherent development assistance as a leading donor country.

(7) Attention to world trends in the water sector

In delivering aid, JICA should take account of the world trends in the sector of water pollution control, such as Public Private Partnership (PPP) and privatization.

(8) Building on lessons learned from past experience

JICA should learn lessons from both successful and unsuccessful experiences in the water pollution control sector and implement better projects accordingly.

Chapter 1 Overview of Water Pollution

This chapter summarizes the state of affairs and aid trends surrounding the issue of water pollution before discussing effective approaches to addressing it.

1-1 The State of Water Pollution

The state of water pollution

No animal or plant can sustain life without consuming water. Nearly 70 % of the human body consists of water, and plants cannot grow without water. Life and water are inseparable. This does not mean, however, that any water can sustain life; all living organisms must take in clean water. Water containing excessive levels of organic chemicals or heavy metals can kill living organisms, and so can water polluted by domestic wastewater. In this sense, water pollution has a direct impact on plant and animal life in ecosystems, and water quality conservation is essential to sustaining life. Despite all these facts, water pollution is becoming more and more acute throughout the world due to the rapid growth in the human population and industrialization in parallel with economic development.

The conservation of water quality is essential to sustaining life.

Water pollution is generally defined as the deterioration of water quality caused by organic matter or toxic substances that are discharged into bodies of water, including rivers, lakes, oceans and groundwater due to lifestyle changes and industrial growth[1]. Among the sources of such pollutants are agricultural/stockbreeding wastewater and polluted rainwater, as well as domestic and industrial wastewater. Wastewater takes its toll in the form of algal blooms resulting from eutrophication, the death of aquatic organisms due to a lack of dissolved oxygen in the water, and the pollution of fish and shellfish and the health hazards to humans caused by toxic substances.

Water pollution is defined as a deterioration in water quality due to wastewater discharges into rivers, lakes, oceans, and other water bodies.

In the developing world, water pollution is more acute than ever. More and more wastewater from domestic and industrial sources is being discharged untreated into public waters as a result of rapid economic and population growth. The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF)[2] estimate that about 20 % of the world's population are without access to safe drinking water, and about 40 % have no adequate sanitation facilities. The World Bank[3] estimates that among the world population as of 2002, 1.7 million people died due to waterborne infectious diseases resulting from unsafe water and unsanitary health environments. Of this mortality, 9 out of 10 were children in developing countries.

Water pollution is getting extremely serious in developing countries.

[1] National Institute for Environmental Studies, *EICnet Kankyo Yogoshu* [EICnet glossary of environmental terms] (http://www.eic.or.jp/ecoterm/)
[2] WHO/UNICEF (2000)
[3] World Bank (2004) (http://www.worldbank.org/watsan/pdf/WSS_report_Final_19Feb.pdf) (accessed in June 2005)

The incidence of eutrophication is greater than ever in closed water areas such as lakes and inner bays.

In addition, eutrophication due to the inflow of nitrogen and phosphorus contained in wastewater into closed water areas, such as lakes and inner bays, gives rise to a number of problems. Aquatic algal blooms or red tides cause damage to local fisheries and adversely affect the intake of water. The algae involved in such blooms are sometimes toxic. Preventing this type of water pollution calls for efforts to reduce the inflow loads by meeting such requirements as: ensuring that factories and other establishments comply with effluent standards and commit themselves to improving their effluent treatment technologies; and the development of sewerage systems or the provision of domestic flush toilet and non-toilet wastewater treatment tanks.

Nevertheless, advanced sewerage systems such as those in Japan require significant capital investments and advanced maintenance technologies. Developing countries may not be able to afford such systems. This makes it often necessary to purse other options that better suit local conditions. The sewerage option assumes the availability of flush toilets, which increase both water consumption and outflow loads of nitrogen and phosphorus. A wastewater treatment system designed to remove these two elements in turn calls for high operating costs and advanced maintenance technologies. This may highlight the importance of using non-flush toilets and recycling human waste as a viable option (see Figure A5-2, Appendix 5).

The institutional framework for water pollution control is not adequate.

The primary responsibility for environmental management rests with the government. Yet environmental management efforts by governments in developing countries are often insufficient. Gradual progress has been made in developing the legal and regulatory frameworks for different environmental sectors, although there still needs to be much more improvement in the institutional, budgetary and human resources aspects.

1-2 Definition of Water Pollution

This report focuses on freshwater bodies – running waters (rivers, waterways, etc.), groundwater bodies and lakes – plus bays, which are enclosed coastal seas.

In this report, water pollution refers to a deterioration in the water quality of public waters that results mainly from human activities and impacts the health and the living environment of residents and other uses of the water, besides water for human consumption. The report focuses on freshwater bodies – running waters (rivers, waterways, etc.), groundwater bodies and lakes – plus bays, which are enclosed coastal seas. Emphasis is not placed on water utilization or flood control as these are discussed in another JICA report entitled *Approaches for Systematic Planning of Development Projects: Water Resources*[4].

[4] JICA Institute for International Cooperation (2005)

International society increasingly stresses the importance of policy support, which covers, among other aspects, awareness-raising concerning water or environmental management as a whole.

1-3 International Aid Trends

This section reviews international aid trends in the water sector while drawing on the relevant reports of JICA[5] and the Ministry of Foreign Affairs' website on ODA[6].

1-3-1 Overview

Development assistance in the water sector was traditionally highlighted by the support of the World Bank and other multilateral development banks in infrastructure development, mainly for irrigation and hydropower. In recent years, however, donors increasingly stress the importance of policy support, especially in public awareness building about water and in environmental management as a whole. The World Bank, for example, is now providing substantial policy development support in cooperation with other multilateral and bilateral donors and NGOs. This is exemplified by the Bank's international partnership called the Water and Sanitation Programme (WSP).

1-3-2 From the Stockholm Conference to the Establishment of UNEP

The Declaration on the Human Environment calls for careful planning or management of water among other natural resources.

In June 1972, representatives from 113 countries participated in the first high-level intergovernmental conference on the environment ever held on a global scale – the U.N. Conference on the Human Environment (also known as the Stockholm Conference).

The Declaration on the Human Environment and the Action Plan for the Human Environment adopted by the 1972 Conference had a great impact on the world's environmental conservation efforts in the years that followed. They also promoted the creation of the United Nations Environment Programme (UNEP) in December 1972. In relation to water pollution, the Declaration stressed the need to safeguard the natural resources of the earth – including water – through careful planning or management in Principle 2. However, concerns about global environmental issues, including water pollution, waned as the international community was preoccupied with addressing the oil and debt crises that followed.

1-3-3 UN Conference on Water at Mar del Plata

Access to water and sanitation was promoted during the UN Water Supply and Sanitation Decade.

In 1977, the United Nations Conference on Water held in Mar del Plata, Argentina, designated 1981-1990 as the UN Water Supply and Sanitation Decade. With the aim of providing safe water and sanitation for all, this initiative focused on promoting low cost affordable technologies and encouraged community participation. This coincided with the emphasis of international donors on Appropriate Technology at that time. These donors also recognized the significance of ensuring access to drinking water and sanitation. To this end,

[5] JICA Institute for International Cooperation (2001), (2002)
[6] Ministry of Foreign Affairs, "Japan's ODA" Website (http://www.mofa.go.jp/mofaj/gaiko/oda)

they made investments on an unprecedented scale in the developing world. At the same time, the donors implemented outreach programs for populations without access to water and sanitation services and mobilized resources to develop the technologies available in developing countries. As a result, 4.1 billion people (79 % of the world's population) had access to improved water supplies and 2.9 billion (55 % of the world population) to sanitation by 1990, the last year of the UN Water Supply and Sanitation Decade.

1-3-4 Global Environmental Summit in Rio de Janeiro, Brazil (UN Conference on Environment and Development)

Agenda 21 identified water pollution issues to be addressed as: protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas: protection of the quality and supply of freshwater resources and their integrated management; and the sound management of sewage-related issues.

In June 1992, the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro, Brazil. Also known as the Global Environmental Summit, UNCED adopted a global action plan, Agenda 21. The agenda touched on water pollution in Section II: Conservation and Management of Resources for Development. Among the relevant chapters are: Chapter 17. Protection of the Oceans, All Kinds of Seas, Including Enclosed and Semi-enclosed Seas, and Coastal Areas and the Protection, Rational Use and Development of their Living Resources; Chapter 18. Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources; and Chapter 21. Environmentally Sound Management of Solid Wastes and Sewage-Related Issues.

1-3-5 World Water Forum

A number of conferences on global water issues followed the Global Environmental Summit in 1992. Yet they did not produce substantial outcomes compared with international initiatives to address political and economic issues – at least in the eyes of some international institutions and academic associations. Then the World Water Council (WWC) was established in France, which also hosted the International Conference on Water and Sustainable Development in 1998 at the proposal of French President Jacques Chirac.

The World Water Vision calls for action for safe water and sanitation as well as the more efficient use of water.

In 1997, WWC and others convened the First World Water Forum (WWF1) in Marrakesh, Morocco. WWF1 decided to develop the World Water Vision for the 21st century and established the World Commission on Water for the 21st Century tasked with drawing up the Vision. In relation to water pollution, the 1997 Forum called for action to ensure access to safe water and sanitation as part of Basic Human Needs (BHN) as well as the effective use of water resources.

The Second WWF (WWF2), held in 2000 in The Hague, the Netherlands, presented the World Water Vision, which stressed, among other things, the importance of the participation of all in solving water problems. The 2000 Forum also adopted the Hague Ministerial Declaration, which identified water challenges and set out a global framework for action.

WWF2 was followed by 2 major events that concerned water pollution among other issues. The United Nations Millennium Summit in 2000 set out the

The target of halving the proportion of people without sustainable access to safe drinking water and sanitation facilities by 2015 as part of the Millennium Development Goals (MDGs)

target of halving the proportion of people without sustainable access to safe drinking water by 2015 as part of the Millennium Development Goals (MDGs). The World Summit on Sustainable Development (WSSD) in September 2002 established the target of halving the proportion of people without access to basic sanitation by the year 2015, among other targets. In March 2003, Japan hosted the Third World Water Forum (WWF3) – the first WWF held in Asia. WWF3 announced the Portfolio of Water Actions, a list of 422 voluntary projects reported from 36 countries and 16 multinational institutions. This conference also adopted the Ministerial Declaration: Message from Lake Biwa and the Yodo River Basin – a product of the discussions of 5 ministerial-level sessions on safe drinking water and sanitation, water pollution prevention and ecosystem conservation and other issues, which also involved the participation of the general public.

1-3-6 World Summit on Sustainable Development (WSSD)

The commitment to increasing access to water, sanitation and other basic needs in the Johannesburg Declaration.

The World Summit on Sustainable Development (WSSD) held in September 2002 in Johannesburg, South Africa reaffirmed the participating countries' commitment to sustainable development.

The Johannesburg Declaration announced at WSSD identified air, water and marine pollution as one of the challenges facing the world in the context of the global environment. The Declaration also confirmed that participating countries would work together to: increase access to such basic requirements as clean water and sanitation; help one another gain access to financial resources; ensure capacity-building; use modern technology; and make sure that there is technology transfer, human resources development, education, and training.

1-4 Trends in Japan's Assistance

The ODA Charter addresses environmental conservation, including water pollution control, as a focal area.

This section reviews trends in Japan's assistance in the water sector, based on JICA's *Study on Development Assistance in the Water Sector: Response to Water Problems in the Developing Countries*[7], and the Ministry of Foreign Affairs *White Paper on Official Development Assistance 2004*[8].

1-4-1 Policies of Japan and JICA on Aid in the Water Sector

The ODA Charter, Japan's aid policy framework over the medium to long term endorsed by the Cabinet in June 1992, placed emphasis on Asia as a priority region and the global environment and BHN as 2 of its priority issues. These 2 issues involve water pollution and access to safe drinking water and sanitation facilities.

TICAD called for better access to safe water supply and sanitation.

Japan has hosted a total of 3 Tokyo International Conferences on African Development (TICAD I, II and III) in 1993, 1998 and 2003. The Tokyo Agenda for Action, adopted at TICAD II, set forth the goal of providing access to safe

[7] JICA Institute for International Cooperation (2002)
[8] Available from the Ministry of Foreign Affairs, "Japan's ODA" (http://www.mofa.go.jp/mofaj/gaiko/oda)

water supply and sanitation for at least 80 % of the population of Africa by 2005 in the section on health and population. To achieve this goal, the agenda called for African countries to increase the number of safe water supply points and strengthen the capacity of communities to maintain water facilities.

The Initiatives for Sustainable Development (ISD) reaffirmed Japan's commitment to addressing water pollution as part of its focus on fresh water issues.

At the 19th United Nations General Assembly Special Session in 1997, Japan announced the Initiatives for Sustainable Development (ISD) toward the 21st Century. ISD set forth Japan's aid policy in the environmental sector over the next 5 years based on the country's achievements in the sector for the 5-year period after the United Nations Conference on Environment and Development (UNCED). As the basic concepts of its philosophy, ISD focused on global human security, self-help efforts and sustainable development. Its Program of Action covered fresh water issues, as well as air pollution (acid rain, etc.), water pollution and waste disposal, efforts to address global warming (the Kyoto Initiative), natural environment conservation, and assistance in enhancing environmental awareness. In this context, ISD reaffirmed Japan's commitment to supporting the development of water and sewage systems and extending knowledge-based assistance for water quality conservation, covering such aspects as regulatory expertise (water pollution control, etc.), water quality monitoring, and the technology to address groundwater pollution.

The Medium-Term Policy on ODA focused on support for poverty alleviation programs and social development, including water supply and sanitation facilities.

In August 1999, Japan announced the Medium-Term Policy on Official Development Assistance based on the idea that ODA's basic approaches, key focuses, and priority issues and sectors by region should be reviewed as appropriate in response to developments at home and abroad. This mid-term policy identified 7 key focuses (priority issues and sectors). Among them are: support for poverty reduction programs and social development, including water supply and sanitation facilities; support for the economic and social infrastructure; human resources development and intellectual support; and responding to global issues.

Japan's commitment to providing aid in the water sector at WSSD.

At the WSSD in September 2002, Prime Minister Junichiro Koizumi announced the Koizumi Initiative (concrete actions of the Japanese government to be taken for sustainable development – towards global sharing). In this initiative, the Prime Minister presented the Environmental Conservation Initiative for Sustainable Development (EcoISD), which builds on ISD of 1997 and provides a basic framework for Japan's assistance in the environmental sector. EcoISD committed Japan to address a number of aspects of water issues, including drinking water, public health, natural environment protection and natural disaster preparedness. Special emphasis was placed on the sustainable supply of safe drinking water and the development of sanitary sewerage systems; collaboration with NGOs; taking into account the important role of women; and a plan to convene the Third World Water Forum and its international ministerial conference in March 2003; among other issues. In a wider context, EcoISD set out its Action Plans (Japan's International Environmental Cooperation mainly through ODA) in four priority areas: Efforts to address global warming; pollution control; fresh water issues; and conservation of the natural environment. At the WSSD, Japan also announced the Japan-US Clean Water

for People Initiative, which is designed to provide safe water and sanitation to the world's poor.

The World Water Vision calls for action for safe water and sanitation as well as the more efficient use of water.

In August 2003, Japan revised the Official Development Assistance Charter (ODA Charter) for the first time in 11 years. In the context of accelerating globalization, the worsening economic and fiscal situation at home and the greater role of varied players including NGOs in ODA, the revised ODA Charter set out 4 priorities: addressing global issues; sustainable growth; poverty reduction; and peace building. Water pollution and other environmental problems were incorporated into global issues. The new Charter stated that environmental conservation and development should be pursued in tandem as the first pillar of the Principle of ODA Implementation.

As viable approaches to water pollution, the new Medium-Term Policy on ODA calls for supporting human resources development, raising environmental awareness, encouraging efforts to address environmental problems, and applying Japan's experiences and technologies.

In February 2005, Japan announced the revised Medium-Term Policy on ODA. The new policy identified pollution control – including control of water pollution – as a key focus of Japan's ODA in the environmental sector. Specific actions included: supporting human resources development in order to enhance the overall capacity of the authorities concerned, research institutions and other agencies in developing countries to address environmental issues; raise environmental awareness in developing countries through policy dialogues, various forums, and other appropriate cooperation schemes; encourage efforts to address environmental issues in developing countries; and share Japanese experiences and scientific technologies.

JICA established the Study Committee on Development Assistance in Water Sectors in February 2002 in preparation for the Third World Water Forum (WWF3). Based on the recommendations of the group, JICA identified 4 guiding principles of JICA's basic policy on water: (i) ensuring a sustainable supply of safe water; (ii) promoting integrated water management; (iii) conserving the environment by improving water quality; and (iv) securing food through appropriate water use. JICA announced this policy at WWF3.

1-4-2 Japan's Aid Delivery Framework in the Water Sector

Japan's ODA in the water sector can be divided into bilateral aid, which is directly extended to developing countries, and multilateral aid in the form of investments and contributions to international aid agencies. Japan's bilateral aid in the water sector can further be divided into technical cooperation by JICA, grant aid delivered by JICA on behalf of the Ministry of Foreign Affairs, and loan aid by the Japan Bank for International Cooperation (JBIC).

JICA implements capacity building and other technical cooperation projects and development studies regarding water pollution in the technical cooperation category. In the grant aid category, JICA supports the development of water and sewage systems associated with water pollution control and provides equipment for water quality monitoring. As for loan aid, JBIC supports projects for large-scale water and sewage systems in relation to water pollution control.

MHLW's support in the water sector addresses both the "hard" component and "soft" component of assistance.

A number of other government offices are also involved in delivering ODA in the water sector, including the Ministry of Health Labour and Welfare

(MHLW), the Ministry of Economy, Trade and Industry (METI), the Ministry of Land, Infrastructure and Transport (MLIT), and the Ministry of the Environment (MOE).

The Ministry of Health, Labour and Welfare (MHLW) supports developing countries primarily in water supply. Emphasis is placed on both the "soft" and "hard" components of assistance for improving living standards in developing countries. The soft component includes institution building and human resources development for socioeconomic development. MHLW's commitment in international cooperation is highlighted by, for example, its policy for proactive contributions to the international community for FY2001.

METI focuses on research on industrial water and wastewater and preliminary studies for possible water and sewage projects.

The Ministry of Economy, Trade and Industry (METI) provides integrated economic cooperation that ensures articulation between aid on one hand and trade and investment on the other. Its activities in the water sector include research regarding hydroelectric power generation and industrial water and wastewater and preliminary studies for possible water and sewage projects.

MLIT plays an active role in the World Water Forum

The support of the Ministry of Land, Infrastructure and Transport (MLIT) in the water sector is highlighted by its engagement in the World Water Forum and the International Conference on the Conservation and Management of Lakes. For the latter conference, MLIT worked hard to pursue partnerships in efforts to conserve lakes in many parts of the world through multilateral negotiations and forums. This ministry's focus on water is also articulated in its white papers. Characterizing water issues as one of the most important challenges for the 21st century, the white papers state that water issues affect food production throughout the world and food imports to Japan and thus have considerable implications for our economy and lives. The papers stress the importance of Japan working hard to address water issues in the context of international cooperation as well.

MOE focuses on freshwater resources and urban environments

The Ministry of the Environment (MOE) is involved in international cooperation and assistance in water among other environmental sectors. In relation to water pollution, *A study report on international environmental cooperation strategies*[9], released by MOE in October 2004, identifies fresh water resources and urban environments as areas of focus to be addressed through the ministry's international environmental cooperation over the next 10 years. Among the pillars of the basic policy set out in this report are: assistance in partnership with other East Asian countries; and increased participation of various players – including local authorities, businesses, NGOs/NPOs – and better coordination among them.

1-4-3 Track Record of Japan's ODA in the Water Sector

Japan has been giving priority to supporting water projects. Approximately 650 billion yen was made available between FY1999 and FY2001 through ODA[10]. Between FY1996 and FY2000, Japan supported a total

[9] Ministry of the Environment (2004) (http://www.env.go.jp/earth/report/h16-05.pdf)
[10] Ministry of Foreign Affairs, "Japan's ODA on Water" (http://www.mofa.go.jp/mofaj/gaiko/oda/seisaku/bunya/mizu/water/02kangae/torikumi.html)

of more than 40 million people with improved access to stable supplies of safe drinking water and sanitary sewerage. Japan's ODA for drinking water and sanitation, a sector for which development targets have been set in MDGs and WSSD, amounted to around one billion US dollars annually for a 3-year period between FY1999 and FY2001, accounting for one third of the total ODA in the world (some 3 billion dollars). This made Japan the biggest donor in this sector among the bilateral and multilateral donors.

(1) Development Studies, Grant Aid (Basic Design Studies) and Technical Cooperation Projects

A look at JICA's technical cooperation in water subsectors between 1974 and 2000 shows that water and sewage systems accounted for the largest proportion at 22 %. For a period of 10 years between 1991 and 2000, water and sewage systems and multi-sector projects represented large portions. By region, support for Asia accounts for the largest proportion at about 50 %, followed by Africa, Latin America and Middle East in that order.

Of JICA's technical cooperation schemes in the water sector, development studies represent the largest portion at 63 %. In recent years, however, the proportion of project-type technical cooperation projects has been increasing.

(2) Grant Aid (MOFA)

A look at grant aid projects implemented by the Ministry of Foreign Affairs (MOFA) in the water sector over a 24-year period between 1977 and 2000 shows that water supply systems accounted for a dominant proportion of 58 % in terms of the number of projects. Sewage systems represented the third largest portion at 12 %, following irrigation and drainage at 17 %.

(3) Loan aid (JBIC)

As far as the water sector is concerned, JBIC provided a total of 4.3 trillion yen in yen loans over a period of 35 years between 1966 and 2000. By sector, the proportion provided for hydroelectric power generation was the largest with 1.3 trillion or 28 %, followed by water supply at 19 %, irrigation and drainage at 15 %, and sewage systems at 12 %.

Chapter 2 Effective Approaches for Water Pollution

Water quality conservation is important for human health and environmental conservation. Development assistance should address both preventive and after-the-fact aspects of water pollution control.

Water is essential from many aspects, ranging from human life, daily activities and the economy to the growth of animals and plants, the conservation of marine environments and circulation of the atmosphere. Securing the required quantity of accessible water on our planet is important, and so is maintaining the quality of water at satisfactory levels for its various uses. Due to the high cost over the short term, investment in water pollution control has been extremely limited in many developing countries given their current socioeconomic situation. Over the long term, however, damage to human health, fisheries, tourism and other aspects resulting from water pollution will become enormous. Vast amounts of time and money will also be required to address water pollution once it occurs. It is therefore important for countries on the path to economic development to also do what they can do to conserve water quality and control water pollution – through both preventive and after-the-fact measures. Donors, for their part, should provide effective assistance for such efforts.

To address water pollution in developing countries, this report has established 2 development objectives: (i) strengthen the capacity of stakeholders for water conservation and pollution control; and (ii) improve the capacity for water conservation and pollution control according to the types of public waters. The idea behind Development Objective 1 is that in order to improve the capacity of a society as a whole for water quality management, it is essential to evaluate the roles of and interrelationships between different stakeholders and develop their capacities accordingly [capacity development]. The idea behind Development Objective 2 is that each public body of water has its own characteristics and requires an approach that is tailored specifically to each one for effective problem-solving. The intention here is to take a more holistic approach to water pollution by analyzing and addressing 2 different aspects of this development issue.

This objective-setting arrangement is especially effective in assessing the relevancy and identifying the components of a project designed to improve the water quality of a given body of water. Project planners are advised to: (i) examine specific options for the type of body of water Development Objective 2 and select the appropriate options; and (ii) study how to implement capacity development or assistance required to put the options into practice based on the menu under Development Objective 1.

2-1 Effective Approaches for Water Pollution

Development Objective 1 Developing the Capacities of Government, Industry, Civil Society and Academia for Water Conservation and Pollution Control as part of their own Functions

Development Objective 1
Developing the Capacities of Government, Industry, Civil Society and Academia for Water Conservation and Pollution Control as part of their own Functions

The key is how to provide opportunities to mobilize and utilize the capacities of the four actors.

The key to environmental capacity development is how to effectively mobilize and utilize the capacities of the 4 key actors – government, industry, civil society and academia. It is often the case, however, that such capacities are not fully recognized, mobilized or utilized in developing countries. Sustainable and effective environmental management requires making the most of local capacities in a developing country and continuing efforts to increase their collective strength.

Developing countries tend to put economic development before environmental conservation, as what are now developed countries once did. This tendency results in many kinds of environmental degradation, and water pollution is no exception. As the economy develops and pollution from industry become serious, government control alone becomes insufficient to conserve the environment, although the government sector is still expected to play the leading role in environmental conservation. At that stage, the government sector encourages industry to take environmental management measures on its own initiative by, for example, providing businesses with incentives for environmental conservation. As Japan's experience shows, complaints and requests from local communities often prompt the environmental authorities to take drastic measures to conserve the environment. Disclosure of environmental information and building of public awareness about the environment are the keys to such environmental monitoring activities by communities. Efforts are also required to form and develop groups of environmental scientists and engineers as a basis for evidence-based environmental administration, regardless of the stage of economic development of the recipient country. These different actors – government, industry, civil society and academia – are thus interrelated, and such interrelationships are subject to constant change according to the socioeconomic conditions. It is important to carefully consider which actor to focus on and when, in order to produce maximum outcomes in developing the capacity of the society as a whole for water conservation and pollution control for the benefit of well-balanced assistance planning.

It is important to assess the ever-changing relationships among government, industry and civil society and accordingly devise a well-balanced program that most effectively supports the capacity of society as a whole for water conservation and pollution control.

In setting targets under Development Objective 1, attention should be given to the different roles of these 4 actors in environmental management.

Mid-term Objective 1-1 Improving the Legal and Regulatory Framework

Mid-term Objective 1-1
Improving the Legal and Regulatory Framework

Governments formulate policies, make them into laws, and implement such laws. Effective implementation of laws demands government commitment, an effective legal and regulatory framework, and a more integrated administrative framework for water management.

It is important to secure policy-level commitments from the central government and other authorities in relation to water conservation and pollution control.

Sustainable development without compromising water quality primarily requires that the central government announce its commitment to the issue of water conservation and pollution control and give it priority in relation to other issues. International frameworks for partnership established at the Global Environmental Summit in Rio de Janeiro, the WSSD, the World Water Forum and other major international conferences play important roles in securing commitments to such sustainable development from participating countries. It is necessary, however, to secure more specific commitments at the policy level. Specific requirements include: clearly defining water conservation and pollution control in the context of national development programs; and explicitly stating its importance in development programs and policies at ministerial and local government levels. Meeting these requirements will be a good starting point for improving the legal and regulatory framework.

Recipient countries are encouraged to ensure that laws, regulations and standards better reflect the local realities for effective implementation.

Although often called for at the policy level, overall progress in water conservation and pollution control has been sluggish due to inadequate institutional frameworks and arrangements in developing countries. The legal framework, which is indispensable for environmental management administration, often fails to accommodate local conditions and is therefore ineffective in the developing world. Some developing countries apply a water quality law primarily designed for one sector to other sectors as well. Others introduce the laws of developed countries as they are without much consideration. For this reason, developing countries often have impractical environmental standards, including effluent standards. On the other hand, it is true that establishing appropriate environmental standards requires experience in enforcing related laws. This is why unremitting efforts are needed to bridge the gap between the reality and the legal framework. Such efforts help the authorities to develop its law-enforcement capacity. In cases where legal action has not been taken to address local incidents of serious water pollution, providing advice on establishing problem-specific laws, regulations or standards may be a viable form of development assistance.

Other requirements include a more integrated administrative framework for water management and an effective law-enforcement system.

In many developing countries, public administration in the water sector is implemented in an old-style administrative arrangement involving a number of government offices. Such an arrangement often translates into poor coordination and much duplication. This points to the need for a more integrated administrative framework for water management.

It is important to ensure that the policy and legal framework facilitates water conservation and pollution control on the ground. This undoubtedly requires an effective law enforcement system that enables the appropriate implementation of regulations and environmental management measures. To this end, it is important to use not only 'the stick' – a crackdown, penalties, etc., but also 'the carrot' – subsidies and incentives for businesses as part of institution building efforts. Another viable approach is to strengthen partnerships with industry though such means as pollution control agreements and disclosure of government information.

JICA's Activities:
JICA's support for legal and regulatory framework development centers on making suggestions through environmental advisers under its expert dispatch program and on making proposals in its development studies. Some JICA projects support the transfer of the Pollution Control Manager System of Japan.

JICA's Activities

JICA's activities in this field include: making proposals on legal and institutional frameworks in its development studies designed to formulate programs for water environment management; and providing advice on a legal and regulatory framework that is appropriate for the recipient country through environmental policy advisers under its expert dispatch program. Undoubtedly, improving the legal and regulatory framework is primarily the responsibility of the recipient country. There is little Japan can do to directly produce tangible outcomes in this respect. This is why JICA's activities in this field center on making proposals in development studies and on making suggestions through environmental policy advisers.

There are, however, some cases where JICA has taken this a step further in its development interventions. One such example is the Sino-Japan Friendship Centre for Environmental Protection Project (Phase II and III), which is designed to transfer the Pollution Control Manager System of Japan. In Phase II, the project conducted both impact and problem analysis of the manager system and a fact-finding survey on corporate environmental management in China. Based on the findings of the analysis and survey, the system was introduced in Chongqing city on an experimental basis. Building on this pilot project, Phase III is exploring ways to solve identified problems and establish a system that that suits China.

Mid-term Objective 1-2
Improving the Institutional and Human Resources Framework

Mid-term Objective 1-2 Improving the Institutional and Human Resources Framework

The central and local governments have different functions in water environment management. It is important to clearly define the roles and responsibilities of the two different entities and improve coordination between them. The central government is responsible for developing the legal and regulatory framework and the national environmental management system. Local governments are responsible for setting out local environmental conservation policies and exercise power granted from the central government. The framework for effective water conservation therefore calls for institutional and human resources development at both the central and local government levels.

Requirements include raising environmental awareness for government officials and improving coordination among central government offices, departments and agencies.

First of all, awareness-building for government leaders is vital to improve the institutional and human resources framework. The central government office in charge of the environment tends to be new and therefore has less power within the administrative machinery. Sometimes, officials not well versed in environmental issues were assigned out of political considerations. In such cases, it is necessary to raise the awareness and motivation of the leadership. To this end, development assistance may take the form of inviting high-ranking officials to study tours or seminars in developed countries for awareness building, giving priority to the environmental sector in financial assistance, or inviting recipient countries to environmental ministerial conferences at the international level.

Also essential to smooth public administration in the area of water conservation and pollution control is that the government office in charge clearly defines its duties and functions and then works better with other offices and agencies. This is necessary to avoid duplication of functions and thus ensure efficient and effective work in this sector by the government sector as a whole. Because government offices in developing countries tend to be understaffed, it may be necessary to give priority to functions related to water pollution affairs within the administrative machinery.

In general, local governments are responsible for monitoring both public waters and pollution sources and for taking necessary actions such as supervision, corrective orders and administrative guidance for the latter. Developing their capacity for water quality and environmental management is a prerequisite for ensuring the framework for proper law enforcement and implementation.

Capacity development for government officials on the ground is the key. It is important to ensure that intellectual assets will accumulate at the organizational level rather than at the individual level.

An effective approach to institutional capacity development is to make environmental management instruments available at the organizational level. Such instruments include techniques for water quality management planning, methods for analyzing water quality data, and arrangements for establishing and implementing environmental laws. This approach allows intellectual assets to accumulate at the organizational level rather than at the individual level. This can also be achieved by developing job descriptions and standardizing operations in writing.

A human resources development program should be devised from a comprehensive and long-term perspective according to the seriousness of the problems, the state of the legal and regulatory framework, and institutional arrangements in relation to water pollution in the recipient country. Making available the environmental management instruments described above also helps reduce the risk of the institutional capacity dwindling as a result of personnel transfers or the loss of skilled human resources to other organizations.

It is also important to consider developing human resources in the private sector and even taking advantage of its existing human resources. After all, the private sector plays an importance role in environmental management.

JICA's Activities:
Typically, JICA transfers monitoring techniques in its technical cooperation projects, and techniques for formulating environmental programs in its development studies. JICA also provides recipient countries with technical assistance in developing the framework for environmental administration through its environmental advisers.

JICA's Activities

As part of its support for institutional capacity development, JICA provides environmental advisers to developing countries to help them strengthen their environmental management framework. JICA also assists them in establishing and reinforcing environmental research and training centers at the national level in order to support evidence-based environmental administration that embraces environmental monitoring and other scientific techniques.

JICA also supports human resources development. For example, JICA invites people from the government, industry and civil society to receive training at the above-mentioned centers and in Japan. In Thailand, JICA has assisted the establishment of the Training Center for Sewage Works in Thailand. During the project period, JICA also trained many sewerage engineers.

Under its development study scheme, JICA conducts relevant studies through steering committees made up of stakeholder organizations to ensure better coordination among them for practical and effective planning. In development studies aimed at planning environmental management programs, JICA makes recommendations on the clear division of responsibilities among stakeholder organizations and on appropriate institutional arrangements for the efficient implementation of environmental management.

Mid-term Objective 1-3
Improving the Financial Framework

Mid-term Objective 1-3 Improving the Financial Framework

(1) Appropriate financial planning

A water pollution control program is unlikely to produce tangible results without the long-term and unremitting commitment to its implementation. For this reason, the central government should take financial and legislative measures so that the local government in charge will be able to maintain the project financially. The make-or-break point is whether the local government has the capacity to formulate a viable financing program in response to such measures by the central government.

In countries where the government is structured at the national, state (provincial) and municipal levels, water pollution control is generally the responsibility of states and municipalities. The costs of water pollution control are roughly divided into the cost of developing the infrastructure and the expenses for operating and maintaining it.

Since water pollution control is costly, appropriate financial planning is essential.

Infrastructure development costs are largely financed by national, state and municipal expenditures, loans, and user fees. Take, for example, a conventional sewerage system, which is a typical infrastructure for waste water control. Construction costs are so huge that all these financial resources have to be mobilized. Unless national, provincial and municipal expenditures are available, the bulk of development costs should be financed by loans. It is unlikely, however, that such loans will be repaid from user fees alone, since sewage services are not a lucrative business. For this reason, it is difficult to construct a sewage system using loans alone.

All these facts suggest that constructing a sewage system would not be an affordable option for ordinary municipalities in developing countries. Of course, it is an affordable option if sufficient national, provincial and municipal expenditures are available. However, this is not likely to be the case except possibly for capital cities, special environmental conservation areas, tourist resorts or industrial districts.

Ideally, the operation and maintenance costs should be covered by revenues from user fees. However, that is a formidable challenge even for developed countries. In Japan, user fee revenues cannot cover the operation and maintenance costs, let alone the construction costs, for which heavy subsidies are provided. The gap between the operation and maintenance costs and the user fee revenues has to be filled using general budget allocations from the municipal governments. These facts point to the need to accurately assess a number of

factors before constructing a water pollution control system. Among them are: how the area where the system will be constructed is positioned in the context of the national agenda; whether the financial framework is in place to cover the construction costs; whether the national, state (provincial) and municipal governments can afford to mobilize financial resources for the construction; whether the state or municipal governments or both can afford to cover the operation and maintenance costs using general budget allocations.

In fact, the difficulty in cost recovery means that there is a limit to addressing water pollution control with a centralized water treatment infrastructure that requires huge funds, such a conventional sewerage systems, in place of the decentralized sanitation or sewerage systems common in developing countries. From the financial point of view, it is important to reduce financial pressure in the future by shifting to more decentralized options that address individual pollution sources, such as reducing pollution loads at source, using on-site treatment facilities, and adopting a relatively small-scale system. Another advantage of these options is that they allow developing countries to increase the coverage of sanitation and sewerage systems.

It should be noted that feasibility study teams must not distort the data to draw a positive conclusion as this will send a wrong message to the recipient country. At any rate, it is important that cooperation projects aimed at transferring water pollution control technologies should address the financial aspect and thus include components designed to provide techniques for securing the necessary funds and promote awareness raising in this regard.

(2) Studying cost recovery options

The key is an appropriate cost recovery option based on the Polluter Pays Principle and an accurate assessment of the ability to pay.

Water pollution control systems do not produce tangible results unless they are operated and maintained in a sustained manner. For this to happen, it is essential to apply the Polluter Pays Principle and establish and comply with laws and regulations that ensure that the principle is in place. An appropriate charging policy based on this principle, if implemented, makes it possible to recover part of the system construction and expansion costs as well as the operating and maintenance costs. This in turn makes it possible to establish a sustainable system of operation and possibly reduces the amount of wastewater.

The cost recovery arrangements should be workable. Both the ability and willingness to pay should be carefully weighed in the light of the Polluter Pays Principle noted above. Planning high charges means a high financial internal rate of return and may look good on the surface. Yet the imposition of charges above the users' ability to pay results in difficulties in collecting them. This may in turn lead to the collapse of the financing system altogether. Thus careful attention should be paid to the charging criteria. Accurate assessment of the ability of poor people to pay is of particular importance. In some cases, it may be necessary to offer preferential treatment to low-income groups.

Levying charges for securing or conserving water resources may well be acceptable for users, as it has a direct impact on their lives or business activities.

However, levying charges for water pollution control may not. For this reason, sewerage charges are usually collected together with water supply charges. As the incentive to pay for water pollution control is weak, it may be necessary to consider taxation or other compulsory collection systems. For example, environmental charges – direct charges for environmental pollution – provides an effective means of reducing environmental stress, especially pollution loads from industrial sources, through market mechanisms. Attention must be paid, however, to the design and implementation of such a charging system. It is important to ensure that the payment of charges will not serve as a justification for discharging pollutants in water systems and thus prove ineffective in reducing pollutant discharges.

A major prerequisite for introducing such a charging system is the development of a mechanism for appropriately managing collected charges – whether in general accounts or special accounts – and putting them to good use for water conservation and pollution control.

JICA's Activities:
JICA's development studies never fail to address the financial aspects in formulating projects for constructing sewerage or other water pollution control systems. JICA's advisers work on the financial aspects as well.

JICA's Activities

JICA's activities in the development study scheme include estimating the costs of project implementation and operation to help the formulation of a program or projects in accordance with the economic scale of the recipient country. JICA thus incorporates financial plans for operation and maintenance into overall program projects. In developing a sewerage construction project, for instance, JICA surveys the willingness of communities to pay, sets charges based on the survey findings, and offers suggestions on charge collection methods.

Under the expert dispatch program, advisers from JICA offer suggestions on improving the financial framework as well as the legal and regulatory framework.

Mid-term Objective 1-4
Improving Scientific Knowledge of the Water Environment

Mid-term Objective 1-4 Improving Scientific Knowledge of the Water Environment

(1) Building the framework for and improving the accuracy of water quality monitoring

Basic knowledge about the water environment is essential for developing water pollution control policy. Most vital of all is a monitoring framework to assess water pollution and take appropriate regulatory measures. In addition, it is important to seamlessly connect 4 processes – monitoring, evaluation and analysis, policy making, and policy implementation – so that the monitoring findings are fed back to be used for water pollution control measures. Such monitoring data provides basic information indispensable for assessing the impact of water quality regulations, addressing problems that occur in water pollution control, and preventing such problems. It is also essential for citizens to assess the state of water quality. In addition, such data is vital for building a public consensus on environmental improvements. Despite limitations in terms of human, financial, technical and institutional resources, developing countries

Water quality monitoring data is indispensable as basic information to formulate water quality regulation and to implement policy. It is necessary to build reasonable framework for measuring and monitoring water quality.

should be able to build a reasonable framework for measuring and monitoring water quality.

As environmental standards are national government goals, the central and local governments should conduct surveys and studies according to some kind of unified standards in a wider context. On top of this, local governments need to conduct additional surveys and studies as necessary, including those required to implement more stringent standards under local ordinances. The provision and operation of monitoring equipment and the transfer of monitoring techniques are two of the technology transfer aspects where Japan has a comparative advantage. Other important technology transfer aspects include the training of technicians and the provision and operation of laboratory equipment. Both aspects are necessary for enhancing the accuracy of data and the reliability of water quality analysis.

Water quality monitoring data is essential as it provides basic information for implementing water pollution regulations and other measures. A reasonable measuring and monitoring framework is critical.

(2) Promoting the accumulation and utilization of water quality data and the disclosure of related information

It is necessary to properly analyze and disclose data related to water pollution. Also of importance is the accumulation and disclosure of such data so as to contribute to improved environmental management.

Basic data collected on water pollution should be compiled as a database and properly analyzed. It is important that such data and the findings of analyses should be presented in a state of the environment report or a white paper on the environment. It is also important to make arrangements to ensure that such information is reported regularly and thus put to good use for water quality management measures. For this to happen, the government sector is not sufficient. Research groups or taskforces for water quality management should preferably be involved as well.

Information regarding water pollution should be made public to ensure that citizens, research institutions and businesses have access to it. Notably, this will help citizens to assess the state of water pollution and even have a greater say in environmental management planning.

JICA's Activities:
Japan has a comparative advantage in this field, involving a diverse range of JICA's activities. These include: providing support for Environmental Centers in technical cooperation projects; making proposals in development studies; offering technical guidance through experts and volunteers.

JICA's Activities

Japan has a comparative advantage in this field since a major component of the development assistance required is the transfer of technology, which is based on scientific knowledge, one of Japan's strengths. In fact, such technology transfer accounts for the bulk of JICA's assistance in water pollution control and is largely implemented through various types of JICA schemes. In its technical cooperation projects, particularly Environmental Center projects, JICA transfers techniques for monitoring water quality, provides the related equipment, and supports the development of research capabilities and appropriate technologies. The typical project components are a mix of equipment provision and technology transfer through capacity development training. In the schemes for the acceptance of trainees, JICA offers a wide spectrum of training courses designed to teach technologies for water

examination and wastewater treatment and improve monitoring capabilities. In the development study schemes, JICA develops master plans and conducts feasibility studies for priority projects to support the establishment of an appropriate monitoring framework. It also makes proposals for accumulating data in the form of databases and the disclosure of related information. In the schemes involving the dispatch of experts and volunteers, JICA has directly transferred analytical and monitoring skills and techniques for identifying pollution sources on many occasions.

Mid-term Objective 1-5
Developing the Environmental Management Capacity of Industry

Mid-term Objective 1-5 Developing the Environmental Management Capacity of Industry

(1) Building and strengthening corporate environmental management systems

Production activities by industries constitute the main source of pollution. Building and strengthening the environmental management capacity of industries reduces the generation of pollutants and thus plays an important role in water pollution control.

It is essential to strengthen the environmental management capacity of industries – the main sources of water pollution.

In developing countries, key impediments to strengthening the environmental management capacity of industries include the lack of highly skilled human resources and poor access to information on appropriate technologies and financial resources. These impediments are most evident in small and medium-sized enterprises (SMEs), which often disregard the need for environmental management or conservation. Reducing water pollution loads in SMEs is a challenge as they represent the bulk of all businesses in the developing world.

Among effective approaches are: technical assistance through the local authorities and trade organizations; support for the introduction of in-house tools for environmental management; and assistance in developing institutional arrangements that involve both auditing by the authorities and reporting to them.

Technical assistance through government entities and trade organizations plays a major role in promoting appropriate technologies in SMEs. Especially effective is technical guidance for a specific pollution source. The need for technology transfer notwithstanding, many businesses in developing countries are exercising good practices in water pollution control. The government sector can provide frameworks or opportunities to share such practices and make good use of the experience and expertise of these innovative businesses.

In-house environmental management tools provide an effective option for water pollution control.

Another potentially viable option for assistance in this field is promoting and supporting the adoption of in-house tools and concepts for environmental management, such as the 5S process (*Seiri* [organization], *Seiton* [orderliness], *Seiso* [cleanliness], *Seiketsu* [organized cleanup] and *Shitsuke* [discipline]) and cleaner production. Cleaner production (CP) demands a review of production processes with the focus on the material and energy balances. CP can offer a springboard to a more advanced environmental management system based on the ISO 14000 series. It should be noted, however, CP is primarily designed to reduce the pollution load and achieve process efficiency at the same time by improving production processes. It does not eliminate the generation of pollutants or the need for EOP (end-of-pipe) treatment processes[11].

[11] JICA Committee for the Promotion of Cooperation on Cleaner Production (2001) p. 2

For the impediments cited earlier, it may be too much to expect businesses in developing countries to implement environmental management measures on their own initiative. A viable approach in this context is to develop institutional arrangements that involve both auditing by the authorities and reporting to them. Governments can provide businesses with incentives for environmental management in the form of tax privileges or subsidies for those that conduct water quality monitoring, contract out water quality monitoring and analysis to private third parties, and outsource the operation and maintenance of water treatment systems. The Pollution Control Manager System provides another effective tool for ensuring that businesses monitor pollutant discharges. This will complement the governmental framework for water quality monitoring.

Japan is a better position to offer pollution control solutions based on streamlined production processes and in-house environmental management systems.

All the options and approaches discussed above – developing and strengthening rational production processes and in-house environmental management systems – are the epitome of Japan's experience in industrial pollution control. It is worth noting that in Japan, businesses, large or small, dedicated themselves to adopting an optimal mix of pollution control measures under the given circumstances. This is why Japan is in a better position to offer appropriate and experience-based solutions in this field[12].

(2) Encouraging private participation in environmental management and promoting environmental conservation industries

Local governments are responsible for developing monitoring plans and marshaling monitoring data in the environmental monitoring category. They are also responsible for supervision, corrective orders and water quality guidance in the pollution source monitoring category. However, many developing countries are facing lack of capacity in aspects of monitoring frameworks or techniques.

Without environmental consulting firms, it is difficult to implement sustainable, effective and reliable water pollution control and environmental management.

This lack of capacity poses a major stumbling block in enforcing environmental laws and regulations. Governments in developing countries need to take legislative action to mobilize the resources of domestic suppliers of environmental conservation equipment and consulting firms in the water pollution control sector to bolster the law enforcement mechanisms. For developing countries, where such industries are immature, luring foreign businesses or introducing preferential tariffs on relevant equipment provides an avenue to complementing or even developing these industries. To promote private participation, the government sector needs to have the expertise and capacity for appropriately supervising contractors. Another avenue to encouraging private environmental management is for the government sector to promote the development of official skills certification systems for examining the qualifications of engineers and technicians in the private sector (like the one to certify environmental measurers in Japan).

To promote private environmental management, it is also necessary for environmental conservation industries to be profitable enough to sustain themselves, as they constitute the backbone of such private participation.

[12] JICA Institute for International Cooperation (2004) pp. 43-44

Environmental conservation industries need to be promoted for private environmental management. Technical and financial support for such promotion will produce substantial outcomes.

Adopting cleaner production techniques or water-saving technologies in the context of appropriate technology contributes to reduced production costs and therefore provides an instrument for industrial promotion as well. The private sector can play a unique role in technical consultations that support the introduction of these technologies. In fact, specific assistance to address individual and specific needs in this field will produce substantial outcomes.

Preferential arrangements for environment-related capital investment not only provide incentives for effluent discharging businesses, but also promote environmental management industries as a whole.

JICA's Activities:
JICA addresses both technical and institutional aspects in an optimal mix of diverse schemes, including development studies, the individual expert dispatch program, technical cooperation projects and the acceptance of trainees program.

JICA's Activities

Developing the environmental management capacity of businesses demands not only technical support for water pollution control, such as the end-of-pipe process, but also knowledge-based support in areas ranging from production processes aimed at pollution control to corporate arrangements for environmental management. JICA has addressed these diverse needs with an optimal mix of its aid schemes. Specifically, JICA has provided: (i) technical assistance regarding the plant and equipment of individual businesses, including energy-saving, cleaner production processes, the design, operation and maintenance of effluent treatment systems, and factory diagnosis under the development study and individual expert dispatch schemes; (ii) support for institution building, notably the development of corporate environmental management systems under the schemes for development studies and technical cooperation projects; (iii) and support for the development of energy-saving promotion centers and other hubs for corporate environmental management under the development study scheme. JICA has also provided training in all these fields.

Mid-term Objective 1-6
Developing the Water Pollution Control Capacity of the Civil Society

Mid-term Objective 1-6 Developing the Water Pollution Control Capacity of the Civil Society

(1) Raising public awareness concerning the conservation of water environments

Citizens are involved in water pollution as sufferers, generators and pressure groups. Pressure from local communities or the public as a whole has as much or more impact on pollutant dischargers than governmental regulations.

It is necessary to raise the awareness and knowledge of the public that they will have a bigger say in water pollution affairs.

Communities cannot fulfill the functions of observers, however, when the environmental awareness of the society as a whole is low. It is therefore necessary to raise pubic awareness and improve knowledge on water pollution by letting them know exactly what adverse effects a declining water environment will have on human health and ecosystems. This is necessary in the context of ensuring the transparency of environmental management administration as well. This can be achieved, for example, by making public the information on the state of water pollution. Conservation of the water environment requires regulations and standards, which effectively restrict the use of water resources. Efforts to

raise public awareness may not produce substantial outcomes if they only address the environmental conservation aspects. It should also focus on the direct impact of water pollution on local communities, including health hazards and adverse effects on fishery resources.

Local people are subject to health hazards from water pollution, but at the same time they discharge pollutants in the form of domestic wastewater. This is why environmental awareness building through environmental education and community information campaigns should also focus on good practices for water environment conservation at the household level or environmentally-friendly lifestyles. A viable option in this context is to ensure that environmental education for school children will lead to environmental activities at home. As environmental education will not produce tangible results in the short term, donors should plan support programs for water issues in collaboration with local authorities and communities based on the mid to long term viewpoint.

It should be noted, however, that such awareness building efforts only provide a tool for promoting behavior change. They are not designed to bring down water pollutant discharges to 0. This indicates the need to develop the infrastructure to ensure that wastewater is treated before being discharged into water systems. In other words, awareness building has to be implemented in parallel with the development of treatment facilities that use technologies suited to local conditions.

(2) Developing the environmental management capacity of community-based organizations

Developing environmental management capacities at the community level significantly contributes to better local water environments.

In the developing world, it is often the case that limited financial resources and technical capacities of the government sector hamper substantial environmental management. In this context, developing environmental management capacities at the community level with respect to water pollution contributes significantly to improving the monitoring of water pollution, a better quality of domestic wastewater, and a more favorable water environment. In urban areas in particular, waste dumping and untreated or inadequately treated domestic wastewater add to water pollution, which in turn aggravates urban sanitation and promotes the spread of infectious diseases. A viable option to address this problem is to provide training or even basic water monitoring kits to communities so that they themselves can assess and keep track of water pollution. Through such monitoring activities, environmental awareness of communities will be raised. Another viable option may be to encourage community members to be involved in organizing community management committees in river basins so as to make them participate in conservation of the water environment.

(3) Strengthening water conservation and pollution control measures that accommodate local and cultural characteristics

The state and cultural background of local communities should be first considered in selecting instruments for water pollution control.

Religious and cultural backgrounds, population density, topography, and hydrological characteristics of the target area are some of the factors that must

be considered before determining aid components. Selecting appropriate water pollution control options for the community based on these factors and in the context of appropriate technology is an important part of an assistance project. Take, for example, the case of sewerage construction in large cities in developing countries. Advanced sewage systems like those in developed countries are often inappropriate in terms of both cost and the maintenance technology required. It is therefore important to select appropriate technologies in the light of the capacity of the local authorities concerned and the project costs required[13]. In rural areas, local people are often not adequately aware of the need for sanitation because of their cultural background and customs. A viable option in such cases is to involve communities in the planning phase onward to accurately assess local needs, encourage their awareness building, and then accordingly construct and promote wastewater treatment facilities. Training, financing and institution building should be an integral part of such aid projects so that communities can operate and maintain these facilities themselves afterwards.

JICA's Activities:
JICA provides support in environmental education and improved sanitation facilities as components of its technical cooperation projects. Other JICA assistance comes from its volunteers, who are in a better position to support development activities at the grassroots level.

JICA's Activities

Community capacity development may not be the major objective of large-scale technical cooperation projects. Yet it constitutes a component of such projects. In fact, JICA prepares materials and curricula for environmental education, offers training in presentation skills for environmental education personnel, and supports the development, improvement and promotion of sanitation facilities in the context of appropriate technology.

The fact that awareness building and behavior change take time indicates the need for strenuous efforts at the grassroots level. In fact, community capacity development is the area of expertise of JICA's volunteer dispatch programs, which have a comparative advantage in grassroots development activities. JICA volunteers in such categories as environmental education and public health support the development of teaching materials and transfer teaching methods for environmental education. Those in the categories of nurses and public health nurses often provide environmental education in the context of primary health care.

Mid-term Objective 1-7
Developing the Water Pollution Control Capacity of Academia

Mid-term Objective 1-7 Developing the Water Pollution Control Capacity of Academia

(1) Developing research capabilities

Demand for reliable scientific data is high in the government, industry and civil society sectors. This highlights the need for research institutions that can not only conduct basic research and promote interdisciplinary research activities on their own in the area of water pollution, but also meet such requests from these three sectors. Among the fields of basic research that need greater attention are: elucidating water pollution mechanisms; identifying pollution

[13] JICA Institute for International Cooperation (2004) pp. 42-43

Developing research capabilities contributes to reduced hazards and improved capacity for selecting optimal options.

sources; identifying and quantifying pollutants and elucidating their causal relationships with pollution sources; assessing the impact on human health and ecosystems; and upgrading water treatment technologies.

Strengthening and promoting education in water pollution at universities and other higher education institutions also contributes to a broader base of human resources for water quality monitoring and environmental conservation industries, as noted above.

(2) Providing information to and seeking more engagement of government, industry and the civil society

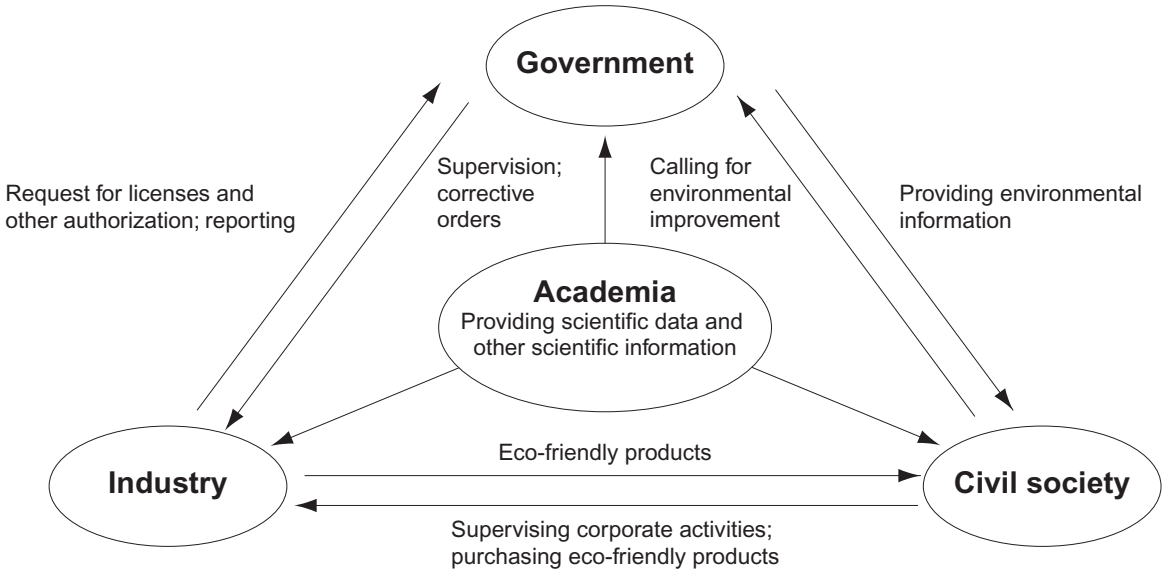
University and other research institutions have the capacity to provide neutral environmental information based on scientific data in a sustained manner. They are required to provide data and other information that allow the government, industries or the civil society to assess environmental and health impacts. They need to ensure that information is provided in such a way that academic societies, public research institutions and government offices will be able to work together more closely to come up with optimal solutions. In this context, it is worth noting that universities and other research institutions in Japan are interested more than ever in building international partnerships in their research activities. JICA's projects may be able to play a catalytic role in building such partnerships between such institutions in Japan and those in developing countries.

JICA's Activities:
JICA's support in this field focuses on the development of analysis capabilities through the Environmental Center approach in technical cooperation projects. It also focuses on the development of human resources in its trainee acceptance program.

JICA's Activities

Upon organizing seminars to announce the outcomes of its technical cooperation projects and workshops to solicit input from stakeholders in the recipient countries after the development survey, JICA takes it into consideration to invite researchers at universities and other institutions so as the counterparts can make appropriate decisions based on the scientific knowledge provided from by the researchers. In addition, JICA implements joint research and other collaborative activities with local research institutions as a component of Environmental Center projects, which play a key role in developing water monitoring capabilities, as already noted. As for human resources development in this field, JICA accepts trainees from the recipient countries.

Figure 2-1 Interrelationships among Government, Industry, Civil Society and Academia in Environmental Management



Source: Prepared and Compiled by Senro IMAI, JICA

Development Objective 1 Developing the Capacities of Government, Industry, Civil Society and Academia for Water Conservation and Pollution Control as part of their own Functions

Mid-term Objective 1-1 Improving the Legal and Regulatory Framework

Sub-targets of the Mid-term Objectives	Means and Methods for Achieving the Sub-targets	Case No.	Typical Activities of JICA
Formulating water management policy	○ Formulating environmental conservation policy (at national and local levels) Emphasis on the need for environmental considerations in the national development program, etc. △ Sustained and incremental efforts over the long term	20, 21, 59	• Offering suggestions for institutional development and improvement [DE] • Water environment management planning [DS] • Providing training to high-ranking government officials [AT]
Developing an effective legal and regulatory framework	○ Revisions and developments to the legal and regulatory framework that are necessary for water environment management ○ Developing administrative instructions △ Setting appropriate environmental standards △ Setting appropriate effluent standards Establishing local ordinances △ Requiring environmental impact assessment △ Incorporating environmental considerations into environmental laws	1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 15, 16, 21, 25, 41, 44, 59	• Offering suggestions for institutional development and improvement [DE] • Water environment management planning [DS] • Water quality management planning [DS] • Developing implementation manuals [DS, DE, TCP]
Strengthening integrated water management	△ Designating the competent ministry and soliciting support from other government offices concerned ○ Building a mechanism to coordinate different government offices △ Making a clear distinction in roles and functions between the central and local governments; transferring power and revenue sources to local governments	59	• Dispatching policy advisers [DE]
Developing systems for appropriate enforcement of the regulations	○ Applying regulatory instruments (notification in writing on the discharge of effluent; supervision of pollution sources; compliance with effluent standards; on-site guidance; corrective orders; suspension of the discharge of effluent; penalties; etc.) ○ Applying economic instruments (taxes, charges, contributions, emissions trading, etc.) ○ Applying informational instruments (information disclosure, voluntary monitoring by businesses, reporting, etc.) ○ Applying procedural instruments (EIA, ISO 14000, etc.) △ Putting in place measures to ensure strict law enforcement (legal measures such as guaranteeing the status of inspectors and giving more power to them) Setting more stringent standards on items subject to national standards and newly imposing standards on other items in accordance with local ordinances △ Concluding pollution control agreements ○ Adopting the Pollution Control Manager System Putting in place Pollutant Release and Transfer Registers (PRTR) △ Providing subsidies and other incentives to wastewater treatment facilities Adopting integrated river basin management	8, 11, 12, 27, 59	• Providing training to government officials in charge [TCP, AT] • Offering suggestions and advice on penalties and law enforcement arrangements [DS, DE] • Building information systems [DE, DS, TCP, SV] • Introducing environmental management systems of Japan, including those of pollution control agreements and certified environmental measurers. [DE, AT, TCP, DS]

Mid-term Objective 1-2 Improving the Institutional and Human Resources Framework

Sub-targets of the Mid-term Objectives	Means and Methods for Achieving the Sub-targets	Case No.	Typical Activities of JICA
Raising the awareness of policymakers	○ Raising the awareness of high-ranking officials △ Promoting compliance △ Strengthening public relations and lobbying concerning environmental management Organizing environmental ministerial conferences △ Setting environmental conditionalities on development assistance		• Dispatching policy advisers [DE] • Providing training to high-ranking government officials [AT]
Clearly defining duties within organizations	○ Developing an integrated administrative framework for water environment management △ Giving more power to the government office in charge of water quality management ○ Revising the government offices and defining duties clearly △ Taking financial measures and providing technical assistance to increase the executive capacity of local governments	29, 39	• Developing operation manuals [DS, DE, TCP]
Improving coordination with other organizations	○ Improving coordination among the government offices and agencies concerned with water quality management ○ Improving coordination between the central and local governments Promoting exchanges among local governments △ Improving coordination between government and academia △ Organizing stakeholder meetings (liaison conferences)	1, 3, 5, 7, 59	• Holding ministerial liaison conferences regularly [TCP, DE]
Developing the capacity of the government officials in charge (excluding water quality analysis and monitoring techniques)	○ Offering training in water quality management planning ○ Developing the capacity to supervise pollution sources (factories and other establishments) ○ Developing the capacity to analyze water quality data △ Offering training regarding the framework of environmental laws ○ Preparing technical manuals and thus standardizing operations	6, 13, 17, 18, 19, 28, 33, 34, 35, 36, 37, 53	• Preparing technical manuals [DS, DE, TCP, SV, JOCV] • Training government officials [AT, TCP, DE, SV, JOCV]

Mid-term Objective 1-3 Improving the Financial Framework			
Sub-targets of the Mid-term Objectives	**Means and Methods for Achieving the Sub-targets**	**Case No.**	**Typical Activities of JICA**
Appropriate financial planning	△ Developing a mechanism to finance the cost of building water pollution control facilities (allocating national, provincial and municipal expenditures) △ Securing tax revenues from tourism and factories and other establishments; introducing a system whereby the cost of a public works project for controlling specific pollution must be partly or totally borne by an establishment that causes or contributes to that pollution Reducing financial burden by shifting from centralized to decentralized wastewater treatment systems.	7, 37, 40, 41, 42	• Sewerage development planning [DS] • Water environment management planning [DS] • Making diagnosis and offering advice on financial health [DE]
Studying cost recovery options	△ Establishing a law or regulation on cost recovery ○ Applying economic instruments, (taxes, charges, contributions, etc.) △ Establishing a charge structure and collection arrangements Establishing a financial accounting system	1, 3, 4, 7, 8, 43, 51	• Water quality/environment management planning [DS] • Sewerage development planning [DS]

Mid-term Objective 1-4 Improving Scientific Knowledge of the Water Environment			
Sub-targets of the Mid-term Objectives	**Means and Methods for Achieving the Sub-targets**	**Case No.**	**Typical Activities of JICA**
Building a framework for and improving the accuracy of water quality monitoring	○ Developing plans for water quality monitoring of public waters (specifying what, where and how to monitor, and making the monitoring findings public) ○ Building a monitoring framework (including the provision, operation and maintenance of equipment, the dispatch of technicians, and the securing of financial resources) ○ Ensuring monitoring accuracy management (data accuracy management and laboratory management) △ Offering training in analysis accuracy and quality control (QC) △ Developing analysis manuals and procedure documents Offering full training and guidance for achieving ISO 17025 certification Assessing the impact of water pollution on human health and local fisheries and agriculture ○ Making an inventory of pollution sources ○ Making a pollution map	1, 3, 5, 6, 7, 9, 10, 13, 17, 18, 19, 20, 21, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 45, 48, 49, 50, 51, 52, 53, 56, 57, 59	• Providing monitoring equipment [GA, DS, TCP] • Offering suggestions and advice on the monitoring framework and methods [DS, TCP, DE] • Offering technical guidance for researchers [AT, TCP, DS, DE, SV, JOCV] • Offering guidance on how to operate and maintain analysis equipment [TCP, DS, DE, SV, JOCV] • Developing analysis manuals [TCP, DS, DE, SV, JOCV] • Offering guidance on how to assess pollution impacts [TCP, AT, JPP, DE]
Promoting the accumulation and utilization of water quality data and the disclosure of related information	○ Designing and utilizing monitoring databases; offering training for these purposes ○ Putting the findings of monitoring analysis to good use for water quality management measures △ Forming a study group on water quality management measures △ Making arrangements for regular reporting; holding consultations with stakeholders △ Publishing an environmental white paper; preparing a state of the environment report ○ Making relevant information available on a website	3, 20, 23, 24, 25, 38, 59	• Supporting the development of pollution databases [DS, DE]

Mid-term Objective 1-5 Developing the Environmental Management Capacity of Industry			
Sub-targets of the Mid-term Objectives	**Means and Methods for Achieving the Sub-targets**	**Case No.**	**Typical Activities of JICA**
Building and strengthening corporate environmental management systems	○ Promoting environmental management activities in production processes (5S, energy saving, CP, EOP equipment, etc.) ○ Promoting in-house instruments for environmental management (environmental auditing, environmental performance evaluation, state of the environment reporting, ISO 14000 certification, the Pollution Control Manager System, etc.) ○ Encouraging voluntary monitoring by businesses, making reporting arrangements, providing incentives (preferential taxes, subsidies, soft loans, eco-logos, etc) △ Establishing a framework for the authorities to check how corporate environmental management systems are operated; building a system for fairly evaluating corporate efforts and performance △ Promoting cooperation among businesses (sharing information and experiences through trade organizations, business associations, etc.) Establishing an industrial association for environmental conservation (tasked with introducing pollution control technologies, designing treatment systems and introducing operation and maintenance consultants) Building mechanisms, including those for financing and technical advice, to encourage businesses to make investments in water pollution control △ Providing information to citizens	3, 8, 9, 10, 11, 12, 18, 19, 21, 25, 26, 27, 28, 33, 34, 58, 59	• Introducing and supporting the adoption of in-house environmental management activities [AT, DE, SV, JOCV, TCP]
Encouraging private participation in environmental management and promoting environmental conservation industries	Acquiring expertise in determining the scope and content of outsourcing and supervising private contractors Promoting private participation in environmental analysis (with, for example, the environmental measurers certification system) △ Promoting ISO 14000 ○ Promoting CP △ Developing a lending facility that features preferential interest rates for environment-related projects Introducing preferential tariffs for wastewater treatment equipment Promoting environmental business with the strict enforcement of laws and regulations for water pollution control	4, 8, 9, 11, 12, 21	• Introducing the concept of CP and supporting the adoption of CP [DE, DS, TCP, AT, SV, JOCV] • Environmental management in industry [DS] • Offering suggestions and advice on the creation and use of lending facilities with environmental interest rates within the “two-step loan” and other arrangements [DS, DE]

Mid-term Objective 1-6 Developing the Water Pollution Control Capacity of Civil Society			
Sub-targets of the Mid-term Objectives	**Means and Methods for Achieving the Sub-targets**	**Case No.**	**Typical Activities of JICA**
Raising public awareness concerning the conservation of water environments	○ Making water quality monitoring data available to the public △ Publishing environmental white papers; state of the environment reports △ Public awareness raising by the mass media Presenting and explaining government policies on websites △ Providing environmental education at school Promoting environmental education (on health impact assessment, environmental pollution, ecosystems, etc. in the context of water pollution), including developing teaching materials and establishing teaching methods ○ Organizing community based workshops on environmental education Promoting green purchasing Disclosing health impact data and taking necessary action △ Publicizing a list of pollution sources	22, 54, 55, 56, 58, 59	• Issuing newsletters [DS, TCP, DE, JOCV, SV] • Promoting technology transfer that focuses on teaching materials and methods for environmental education [DE, SV, JOCV, DS, TCP] • Organizing community seminars and workshops [JOCV, SV, JPP]
Developing the environmental management capacity of community-based organizations	△ Encouraging voluntary activities by citizens, including river cleanups Environmental monitoring by citizens; providing basic water monitoring kits ○ Seeking the greater engagement of neighborhood community associations (including organizing environmental seminars) △ Training leaders Networking △ Promoting low-cost sanitation units to improve living standards △ Providing hygiene education for appropriate wastewater treatment	54, 55, 58	• Providing latrines and other sanitation equipment and systems [JPP, JOCV] • Providing hygiene education for communities [JPP, JOCV, SV, DE] • Organizing community activities to clean up rivers, lakes and beaches [JOCV]
Strengthening water conservation and pollution control measures that accommodate local and cultural characteristics	Understanding local religions and customs ○ Assessing topography and hydrological characteristics △ Assessing population density and land-use patterns ○ Civil society’s efforts to reduce the water pollution load Developing and promoting on-site treatment technologies		• Basic research by JICA overseas offices and project formulation advisors and/or through development studies • Gathering information through development studies

Mid-term Objective 1-7 Developing the Water Pollution Control Capacity of Academia			
Sub-targets of the Mid-term Objectives	**Means and Methods for Achieving the Sub-targets**	**Case No.**	**Typical Activities of JICA**
Developing research capabilities	○ Building a framework in which groups of environmental scientists and engineers support the government sector △ Putting scientific knowledge to good use for water pollution control Establishing water pollution simulation techniques ○ Developing the capacity to elucidate water pollution mechanisms Improving techniques to identify water pollution sources and strengthening the capacity to elucidate causal relationships between such sources and health and other hazards Assessing the impact of water pollution on local fisheries and agriculture	4, 17, 20, 22, 30, 35, 38	• Strengthening the overall research capacity with an Environmental Center as the core [TCP] • Conducting joint research between the Environmental Center and other research institutions [TCP]
Providing information to and seeking more engagement with government, industry and civil society	Organizing seminars and workshops ○ Gathering and making public technical information on water pollution control		

※ Case numbers correspond to the numbers in Table A1-1, Appendix 1.

○: Represents one of the objectives of JICA's projects for which tangible outcomes have been achieved
△: Represents one of the components of JICA's projects
Unmarked: Represents an area that JICA' projects have barely covered

TCP: Technical Cooperation Project AT: Acceptance of Trainees DS: Development Study DE: Dispatch of Experts JPP: JICA Partnership Program
GA: Grant Aid SV: Senior Volunteers Program JOCV: Japan Overseas Cooperation Volunteers Program

Development Objective 2
Developing the Capacity for Water Conservation and Pollution Control according to the Types of Bodies of Water

Development Objective 2 Developing the Capacity for Water Conservation and Pollution Control according to the Types of Bodies of Water

Water pollution takes on different characteristics in different types of bodies of water covered by this report, or any type of body of water for that matter. This demands water conservation and pollution control measures that accommodate the different characteristics of each type. JICA has implemented many projects that focused on specific types of bodies of water (including development studies on bays, lakes, and river basin management; and technical cooperation projects that have targeted specific rivers or part of a large lake). Many requests for such projects will be made in the future as well. This section on Development Objective 2 discuses the characteristics of water conservation and pollution control options for each type of body of water.

It is important to explore options that accommodate the characteristics of different types of bodies of water.

The concept of integrated river basin management is of crucial importance in studying the causes of and measures to be taken against water pollution. This concept is aimed at maintaining the cycle of clean water within the entire basin by taking a holistic approach to pollution sources and pollution loads from the headwaters to the downstream reaches.

Maintaining the water cycle has two important requirements. The first requirement is that water flows are abundant enough and not disrupted in such a way to have adverse effects on ecosystems in inland waters (rivers, lakes, and groundwater bodies) or coastal seas. The second requirement is that a wide range of water uses – drinking water human consumption, industry, agriculture, recreation, tourism and bathing – are ensured in each section of the basin, from the headwaters right down to the coastal seas. The quantitative aspect is of relative importance for the first requirement, and the qualitative aspect for the second requirement.

Although these 2 aspects should be addressed for each type of body of water, this report focuses on the qualitative aspect – water conservation and pollution control.

Mid-term Objective 2-1
Developing the Capacity for Water Conservation and Pollution Control of Rivers

Mid-term Objective 2-1 Developing the Capacity for Water Conservation and Pollution Control of Rivers

(1) Designating uses and setting the levels of water quality conservation

The level of water quality conservation and measures should take account of the uses and characteristics of the river.

Any river has its appropriate uses, and different levels of water quality conservation should be established for each use. It is desirable that the water quality of all rivers satisfies these uses. In reality, however, this may not be possible because water quality is affected by economic activities. Therefore, many countries have classified water bodies according to what is considered their main use and established the level of water quality conservation for each of the different types of bodies of water.

Setting the level of water quality conservation for a river requires a number of steps. The first step is to identify the established uses of the river based on local land-use patterns and input from local communities at public hearings and other occasions. The second step is to assess the conditions of the body of water, including the current water quality and pollution load, by, for example, conducting environmental monitoring and land use surveys in the river basin. The third step is to classify the river based on the findings gained through the first and second steps. The fourth step is to consider the water quality standards required for the classified type of body of water. Measures to achieve them will also be determined.

Conservation and control measures depend on the type of pollution source in the river basin.

(2) Considering options that accommodate the characteristics of river basins and the existing water pollution

After the level of water quality conservation is set for the river in question, the focus is shifted to specific measures to improve or preserve the water quality. The characteristics of the river should be considered in establishing such measures.

Assessing these characteristics requires: (i) obtaining data on the river (flow rates and velocities, and environmental capacity); (ii) identifying and assessing pollution sources (including household, industrial/business, livestock/fishery, municipal, agricultural and natural sources, together with the percentage of each type); (iii) and quantifying pollution loads on the river arising from major pollution sources. Satellite images provide an efficient tool for research designed to meet these requirements. If this option is unfeasible, the pollution load on the river can be calculated using a map on which factories, other pollution sources and land-use patterns are plotted and pollution loads, including those from households, are written.

The optimal approach to water quality control also depends on physical characteristics such as the land use and area of the river basin and the width of the river. This is because, for example, the larger the flow rate of the river, the less time required for reducing the concentration levels of pollutants and the higher the capacity of the river for pollutants. The area of the river basin is also a major factor affecting the pollution levels. These examples point to the need to consider the appropriate approach based on an assessment survey of the characteristics of the river, including: the natural environment in and around the headwaters; the number of tributaries; and notable natural conditions (such as a high frequency of flooding and the presence of arsenic and other pollutants of natural origin).

Water quality control essentially calls for studying options to reduce pollutant discharges while developing environmental laws, regulations and standards for water quality and achieving better coordination and less duplication of the functions of the government offices concerned. The following paragraphs discuss viable options according to the major types of pollution sources.

With regard to industrial and business wastewater sources, options may

include: strengthening on-site inspections by the regulatory authorities, promoting the introduction of wastewater treatment facilities, introducing the concept of Cleaner Production, and providing economic incentives for industry to prevent water pollution of its own accord.

As for agricultural wastewater sources, which are mainly from the heavy use of pesticides and fertilizers, options may include educating farmers about the proper use of pesticides and chemical fertilizers and imposing caps on such use.

Options for domestic wastewater sources differ depending on whether the location is in an urban or rural area. For urban areas, options may include developing conventional or low-cost sewerage systems. Options for rural areas may include providing small-scale, decentralized treatment systems such as wastewater treatment tanks and primary treatment facilities. These options are the most costly and time-consuming, and are also difficult to manage. They are, however, no doubt effective in producing positive outcomes.

Pollution from natural resources is difficult to address as it originates mainly from the vast expanse of forests. Pollution from municipal sources is also challenging because of litter and debris in roads, side ditches and drainage canals are carried by runoff into public waters.

Options that are financially and technically feasible for the recipient countries or communities should always be explored.

(3) Considering options that accommodate the stage of development of the recipient countries and regions

Of the water pollution control options described in this report, some may be difficult to implement without sufficient financial and human resources. The fact is, however, that many developing countries tend to lack these resources.

Another important consideration is that different developing countries and regions are in different stages of development and thus demand different pollution control measures. Introducing a conventional sewerage system for domestic wastewater may be an affordable option only for more advanced developing countries since such an environmental infrastructure incurs huge costs, including not only construction and other initial costs, but also operation and maintenance costs.

This does not mean, however, that no options are available unless countries or communities have attained a certain level of development. There is always room for considering options that are financially and technically feasible for the recipients. Such options may include: (i) strengthening the capacity of government officials in charge from a long-term perspective; (ii) calculating the environment load from each pollution source and identifying major causes of pollution; (iii) strengthening measures to reduce pollutant discharges from factories and other industrial establishments, for which the pollution sources are relatively easy to identify; (iv) conducting activities that focus on building environmental awareness; and (v) introducing domestic flush water and non-flush wastewater treatment tanks or low-cost sewerage systems. Regarding the fifth option, more attention should be paid to the fact that appropriate operation and maintenance of these on-site tanks and sewage treatment systems is a prerequisite for water pollution control.

JICA's Activities:
JICA's development studies center on developing master plans for river basin management and conducting feasibility studies on sewerage development in urban areas. In technical cooperation projects, JICA focuses on building monitoring capabilities. JICA's cooperation is gradually expanding its scope to cover the policy-making domain through policy advice and the provision of scientific knowledge that supports decision-making.

JICA's Activities

JICA has implemented a host of projects aimed at water conservation and pollution control for rivers in many parts of the developing world. They include development studies that involve master plan studies for river basin environmental management and feasibility studies on sewerage development in urban areas within river basins. Master plan studies have made an array of proposals for building sewerage systems, raising environmental conservation awareness of riparian communities, and controlling industrial wastewater. Recommendations on land-use classification have also been made.

In its technical cooperation projects, JICA has much experience in transferring analytical techniques as part of its efforts to develop the monitoring capabilities of the counterparts to assess water quality. To date, JICA has contributed to improved levels of analytical skills and techniques through Environmental Center projects in Thailand, Indonesia, China, Chile and Egypt.

Until recently, JICA had little experience in providing policy advice or scientific knowledge for establishing standards. Yet the Environmental Management Center project in Indonesia has a component that is designed to utilize data that is gained using a river model at the policy-making level. Such cooperation activities are expected to increase in the future.

Mid-term Objective 2-2
Developing the Capacity for Water Conservation and Pollution Control of Groundwater

The difficulty in detecting problems and identifying and addressing pollution sources makes groundwater cleanup a daunting challenge.

Mid-term Objective 2-2 Developing the Capacity for Water Conservation and Pollution Control of Groundwater

Unlike other types of water bodies covered by this report, bodies of groundwater are usually inaccessible to direct human observation. For this reason, problems with groundwater bodies often remain unnoticed. In addition, the difficulty in tracking down water flows underground makes identifying and addressing pollution sources a daunting challenge. Once a groundwater body becomes polluted, the chance of restoring the water quality is slim. These challenges should be considered in devising water conservation and pollution control measures for groundwater.

(1) Designating uses and setting the levels of water quality conservation for groundwater

Groundwater provides an important source of drinking water. Conservation of its quality is crucial.

Although groundwater is used for multiple purposes, including human consumption, irrigation and industry, clean groundwater provides a perfect source of drinking water in many developing countries. For this reason, groundwater should be conserved so that its quality meets the criteria for potable water.

To this end, a number of steps should be taken, including: (i) water demand research, including identifying local groundwater users and assessing their dependence on groundwater for their water consumption; (ii) research on the land use above the groundwater basin; and (iii) groundwater quality monitoring. The current water quality and community needs thus assessed should be taken into account in establishing the levels of groundwater quality

conservation and restrictions on groundwater collection. It is worth noting that the Environmental Quality Standards for Groundwater Pollution in Japan correspond to the Environmental Quality Standards for Human Health under the Environmental Quality Standards for Water Pollution (see Table A3-1, Appendix 3).

Also of note is that this report focuses only on water quality. Although the quantity of water is an important element of groundwater management, this is considered *in Approaches for Systematic Planning of Development Projects: Water Resources.*

(2) Considering options that accommodate the characteristics of groundwater basins and existing water pollution

Containing pollutants at the source and reducing pollution levels are at the center of groundwater pollution control. High-performance treatment technologies are costly and their applicability should be carefully examined.

Pollution control measures for groundwater mainly prevent the spread of pollution from its sources, as with control measures for other types of bodies of water. This requires identifying major pollutants and pollution sources, analyzing the soils around the polluted groundwater basin, and simulating underwater flows.

In Japan, high-performance treatment technologies are used for groundwater pollution control. Some of these technologies remove pollutants from contaminated groundwater bodies and soils. Others cover them with sheets or concrete structures. Yet others detoxify pollutants using a chemical process underground. These advanced technologies are highly costly. They should be carefully examined as options for the recipient countries and regions in the light of their financial and technical capacities.

Groundwater is generally chlorinated to kill colon bacilli for drinking as necessary. Chlorination, however, is ineffective in removing some types of substances which are harmful to health such as heavy metals and organochlorine compounds. In such cases, since it is very hard to remove these substances from the water resource, tapping other water sources is more feasible.

(3) Considering options that accommodate the stage of development of the recipient countries and regions

Preventing groundwater is of utmost importance because once it is polluted, recovering water quality is extremely difficult.

Prevention of groundwater pollution is crucially important. Once it becomes polluted, recovering clean groundwater is extremely difficult. This is mainly because polluted groundwater is rarely diffused and diluted since the velocity of groundwater is very slow. In Japan, when groundwater is polluted, the polluter should take necessary measures under the law. Groundwater users, on the other hand, have no option but to seek alternative water sources when groundwater is found to be unfit for drinking.

Preventing groundwater pollution and conserving water quality pose enormous challenges for developing countries, where statutory regulations are often inadequate. Therefore, options for donors to address these challenges may tend to focused largely on important areas such as the transfer of relevant technology for conducting studies on sewerage systems and solid waste management and support for establishing a legal and regulatory framework for

these issues. Once groundwater is contaminated with hazardous substances, the recommended option for users is, as a matter of course, to refrain from using it. This passive option is universal: it applies to any recipient country and region regardless of their stage of development.

JICA's Activities:
JICA has conducted monitoring to tackle the issue of groundwater quality conservation. It has also addressed the issue as part of its technical cooperation projects for groundwater development and drinking water supply.

JICA's Activities

JICA has conducted groundwater quality monitoring in its development studies as part of its efforts to develop groundwater resources. Yet it does not have a good track record in addressing water quality improvement. Rather, JICA has much experience in addressing it as part of grant aid projects and development studies for developing groundwater resources and as part of technical cooperation projects for tapping groundwater for drinking. These activities are detailed in *Approaches for Systematic Planning of Development Projects: Water Resources.*

Mid-term Objective 2-3
Developing the Capacity for Water Conservation and Pollution Control of Lakes

Mid-term Objective 2-3 Developing the Capacity for Water Conservation and Pollution Control of Lakes

Lakes tend to accumulate inflowing pollutants. Pollution control measures should be tailored to accommodate the conditions of each lake.

Water pollution control is more challenging for lakes than for rivers. Lakes tend to accumulate inflowing pollutants because of a longer water retention time than rivers. Control measures should be tailored to each lake as the pollution load greatly differs depending on a number of factors, including land use patterns and ecological characteristics around the lake and the rivers that flow into and from it. This makes it more difficult to address water pollution in lakes than in rivers. Pollution control at the source is critical for lakes as it is extremely difficult to contain pollutants once they find their way into inflowing rivers.

The following paragraphs discuss key considerations in identifying typical problems and solutions.

Because lakes are closed water areas, water conservation and pollution control are more difficult to achieve for lakes than for rivers. This requires water quality conservation planning for each lake.

(1) Designating uses and setting the levels of water quality conservation for lakes

Lakes tend to accumulate pollutants because the inflowing water stays in such closed water areas. Once a lake is polluted, it is no easy task to improve the water quality. Water pollution usually deteriorates in parallel with socioeconomic development in the lake basin as the pollution load increases. Inflows of nitrogen, phosphorus and other nutrient salts could promote eutrophication, and resultant water blooms pose problems for various water uses. For these reasons, the levels of achievement of environmental standards are usually lower for lakes than for rivers or coastal seas.

Special attention should thus be given to lakes. It is necessary to draw up water quality conservation plans for lakes that set out a systematic list of the levels of water quality conservation. In Japan, there are water quality standards for lakes under the category of the Environmental Quality Standards for water pollution aiming at conservation of the living environment. Some lakes have

their own water quality targets.

As described in Subsection (3) below, water quality conservation for lakes is a serious challenge. Attention should be paid to the levels of water quality conservation. If a recipient country sets unrealistically strict standards, it will not be able to achieve them.

(2) Assessing the hydrological characteristics of lakes

The need to tailor control measures to each lake requires basic data on the hydrological and hydraulic characteristics.

Pollution control measures for lakes should be designed to accommodate their different characteristics. For this reason, two types of characteristics need to be assessed for each lake: hydrological/hydraulic and water quality characteristics. Criteria for hydrological and hydraulic characteristics include: the catchment area, planar shape, cross-sectional shape, capacity, water retention time, water level fluctuations, inflowing and outflowing rivers, and water balance (including precipitation, inflow, evaporation, outflow and balance). Criteria for water quality characteristics include: water quality at monitoring points and trends over the years, horizontal and vertical variations in water quality, seasonal changes in water temperature, discontinuity layers, and sediment components.

To be able to monitor seasonal changes in water quality, development studies and other studies need meticulous monitoring planning, as the periods of these studies are usually limited.

(3) Considering options that accommodate the characteristics of basins and existing water pollution

Pollution source control is crucial, because once the pollutants are released, it is difficult to restore the previous environment.

Water quality control for lakes is no easy task for any country, and Japan is no exception. The bulk of the 10 lakes the Japanese government has designated as those that need special attention have yet to achieve the Environmental Quality Standards for Water Pollution or their own water quality targets. Trends in the pollution load by source over the years suggest that reducing the pollution load from non-point sources is quite difficult. The pollution load from point sources has been significantly reduced thanks to an array of control measures. However, the pollution load from non-point sources has fallen only slightly.

Special measures are necessary for conservation of the water quality of lakes. They should be set out as a systematic policy for this particular type of water body. A key component of such a policy should be a water quality conservation plan. This plan should set out both the levels of water quality conservation, and projects, regulations and the measures required to meet them. It is also necessary to ensure that stakeholders are well aware of the plan as part of efforts to build a consensus among them.

Mechanisms of water pollution in lakes are generally intricate and not fully understood. It is therefore necessary to ascertain the pollution loading characteristics through a pollution load survey for each source and water quality parameter. The efforts to reduce pollution loads should then focus on pollution control at the source.

Sewerage systems are without doubt effective in reducing pollution loads from household sources. Other options for pollution source control and water quality conservation and the purification of waters should also be considered, and those in which the recipient countries or Japan has experience should be given priority. However, it should be remembered that there are limits to the effectiveness of pollution control methods.

The awareness of local people is also crucial in improving water quality. In this context, government should give priority to public awareness building. At any rate, tenacious efforts and a long-term perspective are required for water conservation and purification.

(4) Considering options that accommodate the stage of development of the recipient countries and regions

Pollution load data is the key to considering pollution reduction options. Also of importance is careful examination of cost-effectiveness.

There are 2 key elements in considering options for pollution load reduction: data and cost-effectiveness. The more important of the two is data, including: (i) the distribution of pollution sources; (ii) the types of pollutants; (iii) the pollution loads and concentrations of pollutants from the sources; (iv) the routes from the sources to the lake; and (v) the flow rate and water quality of each inflowing river. These data provide important clues to key questions: Which pollution source has the greatest impact? How and to what extent should the pollutants from that source be reduced? Which option is more effective in reducing pollution loads? What does that option cost? Will statutory regulations work? Will awareness building of local people work?

As for the other key element, cost-effectiveness, pollution reduction options range from affordable but potentially ineffective options, such as regulating land use and planting purification plants, to costly and established options such as sewerage systems and facilities to remove nitrogen and phosphorus. Recipient countries and regions have to select options that are applicable given their levels of socioeconomic development. At any rate, they need to recognize that such options may not be sufficiently effective depending on the mix and scope of such options.

JICA's Activities:
JICA has formulated many medium-term and long-term master plans in its development studies. It has also implemented technical cooperation projects designed to develop and disseminate pollution control technologies.

JICA's Activities

Regarding water conservation and pollution reduction for lakes, JICA has developed many medium and long-term master plans in its development studies. JICA usually simulates pollution loads from sources around lakes and then proposes conservation programs for lakes in these master plans. Other components of the master plans include: measures for pollution source control (including industrial wastewater treatment, water saving and non-point source control), plans to construct sewage treatment facilities, plans for solid waste management in the basin, and water conservation programs for inflowing rivers. Also in its development studies, JICA suggests direct measures as well, including removing or covering contaminated bottom sediment, and removing aquatic plants floating in lakes. In South Korea and China, JICA has implemented technical cooperation projects designed to: develop technologies to

predict and control algae blooms as a result of eutrophication; and develop and disseminate high-performance domestic wastewater treatment tanks and purification technologies based on ecological engineering.

Mid-term Objective 2-4
Developing the Capacity for Water Conservation and Pollution Control of Enclosed Coastal Seas

Mid-term Objective 2-4 Developing the Capacity for Water Conservation and Pollution Control of Enclosed Coastal Seas

Enclosed coastal seas such as bays and estuaries are susceptible to water quality deterioration, eutrophication, heavy metal pollution, and sediment accumulation due to such factors as pollution loading from land, coastal topography, tides and tidal currents, and water mass structure. Such environmental degradation may result in offensive odors, algae blooms, reduced fishery resources and smaller numbers of tourists. Some enclosed coastal seas are more vulnerable than others to contamination by oily discharges or oil spills from vessels. At any rate, inflowing rivers and surrounding land areas play major roles in polluting enclosed coastal seas. This is why pollution control options for other types of water bodies discussed above should be taken into account in considering options for enclosed coastal seas.

Pollution from inflowing rivers and adjacent land areas has a great impact on enclosed coastal seas.

(1) Designating uses and setting the levels of water quality conservation for enclosed coastal seas

Unlike inland waters, the main uses of enclosed coastal seas include fisheries, leisure and transportation rather than human consumption. Strict levels of water quality conservation are applied where leisure is designated as the main use of enclosed coastal seas. The levels of water quality conservation for fisheries, on the other hand, vary greatly depending on the targeted fish species. Setting the level of water quality conservation for an enclosed coastal sea requires information on such aspects as land use patterns in the coastal area, the current water quality of the sea, pollutants and pollutant loads from the inflowing rivers, and the uses of the sea by local people.

Different levels of water quality conservation are set for different uses, including fisheries, leisure and transportation.

(2) Assessing the hydrographic characteristics of enclosed coastal seas

Water conservation options for enclosed coastal seas vary according to their hydrographic characteristics, including the scale, coastal topography, tides, tidal currents, water mass structure, and geographical enclosure index. It is essential to assess these characteristics.

Assessment of the hydrographic characteristics is crucial since water conservation options depend on these.

(3) Considering options that accommodate the characteristics of basins and existing water pollution

The pollution of enclosed coastal seas is caused by both internal and external factors. The internal factors include pollutant discharges from vessels and economic activities in fishing grounds, including aquiculture. The external factors are dominated by pollution loadings from the inflowing rivers and other land-based sources. In fact, the external factors are the main cause of the

Integrated river basin management is necessary to reduce the pollution loads from the inflowing rivers, the main source of pollution.

pollution of enclosed coastal seas. It is therefore important to reduce land-based pollution loads. There are a range of reduction options. Among them are: establishing environmental laws and regulations necessary to reduce pollution loads from rivers; controlling the effluent from industrial plants; constructing integrated sewerage systems that treat domestic and other wastewater; and installing on-site domestic wastewater treatment tanks or other primary treatment facilities. These options can have a great impact on the water quality of enclosed coastal seas, and they should be implemented in an integrated manner in the entire river basin.

Total pollutant load control is a striking example of measures to improve the water quality of enclosed coastal seas. This measure focuses on organic pollutants, notably those contributing to red tides, among other pollutants that are subject to concentration regulations. It controls the total volumes – not the concentrations – of organic pollutants from the entire river basin. Total pollutant load control is usually implemented for large closed water areas among other water bodies. In Japan, the total load of Chemical Oxygen Demand (COD) is controlled in some enclosed coastal seas. Other options for improving water quality include conserving the tidelands lining bays and protecting mangrove forests.

(4) Considering options that accommodate the stage of development of the recipient countries and regions

Because many issues are involved, they should be addressed in order of priority.

Pollution control of these large water bodies has to address a wide and comprehensive range of issues. However, this is no easy task for developing countries. A more viable option may be to get an overall picture of the pollution of the target sea, identify major pollution sources, and address them in order of priority in the context of limited financial resources. As a matter of principle, priority should be given to pollution control for each river. It may be advisable for countries at the early stages of economic development to focus on the coastal seas of high environmental value using a zoning process.

JICA's Activities:
JICA's main activities are developing the monitoring framework and formulating master plans for pollution reduction in its development studies.

JICA's Activities

JICA's activities for water conservation and pollution control of enclosed coastal seas center on developing the institutional framework for environmental monitoring and formulating plans for reducing pollution loads (notably sewerage development plans) through its development studies.

In its development studies concerning the development of environmental monitoring frameworks, JICA implements a number of activities, including: quantitative assessments of marine environments by analyzing satellite images; provision of water quality analysis equipment and the transfer of analytical techniques; water quality monitoring surveys; and the development and evaluation of hydraulic and water quality simulation models. Building on these activities, JICA offers suggestions and proposals on a range of issues on environmental monitoring, including: monitoring items (concerning water quality and environmental resources), methods, frequencies, equipment,

implementation arrangements, institutional and operational management, and on-site inspections.

In its development studies concerning pollution load reduction, JICA mainly focuses on conducting master plan studies and feasibility studies on the construction of sewerage systems and wastewater treatment plants after analyzing water pollution arising from land-based sources and conducting water quality simulations. As additional pollution reduction measures to support sewerage development, JICA also offers suggestions, as appropriate, on such issues as industrial wastewater treatment, solid waste management, the dredging of bottom sediment; and the conservation of mangrove forests, wetlands and tidelands.

In its technical cooperation projects on environmental monitoring, JICA has plans to focus on enclosed coastal seas (monitoring water quality, hazardous substances in bottom sediment, benthos, etc.). However, few of these plans have been implemented yet.

In its trainee acceptance program, JICA offers lectures and on-site inspection tours regarding organic contamination, eutrophication, and contamination by mercury and other heavy metals in enclosed coastal seas. They are offered in its group training courses in Japan on such themes as environmental monitoring and wastewater treatment. Such courses include: Water Environmental Monitoring courses, Heavy Metal and Other Hazardous Substance Pollution Control courses, and Industrial Wastewater Treatment Techniques courses.

Development Objective 2 Developing the Capacity for Water Conservation and Pollution Control according to the Types of Bodies of Water

Mid-term Objective 2-1 Developing the Capacity for Water Conservation and Pollution Control of Rivers

Sub-targets of the Mid-term Objectives	Means and Methods for Achieving the Sub-targets	Case No.	Typical Activities of JICA
Designating uses and setting the levels of water quality conservation for rivers	△ Holding public hearings and assessing the current water quality ○ Conducting monitoring to assess the current water quality ○ Surveying land use patterns and economic activities in the basin △ Surveys using satellite images ○ Identifying appropriate uses of the river ○ Setting the levels of water quality conservation	9, 10, 30, 59	• Integrated river basin planning [DS] • Water quality monitoring [TCP]
Considering options that accommodate the characteristics of river basins and existing water pollution	○ Identifying major causes of pollution (domestic wastewater, industrial/commercial wastewater, etc.) △ River surveys (flow rates and velocities, and environmental capacities) △ Studying pollution characteristics according to the flow rate and velocity ○ Appropriate enforcement of regulations (Mid-term Objective 1-1) ○ Building and strengthening corporate environmental management systems (Mid-term Objective 1-5) Coordination with other government offices in charge of different types of pollution △ Introducing off-site treatment systems for domestic wastewater (sewerage) △ Introducing on-site units for primary wastewater treatment (septic tanks, domestic wastewater treatment tanks, etc.) Increasing education and awareness about the appropriate use of pesticides and fertilizer management △ Considering options that accommodate the land use pattern in the basin ○ Identifying pollution sources that need to be addressed as a priority △ Considering the cost-effectiveness of pollution load reduction options Considering options for controlling pollution caused by natural disasters associated with tributaries (flooding, etc.) Considering options for controlling natural pollutants Considering options according to the size of the river	3, 7, 31, 39, 41, 42, 44, 46, 50, 58, 59	• Water quality and environmental monitoring [TCP] • Environmental management by industry [DS] • Master plan studies for sewerage development [DS] • Improving the environmental capacity of communities [JPP] • Strengthening the environmental management capacity [TCP] • Integrated river basin planning [DS]
Considering options that accommodate the stage of development of the recipient countries and regions	○ Considering pollution load reduction options that accommodate different stages of economic development △ Considering pollution load reduction options that accommodate the local climate (tropical, temperate, etc.) Considering options according to the local population density	36, 40, 43, 45, 46, 47	• Integrated river basin planning [DS] • Master plan studies for sewerage development [DS]

Mid-term Objective 2-2 Developing the Capacity for Water Conservation and Pollution Control of Groundwater

Sub-targets of the Mid-term Objectives	Means and Methods for Achieving the Sub-targets	Case No.	Typical Activities of JICA
Designating uses and setting the levels of water quality conservation for groundwater	△ Identifying local users and uses of groundwater ○ Identifying major causes of pollution ○ Conducting monitoring to assess the current water quality △ Surveying local land use patterns and economic activities △ Setting the levels of water quality conservation	1, 46, 50, 52	• Projects for strengthening the water examination system [GA] • Groundwater resource development [DS] • Projects for providing equipment for water quality management [GA]
Considering options that accommodate the characteristics of groundwater basins and existing water pollution	○ Considering options according to water use Surveying soil contamination around polluted groundwater bodies △ Identifying the direction of groundwater flows Controlling point-source pollution Education and awareness building concerning appropriate fertilizer management	1, 52	• Water supply projects [TCP] • Groundwater resource development [DS] • Rural water supply projects [GA]
Considering options that accommodate the stage of development of the recipient countries and regions	○ Imposing regulations on pollution sources Appropriate treatment of pumped water Shielding off or detoxifying contaminated soils △ Seeking alternative water sources		• Water supply projects [TCP] • Rural water supply projects [GA]

Mid-term Objective 2-3 Developing the Capacity for Water Conservation and Pollution Control of Lakes			
Sub-targets of the Mid-term Objectives	**Means and Methods for Achieving the Sub-targets**	**Case No.**	**Typical Activities of JICA**
Designating uses and setting the levels of water quality conservation for lakes	○ Studying the pollution characteristics of inflowing rivers ○ Conducting monitoring to assess the current water quality ○ Surveying land use patterns and economic activities in the basin Surveys using satellite images △ Identifying the uses of lakes ○ Assessing the inflowing pollution loads △ Studying the main causes of pollution ○ Assessing horizontal and vertical variations in water quality △ Assessing the sediment ○ Setting the levels of water quality conservation	4, 32	• Planning for lake water quality improvement [DS] • Water quality monitoring techniques [TCP]
Assessing the hydrological characteristics of lakes	○ Assessing hydrological and hydraulic characteristics (the catchment area, planar shape, cross-sectional shape, capacity, water retention time, water level fluctuations, inflowing and outflowing rivers, water budget, water cycle, etc.) Assessing vertical characteristics (seasonal variations, discontinuity layers, etc.) Classifying water bodies into fresh, salt and brackish ones and assessing seasonal variations for each type	4, 32	• Planning for lake water quality improvement [DS]
Considering options that accommodate the characteristics of basins and existing water pollution	○ Identifying major causes of pollution (domestic wastewater, industrial/commercial wastewater, etc.) ○ Appropriate enforcement of regulations (Mid-term Objective 1-1) ○ Building and strengthening corporate environmental management systems (Mid-term Objective 1-5) Introducing the concept of total pollutant load control of organic pollutants △ Introducing off-site treatment systems for domestic wastewater (sewerage) △ Introducing on-site units for primary wastewater treatment (septic tanks, domestic wastewater treatment tanks) Education and awareness building about the appropriate use of pesticides and fertilizer management ○ Identifying pollution sources that need to be addressed with priority Considering the cost-effectiveness of pollution load reduction options	4, 32, 51	• Planning for lake water quality improvement [DS] • Water quality monitoring techniques [TCP]
Considering options that accommodate the stage of development of the recipient countries and regions	○ Considering pollution load reduction options that accommodate different stages of economic development Considering pollution load reduction options that accommodate the local climate (tropical, temperate, etc.) Measures for lake water purification (total pollutant load control of COD, vegetation-assisted water purification, etc.)	4, 22	• Planning for lake water quality improvement [DS]

Mid-term Objective 2-4 Developing the Capacity for Water Conservation and Pollution Control of Enclosed Coastal Seas			
Sub-targets of the Mid-term Objectives	**Means and Methods for Achieving the Sub-targets**	**Case No.**	**Typical Activities of JICA**
Designating uses and setting the levels of water quality conservation for enclosed coastal seas	△ Surveys of local fisheries and other economic activities △ Surveys to identify users of the sea ○ Assessing the pollution load from the basin Setting the levels of water quality conservation	2, 5, 6	• Monitoring framework development [DS]
Assessing the hydrographic characteristics of enclosed coastal seas	○ Coastal monitoring and tidal current measurement △ Assessing the depths and flow rates of the target coastal sea △ Assessing the geographical enclosed index	2, 5, 6, 29	• Strengthening environmental monitoring [TCP] • Bay water conservation planning [DS]
Considering options that accommodate the characteristics of basins and existing water pollution	○ Identifying the main causes of pollution ○ Considering the introduction of total pollutant load control for the basin as a whole ○ Taking measures to protect mangrove forests, etc. Considering measures to cope with ship accidents △ Assessing the land use characteristics of the inflowing river basin	38	• Monitoring framework development [DS] • Coastal conservation planning [DS]
Considering options that accommodate the stage of development of the recipient countries and regions	○ Considering pollution load reduction options that accommodate different stages of economic development △ Considering appropriate options to control pollution from the inflowing river basin △ Measures to reduce the pollution load generated by internal factors		• Sewerage development planning [DS]

※Case numbers correspond to the numbers in Table A1-1, Appendix 1.

○: Represents one of the objectives of JICA's projects for which tangible outcomes have been achieved
△: Represents one of the components of JICA's projects
Unmarked: Represents an area that JICA' projects have barely covered

TCP: Technical Cooperation Project AT: Acceptance of Trainees DS: Development Study DE: Dispatch of Experts JPP: JICA Partnership Program
GA: Grant Aid SV: Senior Volunteers Program JOCV: Japan Overseas Cooperation Volunteers Program

Chapter 3 Directions of JICA's Cooperation

Guiding Principles of JICA's Cooperation in Water Pollution Reduction

Target-setting and implementation of development interventions in line with the stage of development, local characteristics and priority needs of the recipient countries.

3-1 Guiding Principles of JICA's Cooperation in Water Pollution Reduction

(1) Target-setting and phasing-in of JICA's cooperation in line with the stage of development and priority needs of the recipient countries

Water pollution control requires a variety of measures to address both the point sources of pollution – household, industrial and commercial, and livestock and fisheries – and the non-point sources of pollution – urban, agricultural, and natural sources (see Appendix 5). Some measures, including the renewal of industrial plants and equipment and sewerage construction, require an enormous investment. These measures may not be affordable or sustainable options for developing countries without external assistance since these countries often lack the financial, human resources and institutional capacity[14].

It is therefore important to identify problems arising from water pollution and give priority to those that require urgent attention. For example, heavy metal contamination that has a direct and serious impact on human health or even life requires urgent action (action based on the precautionary principle) before it becomes too late. Also of importance are effectiveness and efficiency. Identifying major pollution sources and addressing them as a priority are an important requirement.

JICA should consider a portfolio of development interventions that is designed to ensure that the outcomes will be sustainable according to the stage of development of the recipient countries. For this reason, JICA needs to enhance its capacity assessment performance for more accurate analysis of the problems facing the recipient countries and assessment of their capacities at the individual and institutional levels. Also of importance is that JICA may try to transfer Japan's experience, but it should do so in a flexible manner, taking into account such factors as the institutional framework and the local characteristics of the recipient countries.

Within the context mentioned above, JICA needs to follow a series of processes: (i) closely examining the background of the pollution problem to be addressed, possible counterpart institutions, and appropriate aid modalities; (ii) identifying priority issues; (iii) setting objectives; (iv) preparing feasible aid

[14] For example, the least developed countries (LDCs) with low GDP per capita cannot afford large public infrastructure investments. Naturally, they invest only small amounts of money in environmental pollution control. Given these circumstances, it is not feasible to propose sewerage construction or other costly projects. Rather, JICA needs to consider development interventions that accord with the conditions of the recipient countries, especially the stage of economic development and the level of technology.

plans (including phased implementation of measures) that embrace appropriate technology; and (v) implementing development interventions that incorporate Capacity Development. These processes involve two important considerations. One is that the selection of appropriate technologies (see Appendix 5) should be made carefully in the light of their implications for the future. The other consideration is that urban infrastructure developments, such as sewerage construction, the installation of wastewater treatment systems at industrial establishments or other options that call for large scale investment should be placed in a wider context; for example, they should be considered as part of a phased introduction of, or as groundwork for, the development of a larger infrastructure. In short, JICA should prepare practical aid plans that consider their future implications and promote capacity development at both individual and organizational levels in the context of such plans.

(2) Building the capacities of the key actors to develop the pollution control capacity of the society as a whole

Building the capacities of the key development actors to develop the pollution control capacity of the society as a whole

Four major actors – government, civil society, industry and academia – are involved in water pollution control. The key to improving aid effectiveness is to determine the best way to develop the capacities of these 4 actors to increase the capacity of the society as a whole to control water pollution. To this end (i.e. to implement assistance activities centered on Capacity Development support), a number of steps need to be taken: (i) analyzing and assessing the capacity of each actor; (ii) identifying the needs and priority issues; (iii) determining the capabilities of each actor that should be strengthened to address the identified issues; (iv) assessing these weaknesses and constraints; and (v) exploring an optimal portfolio of development interventions for balanced capacity development for the society as a whole, based on such an assessment. These steps must involve the participation of and ownership by the recipients.

Building the capacities of the 4 key actors evenly is not efficient since it requires the input of considerable resources. It is better to concentrate resources on the actor or actors that will produce the maximum outcomes in developing the capacity of the society as a whole to deal with water pollution control. This calls for strategic thinking that factors in the wider implications of the development intervention and the prospects for sustainable and self-reliant development after its completion. It should be remembered that the relationships among the 4 actors are constantly changing according to social conditions. JICA should assess such dynamic relationships in selecting its counterparts (see Figure A3-1, Appendix 3).

(3) Considering the optimal portfolio of development interventions based on Capacity Assessment

Considering the optimal portfolio of development interventions based on Capacity Assessment

The optimal portfolio of development interventions demands, as a prerequisite, the accurate assessment of the stage of development of the aid recipient, the local characteristics, and the capacity of each development actor. In other words, it is crucial to identify the weaknesses in the capacity of the

recipient that pose an obstacle to solving the target problem for each aid project. In fact, this can determine the success or failure of the project.

In Capacity Assessment, it is important to accurately assess the current capacities and roles of the 4 actors – "government", "industry", "civil society" and "academia" – and the relationships among these capacities and roles at 3 levels: "individuals", "organizations", and "institutional/social systems". Effective and efficient assistance will result by determining the portfolio of development interventions based on such Capacity Assessment while sharing with the recipient an awareness of how to make assistance most effective and efficient in developing the water pollution control capacity of the society as a whole[15] (see Table A3-4, Appendix 3).

Up to now, in its project formulation studies and preliminary studies JICA has actually researched the background to requests for aid projects, as well as the need for and purpose of such projects. These studies, however, were not necessarily so comprehensive or systematic as to cover the capacities of the recipients as a whole. Nor has JICA fully shared this awareness of the need for Capacity Development with the recipients. Methodologies for Capacity Assessment at the project formulation or even preliminary phases have not been firmly established to clarify project objectives. In addition, the establishment of a systematic framework for relating JICA's experience to performance indicators is still in the process of being worked out. In short, further improvements are necessary[16].

(4) Strengthening water environment administration and water quality management capacity based on environmental science and technologies

Strengthening water environment administration and water quality management capacity based on environmental science and technologies

It is generally believed that progress in environmental management will tend to occur in parallel with economic and technological development. At the early stages of economic development, access to environmental technologies is quite limited. This makes it particularly necessary to develop environmental laws, the environmental authorities and environmental information. As the economy develops and pollution increases, more accurate information on the environment is accumulated, promoting calls for pollution control based on advanced science and technologies. As the economy expands even further, pollution control becomes a part of integrated environmental management whereby the society as a whole becomes involved in environmental management, including local communities.

Accurate environmental information and scientific expertise in pollution control provide a basis for implementing reliable water environment administration, considering pollution control options, and increasing the

[15] Table A3-4, Appendix 3 provides a standard check list that serves as a tool for assessing the current capacity of each actor. This list should be tailored to suit each actor or project, since different actors or projects require different sets of criteria. In addition, this list needs continuous improvement. For example, it should be made easier to add or subtract criteria for different projects for more effective assessment.

[16] JICA Institute for International Cooperation (2004)

capacity for water quality control. In general, economic development will be accompanied by higher levels of environmental management[17]. Yet efforts to develop expertise based on environmental science and technologies are nonetheless crucial for more advanced environmental management.

Technology transfer designed to develop the capacity to provide environmental science expertise has been one of the areas Japan has long stressed. It will continue to be an important part of the country's international cooperation in water pollution control.

JICA also needs to encourage the recipient countries to analyze information and data on water quality properly and make public the findings of such analyses. This process itself helps to strengthen water environment administration and water quality management capacity, resulting in further improvements in the capacity for integrated water pollution control on the part of the recipient countries. JICA should provide support not only to strengthen environmental science and technologies, but also in the use of environmental data for policymaking.

JICA's Priorities and Considerations

3-2 JICA's Priorities and Considerations

This section discusses the areas to which JICA should give priority and the considerations to be made in addressing them. To tackle water pollution issues, it is necessary to explore the possibility of combining and utilizing an optimal portfolio of Means and Methods of Achieving the Sub-targets in the Development Objectives Chart. This will result in more productive outcomes from JICA's development assistance.

(1) Support for strengthening the capacity for formulating water sector policies and environmental management programs

Support for strengthening the capacity for formulating water sector policies and environmental management programs

Although developing countries generally have a basic policy on water pollution control at the national level, such a policy is often unworkable due to such constraints as the weak capacity of the authorities in relation to water quality management and uncontrolled land development in river basins.

Support for improving the legal and regulatory framework and developing the policies required to overcome these obstacles are important issues.

To implement such policies, it is important that JICA transfer techniques for not only strengthening the policymaking capacity of government officials, but also for putting science-based data to good use in aspects of policy, including the establishment of water quality standards and water pollution strategies. It is necessary to encourage the recipient countries to mobilize a wide range of human resources that are crucial to water environment management. This can be accomplished by integrating into the legal and regulatory framework the mechanisms required to ensure and promote devolution to local autonomous, civil participation pollution control planning that takes into consideration the local characteristics.

[17] Evaluation Team on Environmental Cooperation, Japan Society for International Development (2003)

Successful policy implementation involves developing programs for water environment management. Among these is a water quality management program with the aim of conserving or even improving the current water quality. To this end, it is important to improve the capacity to: (i) assess the current pollution loads; (ii) identify the pollution sources; (iii) determine which sources should be addressed and how far the pollution load from them should be reduced from a comprehensive perspective; and (iv) develop a specific reduction plan.

In addition to the maintenance of accurate environmental data, JICA also needs to transfer expertise regarding the cycle of water quality management planning: (i) developing a pollution reduction plan based on an assessment of the current water quality; (ii) implementing the plan; (iii) monitoring the performance of the plan, especially its impact on pollution reduction; and (iv) developing a new plan based on new data gained from such monitoring. This technology transfer, which leads to successful policy implementation, also involves the important element of techniques for setting performance targets in line with the capacity level of the recipient country and devising feasible pollution control plans.

In the process of water quality conservation management, JICA should take every opportunity to identify stakeholders in the recipient countries, including universities, research institutes and NGOs, and to assess and mobilize their capacities. Mobilization of their capacities plays a pivotal role in building and sustainably developing the planning capacity not only of the government sector, but also of the recipient countries or regions as a whole.

(2) Support for organization and institution building and capacity development for water environment management

Support for organization and institution building and capacity development for water environment management

Developing countries often lack an enabling environment for putting water pollution control into practice. For this reason, organization and institution building is an important part of JICA's cooperation in this sector.

JICA's cooperation should include technology transfer projects designed to ensure that individual capacity development will not stop at the individual level but will rather be part of organization and institution building. To achieve this, it is crucial to select and utilize an optimal portfolio of instruments, like the Means and Methods of Achieving the Sub-targets in the Development Objectives Chart, rather than a single instrument. Another important consideration is that technology transfer should not stop at the counterparts but extend further to their entire organizations and even to other organizations. To this end, JICA should organize technical seminars or training sessions at the organizational level as a component of its projects. Such support for capacity development at the individual and organization levels should entail institution building. This includes the timely strengthening of the institutional framework and arrangements in parallel with the rising level of the capacity of the individuals and organizations.

A great variety of organizations and institutions are involved in water environment management. Apart from the environmental authorities,

government offices in charge of development also play an important role in this sector. For this reason, there is a need to provide a forum for effective coordination among these organizations. It is important that in such a forum an evaluation is made of the state of the environment through analyses based on environmental science, that it assesses the risk of leaving water pollution unattended, and that it discusses remedial options. In addition, it would be advisable to create a framework in which the environmental authorities provide reliable monitoring data and other information to the civil society, whose pressure in turn will have an influence on such a forum.

It may also be advisable to incorporate into environmental management administration effective arrangements for developing the environmental management capacity of businesses. One such arrangement may be for businesses to monitor their own environmental performance, rate their environmental compliance, and make these findings public. Another arrangement may allow businesses to introduce environmental labeling for eco-friendly products. In yet another arrangement, businesses may be required to adopt the Pollution Control Manager System, which is beginning to spread in Asian countries.

(3) Upgrading the level of environmental science and technologies in the field of water environments

Upgrading the level of environmental science and technologies in the field of water environments

As described in the previous section, upgrading the level of environmental science and technologies is essential for water environment administration and capacity development for water quality management. Capacity development in the government or public sector is indispensable in the early stages of economic development in which many developing countries find themselves. For this reason, JICA assistance in water pollution control concentrates on such support for capacity development. Although environmental science and technologies come in different forms, from basic to advanced, JICA will especially focus on the following aspects:

(i) Monitoring techniques for assessing the state of the environment
(ii) Techniques for disseminating environmental information
(iii) Low-cost technologies for wastewater treatment
(iv) Technologies for industrial pollution control
(v) Science and technologies that support environmental strategies and policies

The following considerations will be made in addressing these aspects:

- JICA should evaluate the level of the environmental management system of the recipient country, decide which aspect of environmental science and technologies should be addressed, and develop a technology transfer project. A JICA Environmental Center should act as a hub or catalyst for implementing this project formation process if the recipient country has one. If the recipient does not have such a center, JICA's experts and others should serve that function.

- It is impossible to plan water pollution control projects without scientific knowledge. The reality, however, is that project planners are often not well-versed in this field. Since JICA staff need to make the right decision concerning science and technologies, JICA should take every opportunity to develop a network of experts in water pollution control and facilitate the exchange of information among them.
- When the recipient country reaches a certain stage of economic development where the society as a whole has a high potential for achieving integrated environmental management, JICA should shift its focus from the approach that targets the central government to a cross-sectoral approach that involves local authorities, research institutes, universities and the private sector in order to launch a fully-fledged initiative to improve the water environment.
- It is important that each actor monitor the performance of the measures for environmental management in relation to their objectives. For one thing, such monitoring itself acts as a driving force for the implementation of these measures. In this context, information disclosure through various media, ranging from the state of the environment reports to websites, should be encouraged.
- Projects involving advanced technologies and techniques such as those for water quality analysis tend to end up with experts from JICA training only a few counterparts. This may not be cost-effective. JICA should make such projects more efficient through, for example, the effective utilization of local resources and south-south cooperation arrangements that take advantage of the existing JICA Environmental Centers.

(4) Timely implementation of priority measures for water pollution control

Timely implementation of priority measures for water pollution control

Water pollution occurs where people live, and its hazards spread to wider areas. If project planners look at water pollution hazards only in the local context, they may overlook more serious hazards elsewhere in the recipient country or give low priority to pollution control measures that need to be taken more immediately. This points out the need for the quantitative assessment of water pollution and its hazards and for the timely planning and implementation of projects to address priority issues based on such an assessment. These priority issues may include:

(i) Wastewater treatment in fast-growing, densely populated areas with serious water pollution in the capital and other major cities
(ii) Industrial pollution control in areas where health hazards are occurring
(iii) Conservation of the water quality of lakes, for which improvements in water quality are more difficult than for rivers once the water is polluted.
(iv) Water bodies that need special attention with respect to environmental conservation
(v) Environment Model Cities

The following considerations should be made in addressing these issues:

- As water pollution control involves large amounts of funds, quantitative assessment is necessary for project formation or selection. Such assessments should be well focused. To this end, JICA should make a check list for the selection of priority projects and identify areas that need to be addressed (see Table A3-5, Appendix 3).
- Many people recognize the history of water environment administration in Japan and the country's experience in overcoming water pollution problems as successful examples. Yet a closer look at Japan's experience shows that the government ratcheted up pollution control measures in line with a range of parameters. Such parameters included: the scale of the national economy; the legal and regulatory framework; the capacity for developing applicable pollution control technologies; private sector competitiveness; and the level of public awareness. JICA may try to transfer Japan's experience, but it should do so in a flexible manner, taking into account such factors as the institutional framework and the local characteristics of the recipient countries.
- The use of water resources for different purposes in a given basin may not be possible without maintaining a good water cycle with an appropriate level of water quality and quantity. In this context, careful attention should be given to the option of large-scale water and sewage systems. Such systems involve the mass transport of water resulting from integrated water management, instead of decentralized water management. This causes a partial disruption of the water cycle. Large-scale water and sewage systems also increase the pollution loads on wastewater treatment plants. Moreover, they consume considerable amounts of energy and entail high initial costs and maintenance expenses. These factors should be carefully assessed before implementation to ensure high cost-effectiveness.
- Measures designed to maintain a good water cycle on a small or medium scale have the following advantages, enhancing the prospects for efficient pollution control.
  - A relatively small scale water cycle facilitates the assessment of water pollution and the identification of any problems. It also makes it easier for local people to keep track of the water environment.
  - It is easier to reflect, in water pollution control planning, suggestions from different actors in municipalities and communities in a basin on controlling pollution and improving the overall water environment (including providing open spaces that facilitate access to the waterfront and the water itself).
  - They facilitate the involvement of various actors in the pollution control process.
  - The impact of pollution control is easily felt in everyday life (with citizens acting as monitors).

(5) Partnership with other donors for synergies

Partnership with other donors for synergies

Water pollution control, especially in large cities, eventually calls for large-scale infrastructure developments, including sewerage systems. Supporting such developments is a formidable task for a single aid agency. For this reason, the donor community sometimes adopts a process in which one donor first supports the recipient country in formulating a master plan and then a number of donors work together to implement it. Given the current circumstances surrounding Japan's ODA, JICA is required to make its activities more efficient by improving coordination with other donors. To this end, it is increasingly important for JICA to implement its share of large-scale aid projects in partnership with other donors.

Such partnerships in themselves also eliminate wasteful duplication and result in a more efficient use of resources. They can also contribute to water pollution control in large cities, which may not be addressed by a single donor. This will improve the prospects for successful outcomes.

(6) Program approach involving a range of aid modalities

The program approach involving a range of aid modalities

JICA has an array of aid schemes with different features. The key is how best to combine these schemes into one integrated portfolio as though they are part of a development program (the program approach). Such an optimal portfolio of aid schemes may not be possible without accurately assessing the character and features of the development issue to be addressed and setting goals based on such an assessment.

JICA should take one step further. In addition to taking advantage of the wide spectrum of proprietary tools, JICA should also improve coordination with loan and grant aid programs, as well as with the other programs of agencies affiliated with the Ministry of Economy, Trade and Industry of Japan (JETRO, NEDO, etc.), to purse more coherent development assistance as a leading donor country. In fact, Japan has often supported a number of projects for constructing sewerage systems and other large-scale infrastructures through loan aid. Such interagency cooperation should be promoted to achieve more productive outcomes.

(7) Attention to world trends in the water sector

Attention to world trends in the water sector

In the water supply and sanitation sector, moves toward Public Private Partnerships (PPP) are being accelerated throughout the world. In particular, water companies in Western Europe are involved in this process. Moves to transfer sewerage services to the private sector are expected to intensify. JICA should take account of these world trends in delivering aid in water pollution control.

(8) Building on lessons learned from past experience

Building on lessons learned from past experience

To date, JICA has implemented many technical cooperation projects and other activities in the water pollution control sector. Some projects achieved highly productive outcomes, although there are also some failed to meet their objectives, especially among the early projects. It is essential to learn lessons from both the successful and unsuccessful experiences and implement better

projects accordingly. Although JICA has conducted evaluations of its past projects, especially the unsuccessful ones, the lessons learned from these evaluations have not been fully exploited. For the future, it is important for JICA to develop a mechanism for feeding both successful and unsuccessful experiences back to the project formation and implementation processes. Improving the JICA Knowledge Site and promoting the activities of JICA's thematic taskforces are steps in the right direction.

Appendix 1 JICA's Major Activities (Water Pollution)

This appendix describes JICA's major activities related to water pollution control that are *not* in line with the Development Objectives Chart presented in this report. Any attempt to relate these activities to the Development Objectives Chart would, more often than not, blur their features since they often span two or more medium-term objectives.

Instead, JICA's aid activities (or modalities) are organized around the following four types of operation. In describing typical examples of JICA's activities under each type, reference is made to the features of the Means and Methods of Achieving the Sub-targets in the Development Objectives Chart.

Type 1: Developing policies and programs regarding water pollution control

Development Studies (Master Plan Studies), Technical Cooperation Projects, and the Dispatch of Experts

Type 2: Implementing technology transfer for water pollution control

Technical Cooperation Projects, the Dispatch of Experts, Development Studies, and Group Training

Type 3: Developing facilities and equipment for water pollution control

Providing Grant Aid or conducting feasibility studies in the scheme of Development Studies

Type 4: Promoting greater involvement in water pollution control at the grassroots level

Dispatch of Volunteers and the JICA Partnership Program

The following paragraphs highlight JICA's activities in each of the above types of development activities. Note that the case numbers correspond to the numbers in Table A1-1 in this appendix.

Developing policies and programs regarding water pollution control

1-1 Developing Policies and Programs Regarding Water Pollution Control: Case No. 1-16

JICA supports the development of water pollution control policies and programs through its Development Studies, Technical Cooperation Projects, and the Dispatch of Experts.

Development Studies focus on planning integrated water management and water quality monitoring

Developing countries are facing deteriorating water pollution in their cities as a result of population growth, urbanization and industrialization in line with rapid economic development. Water pollution problems are caused by the increasing volume of domestic and industrial wastewater. Given these circumstances, JICA's Development Studies focus on analyzing water pollution problems, planning integrated water environment management aimed at controlling water pollution, and developing water quality monitoring plans.

With respect to sewerage systems, JICA provides support in developing master plans, as well as providing advice to implementing agencies on construction planning.

Planning for water conservation and pollution control in parallel with planning for water supply by tapping rivers and groundwater

JICA also assists in water conservation and pollution control of rivers and bodies of groundwater. In parallel with planning water supply by tapping rivers and groundwater supplies (important sources of drinking water and water for other uses), JICA develops plans for improving water quality and managing the water environment as a whole. In China, for example, JICA has formulated a master plan on integrated water environment management for the Li-Jiang River, after assessing and analyzing its environmental problems related to water. The main problem with this river is the increasing difficulty in extracting its water for drinking, agricultural and industrial purposes due to the inadequate flow rates during the dry season and water pollution caused by domestic and industrial wastewater. JICA has developed this master plan as a development study, which was formerly known as the Study on the Integrated Management Master Plan for the Water Environment of the Li-Jiang River in the People's Republic of China.

Water environment management planning for lakes that focuses on eutrophication control

Compared with rivers, lakes are often not only a source of drinking water, but also provide resources for tourism due to their scenic value. Yet water pollution tends to be more serious as lakes retain their water for a much longer period. Water pollution requires urgent attention as industrial development, agricultural modernization and rapid increases in the population are taking their toll. In China, water quality deterioration is adversely impacting Tai Lake, where eutrophication often gives rise to algal blooms. To address this situation, JICA has developed a master plan study for the management of the water environment of Tai Lake. As part of this study, JICA has developed a eutrophication model for Tai Lake. Using this model, JICA has made predictions regarding major parameters for water quality analysis, including discharged pollution loads, inflow loads and lake water quality. Based on these predictions, JICA has formulated a water environment management plan focusing on eutrophication control.

Planning environmental monitoring for enclosed coastal seas where there are environmental concerns about local fishery resources and coral reefs in the face of rapid industrialization and oil spills during the Gulf War

Water pollution of enclosed coastal seas is mainly caused by untreated domestic and industrial water carried by inflowing rivers, as well as oil spills. To address this deterioration in water quality, JICA provides support in developing programs for marine environments and water quality management that involve water quality monitoring and water quality simulations for the analysis of seawater pollution problems. In Saudi Arabia, JICA has formulated an environmental monitoring plan for coastal areas where there are

environmental concerns about local fishery resources and coral reefs in the face of rapid industrialization and oil spills during the Gulf War. JICA developed this plan through a development study formally known as the Study on an Environmental Assessment and Monitoring of Arabian Gulf in the Kingdom of Saudi Arabia.

Conducting master plan studies for promoting industrial effluent control and cleaner production as part of support for the business sector

Environmental pollution caused by industrial wastewater is also a serious problem in developing countries as they pursue rapid industrial development. Industrial production in developing countries is largely supported by small and medium-sized enterprises, which often use out-of-date production technologies due to a lack of technical information or funds. This also contributes to environmental pollution. In Viet Nam, JICA has produced a Master Plan Study for Industrial Pollution Prevention in Viet Nam (Wastewater). This study identified five industrial subsectors that have caused serious effluent pollution: textiles and dressmaking; chemicals; pulp and paper; food processing; and metalworking. The plan then sets out effluent treatment plans for each of these subsectors.

Box A1-1 Study on Environmental Management for Ha Long Bay

Ha Long Bay, located in northeastern Viet Nam, is one of the most popular tourist spots in the country. With a unique landscape that includes many islets and unusually-shaped rocks, the bay was designated as a World Natural Heritage Site by UNESCO in 1994.

The unique landscape notwithstanding, areas surrounding Ha Long Bay were experiencing rapid development and economic growth. The resultant environmental degradation, including water pollution, was beginning to adversely impact these areas and the bay itself. Water pollution had already deteriorated in some areas due to domestic and industrial wastewater discharges and the effluent from mines. It was feared that ongoing industrial and urban development would further degrade the bay environment. This prompted JICA to implement a development study aimed at supporting Viet Nam in developing an integrated plan for the environmental management of Ha Long Bay designed to pursue both environmental conservation and economic development.

To gather information and data, several steps were taken. The first step was the assessment of the state of Ha Long Bay with a focus on economic activities in the surrounding area and wastewater discharges as well as solid waste generation from this area. The second step was the elucidation of the mechanism of water pollution within the bay. To understand this, a number of studies were carried out, including: surveys of the tides and tidal currents, research on the water mass structure, determining the water retention time, surveying the water quality of the bay and the inflowing rivers, and making an inventory of pollution sources. Satellite images were also used to collate this data. The third step was estimating the balance between the inflow and outflow loads. The fourth step was the development of a model for simulating pollution dispersion and eutrophication in the bay.

Based on these assessments and other data, the study then divided its target area into four zones. Then conservation targets were set for each zone, including those for water quality, mangroves, coral reefs, fish and shellfish, and landscapes. These targets were incorporated into the environmental management plan.

This environmental management plan set out the essential options for environment conservation. Among these, priority was given to the installation of domestic wastewater treatment facilities in four districts; the management of industrial water; the installation of solid waste management facilities; environmental considerations in coal mining; the regeneration of mangrove forests; the regular implementation of environmental monitoring; and the establishment of a visitor center.

Source: JICA (1999)

In Malaysia, the National Development Policy calls for "the Promotion of Cleaner Technology" as a means of sustaining healthy economic development while giving adequate attention to the protection of the environment. To support this policy, JICA has implemented a Study on the Promotion of Cleaner Production in the Industrial Sector. This study has conducted pollution analyses on 4 industrial sectors-electroplating, anodizing, food processing, and textiles to make recommendations on a serious of measures: developing a national strategy/policy to promote cleaner production; information campaigns; networking; providing better access to technical and other services; tightening regulations; and capacity building.

Implementing and Supporting Technology Transfer for Water Pollution Control

1-2 Implementing and Supporting Technology Transfer for Water Pollution Control: Case No. 17-37

JICA implements technology transfer for water pollution control through its various schemes such as Technical Cooperation Projects, the Dispatch of Experts, Development Studies, and Group Training.

In developing countries, the central government institution in charge of the environment tends to be less powerful within the administrative machinery and staffed with officials not well versed in environmental conservation. Under these conditions, the implementation and enforcement of water quality standards, the designing of measurement plans, the implementation of environmental monitoring, and the marshaling of monitoring data are often the responsibility of local governments. In many cases, however, local governments lack sufficient capacity to carry out these duties. This generally applies to the sewerage sector as well. Only a few local governments and authorities have sufficient capacity in relation to sewerage engineering, sewerage maintenance techniques, and the overall management of sewerage systems.

Technology transfer for improving sampling and analytical accuracy at environmental protection (management) centers and university laboratories through development studies

JICA's support for capacity building in water quality management and monitoring includes technology transfer to the Environmental Management Center in Indonesia, the Japan-China Friendship Environmental Protection Center in China and university laboratories in developing countries. The transfer of monitoring, analytical and data processing techniques is designed to strengthen the capacities of these institutions, including those for environmental monitoring, environmental management, and the collection and analysis of environmental information. In its master plan study for water quality and environmental monitoring in coastal areas in Mexico, JICA transferred technologies for wastewater quality monitoring and analytical techniques in the process of planning coastal water quality monitoring.

As part of its support for capacity building in the sewerage sector, JICA has transferred technologies for the overall management of sewerage systems and sewerage engineering to relevant government offices and departments and water and sewerage authorities.

JICA transfers water pollution control technologies to the business sector as well. A case of this is its technical cooperation project at the Industrial Water

Box A1-2 Projects of the Environmental Management Center (EMC) in Indonesia

In Indonesia, air, water and other environmental pollution problems are taking their toll in the Greater Jakarta as a result of rapid rural-to-urban migration and increasing economic activities in the metropolitan region. This increase in environmental degradation prompted the Indonesian government to develop a framework for environmental administration during the 1980s and 1990s, including the enactment of the Basic Provision for Environmental Management Act and the establishment of the State Ministry of Population and Environment, and the Environmental Impact Management Agency.

Yet engineers and researchers in the environmental sector were in short supply. To rectify this situation, the Indonesian government incorporated into the National Development Plan a project to establish an environmental management center that would play a pivotal role in environmental administration. The government then asked Japan to provide financial and technical assistance to launch the center.

In 1991, Japan started to provide grant aid to construct the center and also provide analytical equipment. This was followed by a technical cooperation project for the EMC, which started in 1993. Through this project, the EMC has achieved a number of its objectives, including: acquiring monitoring techniques for the environmental monitoring of water, air and toxic substances; establishing standard methods of analysis and preparing manuals for them; and developing the capacity to provide training for other agencies conducting analyses. JICA's support for developing environmental management capacity by improving analytical techniques through the establishment of such an environmental center has also been implemented in Thailand, China, Egypt, Mexico and Chile. This is called the Environmental Center approach.

With JICA's assistance, the EMC developed the capacity to implement basic monitoring. However, they did not have adequate skills to ensure that its environmental data would be translated into policies. In addition, local governments were required to improve their environmental management capacities after environmental management functions were transferred to them in line with the ongoing decentralization process in Indonesia. These circumstances prompted the Indonesia government to request Japan for additional technical cooperation. This led to the launch in July 2002 of the Project for Strengthening Decentralized Environmental Management Systems in Indonesia.

This project has 2 major objectives. One is to develop the capacity of the EMC to provide training to transfer the technologies it accumulated with the help of JICA to local governments. The other is to develop the environmental management capacities of provincial environmental boards. As a first step, this project focuses on the North Sumatra Provincial Government and a model river in the province. In the project, the provincial environmental board is now practicing a water management cycle – water quality monitoring, identification of pollution sources, and designing a strategy to reduce pollution – under the guidance of the EMC. The idea is to develop a framework for technology transfer from the EMC to provincial governments for the development of the environmental management capacities of the latter and to disseminate this framework to other provinces. This project is regarded as a potential model project to support capacity development for environmental management in many other developing countries that are in the process of decentralization.

Source: JICA (2000), (2002)

Transfer of effluent treatment technologies to the Industrial Water Technology Institute in Thailand as part of JICA's support for the business sector

Technology Institute (IWTI) in Thailand, which was established to develop human resources within the Ministry of Industry to promote and offer guidance on industrial pollution control technologies to private businesses. To support IWTI, JICA has offered technical guidance on industrial water-related technologies, including those for wastewater treatment and reuse. It has also provided training for pollution control managers and factory engineers.

Developing Facilities and Equipment for Water Pollution Control

1-3 Developing Facilities and Equipment for Water Pollution Control: Case No. 38-52

JICA supports the development of facilities and equipment for water pollution control with providing Grant Aid, and also with conducting feasibility studies in the Development Study Scheme.

Many developing countries have sewers and sewage treatment plants that were constructed by their former colonial powers. Yet these facilities are now aging. Sewer mains are inadequately cleaned and otherwise poorly maintained. Wastewater is often discharged directly into rivers without treatment. Even if it is treated, there are concerns that existing treatment plants will not be able to cope with increasing volume of sewage in the coming years. Developing countries need development assistance in the water supply sector as well. In fact, JICA is asked to provide support, for example, in the planning and designing of water supply facilities, as well as for analytical centers (laboratories) designed to improve water quality analytical techniques for drinking water.

Developing countries are suffering from deteriorating water pollution due to the aging or inadequate treatment capacity of sewage facilities

In the Development Study scheme, JICA develops master plans in the context of emergency and also in the context of medium-term and long-term planning for the water environment and water and sewage systems. JICA also designs facility development plans as part of feasibility studies on some projects selected from the projects designed in the master plan since JICA identified its emergency and priority. In Brazil, Guanabara Bay in Rio de Janeiro was experiencing significant degradation of its aquatic environment due to a range of factors, including: haphazard deforestation upstream; pollution sources such as large industrial plants, shopping centers and hospitals; land reclamation; and domestic wastewater inflows. In response, a sewerage construction project (first phase construction) was launched based on the recommendations of JICA's Development Study known as the master plan study for water pollution control in Guanabara Bay. Yet it became apparent that the first phase would fail to remove pollutants adequately. Consequently, JICA conducted a feasibility study to explore how better to clean up the bay after the completion of the first phase construction.

Supporting sewerage development by feasibility studies in the Development Study scheme

JICA's activities under the Grant Aid scheme can be divided into 3 types. The first type is design and construction in relation to existing sewage systems, including sewer mains and treatment plants. Yogyakarta city in Indonesia is experiencing a deterioration in river water quality as wastewater is directly discharged into its rivers. Although the city has a sewer network constructed by the Dutch colonial government, it does not have a treatment plant. In response, JICA implemented the Project for the Construction of a Sewerage Treatment Plant. This project produced a detailed design for the construction of a new treatment plant and sewer mains with a total length of 6 kilometers (km). The second type concerns water supply. It includes the design and construction of water purification facilities, conveying pumps and hydroelectric facilities, as well as 'soft' components, mainly guidance on the construction, operation and

Designing and constructing sewage systems using Grant Aid

Supporting improvement of drinking water quality using Grant Aid

maintenance of these facilities. As water supply is directly linked with the lives of local people, the provision of facilities for water service delivery is a matter of urgency. Some regions have a problem of high levels of iron, manganese, arsenic and other toxic substances in the groundwater. To address this problem, JICA implemented a basic design study for installing a system for removing iron, manganese and other elements in the groundwater and providing related equipment as part of its Project for Improvement of Water Quality in Local Areas in the Philippines. The third type includes the construction of water testing laboratories at the environmental centers and other institutions, as well as the provision of analytical equipment for determining water quality. In Bangladesh, serious arsenic contamination of the soils came to the surface. This led to the implementation of JICA's Project on Strengthening of the Water Examination System. In this project, JICA conducted a basic design study for refurbishing 1 central and 2 local laboratories for the examination of drinking water (the central laboratory supervises and coordinates the local ones).

Constructing water examination laboratories and providing relevant equipment using Grant Aid

Box A1-3 Nakuru Sewage Works Rehabilitation and Expansion Project in Kenya

Lake Nakuru, located about 150 km northwest of the Kenyan capital of Nairobi, and its surrounding areas are endowed with natural beauty, including the lake water, wetlands, rivers, grassland, forests, and stretches of rocky outcrops. These provide habitats for a great variety of wild animals and plants. The lake, which was listed as a Wetland of International Importance under the Ramsar Convention in 1990, is one of Kenya's leading tourist spots, attracting many tourists from all over the world.

Just north of Lake Nakuru is Nakuru Municipality, with a population of 360,000 (as of 1993). The city and its surrounding areas were experiencing rapid urbanization and industrialization, along with increasing domestic and industrial wastewater discharges. This in turn was causing rapid deterioration of the water of Lake Nakuru, a closed lake with no outflowing rivers. The city had a public sewerage system, but its coverage was only 13 km^2, concentrated on the city center. To make matters worse, the pollution load of the sewage from these areas exceeded the design capacity of the existing treatment system.

This was the background to the Study on the Nakuru Sewage Works Rehabilitation and Expansion Project. As part of this study, JICA conducted feasibility studies for improving the existing sewage system. Based on this, Japan provided a Grant Aid project to support rehabilitation and expansion of the sewage works.

This project introduced the pond wastewater treatment system. In this system, wastewater is detained in a pond for an extended period and purified through a process of biochemical oxidation. This system requires a large area for the facilities. However, land is available at relatively low cost in Kenya. Aside from the initial costs, the system does not require much money to cover the operating and maintenance costs or much manpower. For these reasons, this system is considered a technology that is appropriate for Kenya. The wastewater treatment facilities in Nakuru also use additional technology to further purify the treated water, making the system more complete. It is safe to say that this system will serve as a model for other sewage treatment plants in Kenya. Furthermore, the successful application of appropriate technology in this project will serve as a model for development interventions in other developing countries as well.

Sources: JICA (1994); JICA, Planning and Evaluation Department (2001)

Promoting greater involvement in water pollution control at the grassroots level

1-4 Promoting Greater Involvement in Water Pollution Control at the Grassroots Level: Case No. 53-59

JICA promotes greater involvement in water pollution control at the grassroots level through the Dispatch of Volunteers and the JICA Partnership Program.

The dispatch of volunteers for water pollution control focuses on environmental education and water examination.

Dispatch of volunteers in the categories of environmental education and water examination

JICA volunteers for environmental education are generally assigned to environmental departments or laboratories in the central government or local authorities in the recipient countries to provide advice on environmental education at the grassroots level and on analytical and examination techniques for determining water quality. In Tanzania, JICA volunteers at the Mtwara Mkindanti Town Council organize hygiene improvement seminars at the village level in this largest town in southern Tanzania. They also gather information on

Box A1-4 Project for environmental conservation planning and promoting priority measures in local governments in the Philippines

Cavite Province south of Metro Manila was experiencing rapid population growth partly due to its easy access to the capital region and the construction of industrial parks. This population growth was increasing environmental stress on the province. Local governments in charge of environmental management were effectively allowing this stress to increase environmental pollution as they lacked ordinances or plans for environmental conservation.

Against this background, the International Center for Environmental Technology Transfer (ICETT) of Japan helped Imus City in the province in, for example, establishing an environmental ordinance over a 3-year period between 1997 and 1999 with support coming mainly from the Mie Prefectural Government in Japan. Between 1999 and 2001, JICA provided technical guidance on environmental education, water quality monitoring and solid waste management through its expert assignment program as part of the JICA Public Participation Program. These efforts resulted in strengthening the capacity of Imus City in environmental management. ICETT then decided to apply this approach to neighboring municipal governments in order to achieve a broader approach to environmental conservation based on self-help and partnership among these municipalities. This was how this project was launched under the JICA Partnership Program.

This project selected 4 municipalities around Imus in Cavite Province as model cities and provided technical support to them. The fields of technical support ranged from the establishment of environmental ordinances, the sorting and composting of waste at the community level to river water monitoring by municipal government staff and teaching methods for environmental education in primary schools.

Although no Japanese experts resided in these municipalities during the project period, the project achieved more than expected in some areas thanks to cooperation and competition among the 4 municipalities, increasing the prospect of the project serving as a model for future development interventions. Another advantage of this project was that the use of the ICETT network for recruiting experts made it possible to better meet the project needs than JICA's conventional procedures for recruiting them.

Capacity building not only at the central government level but also at lower levels of government and the grassroots level is important for environmental management. JICA is advised to incorporate this approach in its aid projects and thus promote partnerships at the grassroots level.

Source: JICA, Global Environment Department (2004)

the number of latrines in each village and provide education on the hygienic use of latrines for local people.

JICA volunteers for water examination are assigned to environmental monitoring departments or water and sewerage authorities in the recipient countries to provide guidance on the examination of drinking water, industrial wastewater and sewage. In Mongolia, JICA volunteers at the waterworks management bureau, the Ministry of Infrastructure Development conduct water examination and microbiological assays with a view to shifting from chemical processes to microbiological processes in the treatment of wastewater. They also provide advice on the procurement of equipment.

In the JICA Partnership Program, efforts are made to transfer water pollution control technologies developed by local governments in Japan. For example, these local governments provided an association of bean curd manufacturers in Indonesia with technical guidance on treating wastewater from their factories. They also support local governments in the Philippines in establishing environmental ordinances and improving water quality monitoring capabilities.

Table A1-1 List of Selected JICA Projects in the Water Pollution Sector

Note: Only activities related to water pollution are listed.

No.	Recipient Country	(1) Project Title / (2) Overview / (3) Implementing Organizations or Counterparts	Duration	Scheme	Medium-term Objective	Means and Methods Used in the Project for Achieving the Sub-targets
1. Developing policies and programs regarding water pollution control						
1	Malaysia	(1) Study of Sustainable Groundwater Resources and Environmental Management for the Langat Basin (2) • Cross-sectoral and integrated groundwater development for the sustainable use of resources and the provision of safe groundwater supplies • Designing a master plan for environmental management (3) Geological research institute, Ministry of Primary Industry	2000.03～2002.01	DS (M/P)	1-1 1-2 1-3 1-4 2-2	• Identifying major factors causing groundwater pollution (non-point and point pollution sources, infiltration of seawater in coastal areas, etc.) • Setting groundwater protection standards (for organic compounds, heavy metals, electrical conductivity, etc.) • Planning water quality management (regular continuous monitoring, detailed monitoring in abnormal cases, IT-assisted systems for management and information with, for example, GIS (ArcView) • Reviewing the existing laws and regulations concerned (adding provisions on hydrogeology and groundwater development) • Establishing a charging system (proposing a system for charging groundwater pumping) • Improving coordination among environment-related government offices and agencies concerned with water pollution management
2	Viet Nam	(1) Study on Environmental Management for Ha Long Bay in the Socialist Republic of Viet Nam (2) Designing a master plan for the environmental management of Ha Long Bay and its surrounding area, which has vast potential for industrial and tourism development, in line with trends in such forms of development (3) Ministry of Science, Technology and Environment; People's Committee of Quang Ninh Province	1998.02～1999.09	DS (M/P)	1-1 2-4	• Coastal monitoring and tidal current survey • Assessing pollution loadings from the basin (identifying and assessing point sources of pollution such as domestic, industrial and livestock wastewater, and non-point sources such as rainwater; inventorying pollution sources; understanding the mechanism of water pollution; calculating pollution loads) • Developing a water quality simulation model • Designing an environmental management plan (with the focus on conserving the World Natural Heritage Site, introducing total pollution load control, and strengthening law enforcement capacity)
3	China	(1) Study on Integrated Management for the Water Environment of Li-Jiang River (2) Designing a master plan for integrated aquatic environment management based on an assessment and analysis of the water environment of the Li-Jiang River, where water pollution due to domestic and industrial wastewater is affecting the tourism industry (3) Science and Technology Commission, Guangxi Zhuang Autonomous Region	1996.06～1997.07	DS (M/P)	1-1 1-2 1-3 1-4 1-5 2-1	• Estimating pollution loads (discharges from factories) • Assessing the self-purification and environmental capacities of the river (self-purification coefficients for BOD, COD and NH4-N, reaeration coefficient, etc.) • Developing a water quality prediction model regarding the DO and BOD of the river water (a model that factors in the self-purification function) • Constructing scenarios for the pollution load (in the case where no pollution control measures are taken and in the case where sewerage and industrial wastewater treatment plants are constructed) • Applying effluent standards that are more stringent than the national standards • Banning pollution discharging businesses and providing tax incentives for good practices • Considering the introduction of a wastewater charging scheme (including the setting of sewerage fees and charges) • Establishing an aquatic environment management commission • Developing an information system for river environment management • Establishing monitoring techniques (developing a system for automatic water quality monitoring)
4	China	(1) The Study on Eutrophication Control of Tai Lake (2) Developing a eutrophication prediction model and designing a master plan for water environment management with the focus on measures to prevent eutrophication in Tai Lake, where the deterioration in water quality due to eutrophication is becoming a serious threat to the local environment (3) Lake Taihu Basin Management Bureau, Ministry of Water Resources	1996.01～1998.07	DS (M/P)	1-1 1-3 1-5 1-7 2-3	• Calculating pollution loads (those from point and non-point sources, including rainwater) • Assessing the current water quality (including electrical conductivity [through a river cruising survey], lake flow regime, and ecosystems) • Survey using satellite images (of the distribution of aquatic plants) • Developing eutrophication prediction models (including a model for the inflow load from rivers, a model for the lake water and calculation of the lake flows) • Measures against eutrophication (restricting the construction of industrial establishments; control on wastewater discharges; banning synthetic detergents containing phosphorus; installing high-performance domestic flush toilet and non-toilet wastewater treatment tanks; taking advantage of plants with floating leaves, including the water hyacinth) • Reviewing existing laws and regulations concerned (setting discharge standards for nutrients [N-P]) • Setting reasonable charges and user fees (raising water user fees) • Providing incentives for businesses to control pollution • Providing public subsidies for environmental conservation projects (loan incentives; guidance policy financing based on a pollution load charging system)
5	China	(1) Study on the Improvement of the Marine Environmental Monitoring System for the Pearl River Estuary in the People's Republic of China (2) Assessing the state of the marine environment, developing a water quality monitoring model and then designing a master plan with a view to improving the marine environment (3) South China Sea Branch, State Oceanic Administration	2000.03～2001.09	DS (M/P)	1-1 1-2 1-4 2-4	• Assessing pollution loadings from the basin (inventorying pollution sources; assessing the impact of tides) • Water quality simulation (3D hydraulic, 3D advection-diffusion model) • Establishing the water quality monitoring arrangements (points, parameters, frequency, etc.) • Improving coordination among environment-related government offices and agencies in water pollution management (suggesting a coordination framework based on the experience of the Association for the Environmental Conservation of the Seto Inland Sea in Japan) • Establishing environmental laws and ordinances (establishing an Ordinance for Conservation of the Marine Environment of the Pearl River Estuary based on the experience of the Law concerning Special Measures for the Conservation of the Environment of the Seto Inland Sea in Japan)

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6	Saudi Arabia	(1) Study on an Environmental Assessment and Monitoring of Arabian Gulf in the Kingdom of Saudi Arabia (2) Assessing the state of the environmental monitoring framework, identifying issues to be addressed, and making recommendations on the framework for the coastal areas surrounding the Arabian Gulf where seawater quality is deteriorating due to industrialization and desalination and where there are concerns about the environmental impact of oil spills on fishery resources and coral reefs (3) Meteorology and Environmental Protection Administration	1999.02～2001.01	DS (M/P)	1-2 1-4 2-4	• Coastal monitoring (nutrients [N-P]) • Analyzing satellite images (with a focus on SS, chlorophyll, oil contamination, water temperature distribution, land use patterns of coastal areas) • Proposing a national water quality monitoring system (for coastal and inland areas; elucidating the eutrophication mechanism and making remedial measures) • Capacity building for environmental management (improving laboratories and analytical techniques; technology transfer through OJT on satellite image analysis)
7	Bulgaria	(1) Study on Environmental Management for Water Pollution Control in Maritza River Basin in the Republic of Bulgaria (2) Designing a master plan for integrated environmental management to deal with water pollution (3) Ministry of the Environment and Waters	1997.04～1999.03	DS (M/P)	1-1 1-2 1-3 1-4 2-1	• Designing a basin management plan (based on the EU water policy guidelines) • Establishing a basin management organization • Designing a master plan for basin environment management (point and non-point source pollution control; physical infrastructure development; non-physical infrastructure development in relation to such aspects as land-use/environmental zoning and water quality monitoring) • Securing financial resources for sewage systems (establishing an environmental protection fund, setting water charges, etc.) • Improving the charging system
8	Colombia	(1) The Study on Industrial Pollution Abatement by Promoting Cleaner Production Technology in Santafe de Bogota (2) Making recommendations on policies and measures to reduce industrial pollution and proposing an industrial pollution abatement program that will focus on four industrial subsectors (textiles, oil and fat refining, soapmaking, and metal plating) (3) Environment department, Bogota city government	1998.10～1999.08	DS	1-1 1-3 1-5	• Field research (including seminars, follow-up factory inspection, detailed factory inspection, recommendations on policies and measures to reduce industrial pollution) • Factory research (assessing plant and equipment and amounts of waste generated; identifying problems with production and management technologies) • Proposal for an industrial pollution abatement program in four industrial sub-sectors – textiles, oil and fat refining, soapmaking, and metal plating (with a focus on improving management technologies) • Reviewing existing laws and regulations concerned (establishing environmental standards and revising effluent standards) • Setting reasonable charges and user fees (revising the charging system) • Providing tax incentives for investments in environmental conservation
9	Egypt	(1) The Study on Industrial Waste Water Pollution Control in the Arab Republic of Egypt (Phase I) (2) Making policy recommendations on the proper treatment of industrial wastewater from 5 factories in the Nile Basin based on an accurate assessment of the state of the wastewater (3) Ministry of State for Environmental Affairs	1999.08～2000.10	DS	1-4 1-5 2-1	• Assessing the state of affairs (water use, water quality, pollution loadings, water quality monitoring, industrial effluent pollution) • Effluent treatment design for the target factories (4 steel plants and 1 chemical plant) • Focusing on one representative steel plant, presenting the findings of an inspection of pickling equipment and waste acid recovering equipment and making relevant suggestions • Introducing the concept of cleaner production (including identifying problems with the current arrangements for industrial effluent treatment and offering relevant suggestions)
10	China	(1) Detailed Design on Waste Water Treatment Project in Dexing Copper Mine, China (2) Conducting a development study on basic measures for effluent treatment at the Dexing Copper Mine, the largest copper mine in China, in line with its current scale of production and plans for an increase in production (3) China National Nonferrous Metals Industry Corporation	1993.03～1995.01	DS	1-1 1-4 1-5 2-1	• Field research (surveying sources of acid and alkaline effluent) • Detailed field research (hydrologic and water quality survey, environmental impact evaluation, effluent neutralization testing, surveying sources of acid effluent, etc.) • Designing a basic policy for effluent treatment (including proposals for iron bacteria oxidation, neutralization, foam fractionation, solvent extraction and environmental monitoring planning)
11	Viet Nam	(1) The Master Plan Study for Industrial Pollution Prevention in Viet Nam (Wastewater) (2) Designing a master plan to review the regulatory framework, promote industrial pollution control and provide government incentives as part of support for developing an industrial pollution control strategy based on research on the existing monitoring framework and regulatory standards (3) Ministry of Industry	1999.10～2000.08	DS	1-1 1-5	• Studying policies on industrial promotion, industrial pollution control, environmental conservation, and financing • Analyzing water quality and offering suggestions on remedial action at the target factories • Designing industrial pollution control policies in the industrial, environmental and financial sectors and industrial pollution control measures for 5 subsectors (textiles and sewing, chemical, pulp and paper, food processing, and metalworking) • Introducing the concept of Cleaner Production (through seminars and workshops on environmental management and productivity improvement)
12	Malaysia	(1) The Study on Cleaner Production Promotion in the Industry Sector (2) Promoting Cleaner Production through human resources development in the implementing organization and proposing a policy and action plan for such promotion (3) Standard and Industrial Research Institute of Malaysia (SIRIM Berhad)	2000.11～2002.08	DS	1-1 1-5	• Industrial pollution analysis (in electroplating, anodizing, food processing and textile industries) • Introducing the concept of Cleaner Production (through demonstration projects) • Developing a policy and action plan designed to promote Cleaner Production and reduce industrial pollution • Developing the framework for corporate pollution control (including a Cleaner Production consultant scheme and a voluntary environmental audit manager scheme) • Establishing environmental laws and ordinances (establishing an energy saving law, providing tax incentives for investments in Cleaner Production)

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13	Panama	(1) Water Quality Monitoring Techniques in Panama (2) Providing technical assistance to reorganize the implementing organization's water quality laboratory, train scientists and promote and strengthen the implementation of water quality monitoring (3) National Environmental Authority	2003.10～2006.10	PTTC	1-1 1-2 1-4	• Establishing monitoring arrangements (frequency, points, method, parameters) • Training for improving accuracy in analysis (in conducting chemical and bacterial analysis and using analytical equipment) • Developing analytical manuals • Reviewing existing laws and regulations concerned (effluent standards) • Training in how to design water quality management plans (regarding training curriculum development, environmental analysis techniques, and environmental education)
14	Thailand	(1) Planning For Sewage Works in Thailand (2) Providing sewerage engineers from JICA (3) Sanitary Engineering Division, Public Works Department, Ministry of the Interior	1994.03～1996.03	DE	1-1	Sewerage planning
15	Qatar	(1) Drainage Master Plan For Foul Works in Qatar (2) Providing sewerage works engineers (3) Engineering Affairs Administration, Ministry of Municipal Affairs and Agriculture	1995.11	DE	1-1	Sewerage master planning
16	Kenya	(1) Sewage Planning in Kenya (2) Providing sewerage works engineers (3) Ministry of Local Government	2000.03～2002.03	DE	1-1	Sewerage planning
2. Implementing and Supporting Technology Transfer for Water Pollution Control						
2.1 Technology transfer for water quality management						
17	Indonesia	(1) Environmental Management Center Project in the Republic of Indonesia (2) Technology transfer in such areas as air pollution, water pollution, hazardous substances, and training in order to ensure that the Environmental Management Center (EMC), which was set up using grant aid from Japan, serves multiple functions: providing laboratory services, implementing monitoring programs, gathering and analyzing environmental information and offering training (3) Environmental Impact Management Agency	1993.01～2000.03	PTTC	1-2 1-4 1-7	• Improving environmental management capacity • Training for improving accuracy in analysis • Encouraging EMC to achieve ISO 17025 accreditation • Providing, operating and maintaining laboratory analytical equipment (with a laboratory information management system) • Developing water pollution databases (inventorying pollution sources) • Providing monitoring equipment • Establishing monitoring techniques • Training for improving accuracy in analysis
18	Indonesia	(1) Project on Training in Industrial Pollution Prevention Technology in Indonesia (2) Technology transfer to develop human resources at the implementing organization that can promote and offer guidance on industrial pollution control technologies to private businesses (3) Agency for Industrial R&D (BPPIP), Department of Industry and Trade	1993.10～1998.10	PTTC	1-2 1-4 1-5	• Providing an array of technical assistance in pollution control (industrial pollution abatement, training of corporate management in industrial pollution control techniques) • Information exchange with other donor/implementing agencies (EMC, JETRO) • Training for improving accuracy in analysis • Questionnaire survey of factories (factory diagnosis, etc.) • Water quality monitoring
19	Thailand	(1) Project on the Industrial Water Technology Institute (IWTI) (2) Technology transfer of analytical and treatment techniques in the area of industrial pollution through practical training and factory inspection, with a view to developing human resources at the implementing organization that can promote and offer guidance on industrial pollution control technologies to private businesses (3) IWTI, Department of Industrial Works, Ministry of Industry	1998.06～2000.05	PTTC	1-2 1-4 1-5	• Provision, operation and maintenance of monitoring and analytical equipment • Questionnaire survey of factories • Information exchange with other donor/implementing agencies (NEDO, JETRO, and implementing agencies of other PTTC)
20	China	(1) The Japan-China Friendship Environmental Protection Center Project (2) Transfer of techniques necessary for the activities of the Center to would-be staff to ensure a smooth launch (3) State Environmental Protection Administration	1992.09～1995.08	PTTC	1-1 1-4 1-7	• Research, development and promotion of pollution control technologies that can adequately cope with environmental pollution in China • Developing water pollution databases (establishing a framework for the accumulation, analysis, and statistical processing of data regarding environmental information) • Establishing an environmental policy (strategic and policy research on environmental conservation) • Providing monitoring equipment

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21	China	(1) The Japan-China Friendship Environmental Protection Center Project (Phase II) (2) Researching environmental monitoring technologies, standardizing monitoring techniques, and establishing techniques for accumulation, analysis, and statistical processing of environmental data (3) State Environmental Protection Administration	1996.02～2002.03	PTTC	1-1 1-4 1-5	• Developing a national registration system for ISO 14001 • Reviewing existing laws and regulations concerned (environmental standards) • Providing monitoring equipment (Great Western Development) • Policy advice on private initiatives in Cleaner Production • Technologies to detect and assess the risk of toxic chemicals and hazardous wastes • Establishing an ISO 14000 secretariat • Training for improving accuracy in analysis
22	China	(1) Water Environment Restoration Pilot Project for Lake Taihu (2) Technology transfer that focuses on the development of technologies for high-performance domestic flush toilet and non-toilet wastewater treatment tanks and on the analysis and assessment of the properties of pollution loads discharged from decentralized domestic wastewater treatment systems (3) State Environmental Protection Administration	2001.05～2006.05	PTTC	1-6 1-7 2-3	• Developing technologies for high-performance domestic flush toilet and non-toilet wastewater treatment tanks (assessment of the properties of pollution loads discharged from decentralized domestic wastewater treatment systems; technological development for high-performance treatment plants using the denitrification and dephosphorylation processes; preparation of technical guidelines) • Considering other options including vegetation-assisted water purification at lakesides (development of purification technologies based on ecological engineering; treatment technologies using vegetation-assisted water purification or biological filtration; preparation of technical guidelines) • Promoting these technologies (proposing arrangements for promoting high-performance treatment systems; environmental education)
23	Egypt	(1) Environmental Monitoring Training Project (2) Technology transfer of environmental monitoring techniques, including sampling, analysis and evaluation, to the Cairo Central Center (CCC) in particular and Regional Branch Offices (RBO) as well (3) Egyptian Environmental Affairs Agency	1997.09～2004.10	PTTC	1-4	• Training for improving accuracy in analysis (laboratory management, accuracy management) • Developing water pollution databases (software programming, networking, operation and maintenance) • Providing monitoring equipment • Establishing monitoring techniques • Training for improving accuracy in analysis
24	Thailand	(1) The Technical Training Center for Sewage Works (TCSW) Project in Thailand (2) Providing technical cooperation mainly in developing training programs, curricula and teaching materials and in training instructors in order to train sewerage engineers and managers who can play key roles in sewerage development projects (3) Public Works Department, Ministry of the Interior; Bangkok Metropolitan Administration	1995.08～2000.07	PTTC	1-4	• Providing training at TCSW (including the development of training programs and curricula) • Planning data system development
25	Malaysia	(1) Project on Risk Management in Relation to Hazardous Chemical Substances (2) Technology transfer with the aim of applying technologies for the evaluation and analysis of hazardous chemicals and effluent treatment, including the removal of color and nitrogen compounds (3) Standard and Industrial Research Institute of Malaysia (SIRIM Berhad)	1998.04～2001.03	PTTC	1-1 1-4 1-5	• Training for improving accuracy in analysis (sampling and risk assessment in relation to mutagenicity testing) • Technology transfer in effluent treatment (removal of color and nitrogen compounds) • Establishing environmental laws and ordinances (occupational safety and health act, industrial chemicals act) • Developing analytical manuals (preparing testing manuals based on OECD guidelines)
26	Argentina	(1) Mine Pollution Control Research Center (2) Technical cooperation aimed at training water quality control technicians in parallel with mining resources development (3) Mining Agency; Government of the Province of San Juan	1998.05～2002.04	PTTC	1-4 1-5	• Training water quality control technicians • Providing treatment services for effluent from mining mills •Training for improving accuracy in analysis (preparing an introductory manual for ore analysis) • Pollution source control techniques (testing compliance of gold ore dressing and refining practices with environmental standards)
27	Thailand	(1) Project on the Industrial Water Technology Institute (IWTI) (Phase II) (2) Technology transfer of technologies related to industrial wastewater to IWTI, an institute designed to provide technical guidance on rational water use, wastewater treatment and reuse, and industrial water supply (3) IWTI, Department of Industrial Works, Ministry of Industry	2000.06～2004.03	PTTC	1-1 1-4 1-5	• Industrial water treatment (with a combination of the soda lime process and the membrane ion-exchange process) • Training concerning industrial water treatment (training of factory engineers, pollution control managers, etc.) • Providing consulting services (factory inspection and testing, conceptual design, planning of remedial options, preparation of manuals and guidebooks)

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28	Chile	(1) Mine Safety and Environment Training Center Project (2) Technology transfer of techniques for mine safety, pollution control and related chemical analysis required of the Center (3) National Geological and Mining Service (SERNAGEOMIN), Ministry of Mining	1994.07～1999.06	PTTC	1-2 1-4 1-5	• Technical guidance on mining safety/pollution • Technical guidance on mine control (treatment processes and waste management) • Training for improving accuracy in analysis (technical guidance of chemical analysis) • Achieving ISO 14000 certification
29	Mexico	(1) Master Plan Study for Water Quality and Environmental Monitoring in Coastal Areas in Mexico (2) Designing a program for monitoring coastal water quality and offering recommendations on technical capacity development for the National Water Commission (CNA) (3) CNA	1999.01～2003.03	DS (M/P)	1-2 1-4 2-4	• Planning water quality monitoring • Training for improving accuracy in water quality analysis • Coastal monitoring
30	Thailand	(2) Development of treatment technologies for shrimp aquaculture wastewater; measurement of heavy metal accumulated in freshwater fish; and technology transfer concerning ion chromatograph applications (3) Environmental Research and Training Center	1993.01～1995.01	DE	1-4 1-7 2-1	• Improving the ability to elucidate the mechanism of pollution (R&D on treatment technologies for shrimp aquaculture wastewater) • Water quality monitoring (analysis of river sediments; measurement of heavy metal concentrations in water) • Training for improving accuracy in analysis (techniques to measure heavy metal accumulation in freshwater fish; ion chromatograph applications)
31	Egypt	(2) Providing guidance on water quality analysis for criteria subject to the national standards of Egypt and analyzing the water quality of the Nile (3) Egyptian environmental monitoring training center	1998.02～2000.02	DE	1-4 2-1	• Training for improving accuracy in analysis (analysis of factory wastewater) • Water quality monitoring (of the Nile)
32	Developing countries	(1) Lake Water Quality Management (2) Training in the appropriate management of lake water quality in the environment as a whole for researchers as well as technical government officials in charge of lake water quality management in developing countries and regions, including devising conservation measures and designing management plans (3) Technical government officials in charge of water quality conservation	2005.01～2005.03	GT	1-4 2-3	• Reviewing the existing laws and regulations concerned (through training on Japan's statutory regulations and development for lake water quality management based on Japanese experience with Lake Biwa) • Training for improving accuracy in analysis (measurement and control techniques for criteria subject to environmental standards in such categories as the living environment, human health and eutrophication) • Qualitative restrictions on organic pollutants (calculation of pollution loads and water quality prediction techniques for planning lake water quality management) • Acquiring environmental management capabilities for lake water pollution control
33	Developing countries	(1) Industrial Wastewater Treatment Techniques II (2) Technology transfer to technicians and government officials in charge of industrial effluent management in different industries, in relation to measures and techniques for water pollution control and environmental quality improvement based on Japanese experience in Kitakyushu (3) Effluent treatment technicians at government offices and manufacturers	2004.07～2004.11	GT	1-2 1-4 1-5	• Training on environmental laws and regulations for government officials (including basics of water pollution control, the global environment and environmental impact assessment, etc.) • Effluent treatment processes, overview of effluent treatment, new effluent treatment technologies, etc. • Effluent treatment planning (basic plans for effluent treatment facilities, selection of treatment facilities, model testing, etc.) • Operation and maintenance of effluent treatment facilities (effluent analysis, operation management, and the theory and field practice of facilities maintenance)
34	Developing countries	(1) Domestic Waste Water Treatment Techniques (2) Technology transfer regarding knowledge and techniques for domestic wastewater treatment accumulated in the Kitakyushu area in Japan and government practices in water pollution control, water quality analysis and domestic wastewater treatment (3) Senior engineering managers in charge of domestic wastewater treatment	2004.08～2004.11	GT	1-2 1-4 1-5	• Strengthening the policymaking capacity for pollution control • Transfer of pollution control technologies (including technologies for wastewater treatment, night soil treatment, water supply, and domestic flush toilet and non-toilet wastewater treatment tanks, as well as lectures on the outlines of water quality management) • Training for improving accuracy in analysis (with biological water quality assessment, toxic substance analysis and bacterial contamination monitoring) • Technology transfer of effluent treatment techniques (including reuse of sludge and wastewater, advanced effluent treatment, membrane water treatment, domestic flush toilet and non-toilet wastewater treatment tanks, and the conservation of water quality at the bottom of the lake)
35	Developing countries	(1) Water Environmental Monitoring (2) Technology transfer of Japan's experience and techniques concerning water pollution control, with the aim of securing and training technical staff for water quality monitoring in developing countries (3) Staff in charge of water quality monitoring at research institutions at the central and local government levels	2004.09～2004.11	GT	1-2 1-4 1-7	• Improving the ability to elucidate the mechanisms of pollution (through lectures on the history of water pollution in Japan, the behavior and fate of pollutants, etc.) • Training in how to design systems for water quality management (regulations and administrative guidance, the value of monitoring, etc.) • Improving the capacity for analyzing water quality data with advanced techniques (including monitoring system development, total organic carbon analysis, analysis of heavy metals using an atomic absorption spectrometer, and analysis of agricultural chemicals using gas chromatography and liquid chromatography)

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2.2	**Technology transfer for improving the levels of sewerage engineering**					
36	Thailand	(2) Technology transfer for, among others, establishing design standards for sewage works, to Thailand where guidelines, standards and manuals for sewerage development are inadequate (3) Public Works Department, Ministry of the Interior	1991.05～1994.03	DE	1-2 2-1	• Preparing technical manuals and thus standardizing operations (preparing a sewerage design manual, providing technical advice on sewerage engineering) • Options in line with the stage of economic development (offering an optimal system for the sewerage development program in the lower Chao Phraya basin, advice on design specifications and making recommendations on options for improving existing sewage plants in Phuket, Phatthaya and Hua Hin)
37	Developing countries	(1) Training of Sewerage Maintenance and Management Engineers (2) Technology transfer regarding sewerage engineering, with the aim of providing knowledge and skills regarding the operation and maintenance of sewers and sewage plants, the effective use of resources (treated water and sludge) and industrial effluent regulations (3) Central and local government officials	2004.08～2004.10	GT	1-2 1-3	• Raising the environmental awareness of high-ranking government officials (with the focus on the basic concepts of sewerage systems, the operation and maintenance of sewers and sewage plants, knowledge required for factory effluent treatment, effective use of treated wastewater and sewage sludge, and the financing of sewerage systems)
3.	**Developing Facilities and Equipment for Water Pollution Control**					
38	Brazil	(1) Feasibility Study on Water Pollution Control in Guanabara Bay (2) A feasibility study on water pollution control options for cleaning up the bay after the completion of the first phase construction of the sewerage construction project based on the master plan for water pollution control (3) Secretariat for sanitation and water resources, State of Rio de Janeiro Government	2002.03～2003.09	DS (F/S)	1-4 1-7 2-4	• Identifying major causes of pollution (qualitative assessment of pollution loads from the basin, those from point and non-point sources, and those flowing into the bay) • Developing water quality prediction models (hydraulic models, advection-diffusion models, biochemical reaction models, and eutrophication models) • Developing water pollution databases
39	Viet Nam	(1) Implementation Plan for Urban Drainage and Sewerage Systems in Ho Chi Minh City (2) A detailed design study for the Ho Chi Minh City Water Environment Improvement Project (3) People's Committee of Ho Chi Minh City	2000.03～2001.06	Partner-ship D/D	1-2 2-1	• Considering options for physical infrastructure development: watercourse rehabilitation, retarding basin development, pump drainage, sewage plants using the activated sludge process, etc. • Considering options for non-physical infrastructure development: identifying potentially flooded areas, effective use of retarding basins, flood control regulations, the establishment of a sewerage and drainage authority, etc.
40	Bangladesh	(1) Feasibility Study for the Development of Sewerage Systems in North Dhaka (2) A feasibility study for the priority project identified in the master plan on phased sewerage development in North Dhaka (3) Dhaka Water Supply and Sewerage Authority	1997.03～1998.08	DS (F/S)	1-3 2-1	• Options in line with the stage of economic development (selection of on-site treatment options from: on-site treatment [septic tanks or domestic flush toilet and non-toilet wastewater treatment tanks] and off-site treatment) • Improving the charging system (introducing a water charge system, reducing the amount of water that cannot be accounted for, etc.)
41	Guatemala	(1) Feasibility Study for Sewerage Development in the Guatemala Metropolitan Area (2) A feasibility study for the priority project identified in the master plan in the sewerage and sanitation sector for public health improvement and environmental conservation (3) Guatemala Municipal Water Supply Public Corporation (EMPAGUA)	1995.03～1996.09	DS (F/S)	1-1 1-3 2-1	• Setting the maximum allowable pollution loads (in terms of BOD) • Reusing treated wastewater and sewage sludge • Reviewing the existing laws and regulations concerned (setting appropriate discharge standards) • Improving the charging system (charging sewerage rates based on the user-pays principle) • Securing external financial sources such as tourism taxes (setting up a sewerage development fund)
42	Albania	(1) The Feasibility Study for Sewerage Development in Greater Tirana (2) A feasibility study for the sewerage development plan in Greater Tirana to be completed in FY2010 (3) Ministry of Public Works and Tourism	1996.07～1998.03	DS (F/S)	1-3 2-1	• Studying the major causes of pollution (assessment of: existing pollution control facilities, the amounts and quality of wastewater, the state of on-site treatment, the operation and maintenance of sewerage systems, and community awareness) • Striking an appropriate balance between revenues and expenses (management of the sewerage operating organization)
43	Sri Lanka	(1) Feasibility Study on the Greater Kandy and Nuwara Eliya Water Supply and Sewerage Development Project (2) A feasibility study for the priority project identified in the master plan on the water supply system designed to improve potable water quality and the sewerage and sanitation system (3) Ministry of Housing, Construction and Public Utilities	1998.02～1999.01	DS (F/S)	1-3 2-1	• Introducing simple on-site wastewater treatment facilities (septic tanks) • Improving the charging system

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44	India	(1) Study on a Water Quality Management Plan for the Ganga River (2) A feasibility study for the priority project identified in the master plan that assessed river water pollution in and around 4 cities and proposed measures for water quality improvement (3) National River Conservation Directorate, Ministry of Environment and Forests	2003.03～2005.01	DS (F/S)	1-1 1-2	• Reviewing the existing laws and regulations concerned (environmental standards) • Studying the major causes of pollution (analysis of river water pollution; assessment of pollution loads per unit and basin pollution loads, and maximum allowable pollution loads)
45	Malawi	(1) Lilongwe Sewerage Project (2) Construction of sewerage facilities and the provision of equipment for water examinations and other purposes for Malawi, where sewerage is inadequate (3) Ministry of Local Government and Rural Development; Lilongwe City	1993.08～1993.09	GA	1-4 2-1	• Designing sewerage facilities (sewage plants, sewer mains and feeder sewers) • Providing monitoring equipment (water examination equipment, sewer cleaning equipment, trucks and boats for sewage plant management)
46	Indonesia	(1) Project for the Construction of the Yogyakarta Sewerage Treatment Plant (2) Detailed design for the provision of sewage plants and the construction of sewer mains (3) Directorate General of Human Settlements, Ministry of Public Works (Cipta Karya)	1992.07～1992.09	GA	2-1 2-2	• Identifying major factors in pollution (groundwater pollution of wastewater discharges) • Designing facilities (sewage plants, sewer mains and outfall sewers) • Providing equipment (submersible pumps, sewage sludge dischargers, analytical instrument, tools, dump trucks and minivans)
47	Bangladesh	(1) Sewer Network Development Project (2) Detailed design (rehabilitation of the existing sewer network and construction of new sewerage plants) (3) Dhaka Water Supply and Sewerage Authority	1987.09～1987.10	GA	2-1	• Detailed design (rehabilitation of the existing sewer network and construction of new sewer plants)
48	Jordan	(1) Project for Water Pollution Monitoring Systems (2) Providing water pollution monitoring facilities and equipment as a preliminary step since fundamental and more effective water pollution control is difficult for now (3) Higher Council for Science and Technology (HCST)	1999.11～1999.12	GA	1-4	• Providing monitoring equipment (monitoring stations, telemetry system equipment, and equipment for regular chemical analysis at fixed-point monitoring)
49	Indonesia	(1) Project for Constructing the Environmental Management Center (EMC) (2) Designing construction of the EMC and providing relevant equipment with the aim of establishing monitoring techniques and human resources development in environmental administration (3) Environmental Impact Management Agency	1991.06～1991.07	GA	1-4	• Providing monitoring equipment (monitoring facilities, gas chromatographs, UV/FL high performance liquid chromatographs, ion chromatographs, etc.)
50	Syria	(1) Project for the Development of a Hydrological and Meteorological Observation Network (2) A project to provide equipment for managing water resources information to the Water Resources Information Center (WRIC) (3) WRIC, Ministry of Irrigation	2003.02～2003.07	GA	1-4 2-1 2-2	• Providing monitoring equipment (an automated precipitation observation system; an automated evaporation observation system; surface water observation equipment including current meters and an automated water-level gauging system; groundwater observation equipment including an automated groundwater observation system and an automatic water quality observation system; other related equipment, including water samplers, well examination instruments and computers for data collection) • Monitoring the groundwater quality
51	Kenya	(1) Nakuru Sewage Works Rehabilitation and Expansion Project (2) Rehabilitation and expansion of the two existing sewage plants in Nakuru Municipality (3) Ministry of Water Development	1994.03～1994.05	GA	1-3 1-4 2-3	• Considering technical and financial options for rehabilitating the existing sewerage facilities • Expanding the sewerage facilities and introducing appropriate technologies (including the lagoon process) • Constructing a water quality testing laboratory (to analyze the quality of the water flowing into Lake Nakuru)
52	Philippines	(1) Project for the Improvement of Water Quality in Local Areas (2) Provision of a system for removing the iron and manganese content in deep-well water and the related facilities and equipment (3) Local Water Utilities Administration (LWUA)	1999.08～1999.12	GA	1-4 2-2	• Studying treatment options according to water uses (the application of a system for removing the iron and manganese content of deep-well water) • Providing monitoring equipment (pH meters, turbidimeters, storehouses, personal computers for data management, etc.) • Providing, operating and maintaining laboratory analytical equipment

No.	Recipient country	(1) Project Title / (2) Overview / (3) Implementing Organizations or Counterparts	Duration	Scheme	Medium-term Objective	Means and Methods Used in the Project for Achieving the Sub-targets
4. Promoting greater involvement in water pollution control at the grassroots level						
4.1 Dispatch of volunteers in the field of environmental education						
53	Egypt	(1) Volunteers in the field of environmental management (2) Providing guidance on analytical and measurement techniques to Regional Branch Offices (RBO) (3) Suez regional branch office, Egyptian Environmental Affairs Agency	1999.12～2003.03	Dispatch of Volunteers	1-2 1-4	• Training for improving accuracy in analysis (guidance on analytical and measurement techniques for factory effluent) • Raising the environmental awareness of government officials (introducing the state of environmental administration in Japan)
54	Tanzania	(1) Volunteers in the field of hygiene education (2) Providing hygiene and environmental education in the largest town in southern Tanzania (3) Mtwara Mkindanti Town Council	2003.04～2005.04	Dispatch of Volunteers	1-6	• Providing environmental education (offering guidance on how to dispose of household wastes, organizing seminars to improve the hygiene environment, providing education for local people on the sanitary use of toilets)
55	Paraguay	(1) Volunteers in the field of environmental education (2) Providing environmental education in schools that the children of indigenous peoples, as well as other children, attend (3) Cerrito, Presidente Hayes Department	2003.04～2005.04	Dispatch of Volunteers	1-6	• Providing environmental education (solid waste management, household wastewater, hygiene improvements, etc.) • Approaching community associations (organizing seminars for housewives, etc.)
4.2 Dispatch of volunteers in the field of water examination						
56	Bulgaria	(1) Volunteers in the field of water examination (2) Offering advice on environmental conservation and collecting information on forests and air, water and land pollution (3) Regional Inspectorate of Environment and Water - Veliko Turnovo, Ministry of Environment and Water	1996.12～1998.12	Dispatch of Volunteers	1-4 1-6	• Gathering and publicizing information on technical options (gathering information on forests and air, water and land pollution and offering advice on environmental conservation) • Training for improving accuracy in analysis (collection and chemical analysis of samples from rivers, groundwater, lakes and factory effluent)
57	Guatemala	(1) Volunteers in the field of water examination (2) Water examination for sources of rural water supply and groundwater (3) Water quality management department, National Municipal Development Institute (INFOM)	1999.12～2001.12	Dispatch of Volunteers	1-4	• Training for improving accuracy in analysis (technical guidance on water examination techniques, including atomic absorption spectrometry, gas chromatography and parasitic analysis) • Developing analytical manuals (including guidebooks on analytical techniques)
4.3 Activities through the JICA Partnership Program						
58	Indonesia	(1) Aqua-Environment Improvement Project for a Demonstration River Basin in Semarang (2) Providing technical guidance on technologies to treat wastewater discharged by bean curd manufacturers into the Bajak River in the city and offering technical support for reviewing their production process (3) Indonesian Association for Environmental and Ecological Development (yayasan BINTARI); Semarang City	2001.06～2004.03	JICA Partnership Program	1-5 1-6 2-1	• Providing technical support for controlling pollution caused by wastewater • Organizing seminars designed to raise environmental awareness among local people • Implementing options that accommodate the pollution properties of rivers
59	Philippines	(1) Project for environmental conservation planning and promoting priority measures in local governments in the Philippines (2) Providing technical support to four municipalities on the establishment of environmental ordinances, techniques for water quality monitoring, separation of solid wastes, and environmental education in schools (3) Four municipalities in Cavite Province	2002.02～2005.02	JICA Partnership Program	1-1 1-2 1-4 1-5 1-6 2-1	• Establishing environmental ordinances • Establishing penalties • Developing partnerships with neighboring municipalities for water quality management • Providing guidance to businesses on how to operate wastewater treatment facilities • Promoting environmental education in primary schools • Encouraging the municipalities to implement water quality monitoring • Considering options that accommodate the pollution properties of rivers

* The figures in the "Medium-term Objective" column correspond to those for the medium-term objectives in the Development Objectives Chart.
* The abbreviations in the "Scheme" column stand for the following:

DS: Development Study
DS (M/P): Master Plan Study as part of a Development Study
DS (F/S): Feasibility Study as part of a Development Study
PTTC: Project-type Technical Cooperation
DE: Dispatch of Experts
Partnership D/D: JICA-JBIC partnership, conducted detailed design
GT: Group Training
GA: Grant Aidi

Appendix 2 Major Donor's Activities in Water Pollution Control

Not a few donors provide development assistance in water pollution control in developing countries. Among the major multilateral donors are: the multilateral development banks such as the World Bank, the Asian Development Bank (ADB), and the Inter-American Development Bank (IDB); and UN agencies such as the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). Major bilateral donors of the OECD countries with experience in this sector include: the United States Agency for International Development (USAID), the German Agency for Technical Co-operation (GTZ), the Ministry of Foreign Affairs of the Netherlands (MFA), the Swedish International Development Cooperation Agency (Sida), and the UK Department for International Development (DFID).

This appendix includes the basic policies, features and experience of these donors in addressing water problems including water pollution, drawing on *Study on Development Assistance in the Water Sector*[1], and *Fact-finding Survey on Policies and Assistance of Bilateral and Multilateral Donors in Water (Mizu ni Kanren Suru Kokusaikikan oyobi Kaku Dona no Seisaku oyobi Enjo no Jittai ni Kansuru Chosa*[2]*).*

World Bank

World Bank
- Water Resources Management Policy Paper
- Operational Policy on Projects on International Waterways
- Water Resources Management Operational Policy

2-1 World Bank

2-1-1 Basic Policy on the Water Sector

The World Bank's basic policy in the water sector is based on: the Water Resources Management Policy Paper[3]; the Operational Policy on Projects on International Waterways (OP7.50)[4]; and the Water Resources Management Operational Policy (OP4.07)[5].

The Water Resources Management Policy Paper, which was prepared in 1993 following the 1992 U.N. Conference on Environment and Development in Rio de Janeiro, reviewed problems for development assistance in the water sector and states that the Bank will implement sectoral evaluations at the national level. The paper touches on water pollution when it says that public investments and regulations have often neglected water quality, health, and environmental concerns.

The Bank's overarching objective in the water sector is to reduce poverty by supporting the efforts of countries to promote equitable, efficient, and

[1] JICA Institute for International Cooperation (2002) pp. 107-109
[2] International Development Center of Japan (2002)
[3] World Bank (1993)
[4] World Bank (http://wbln0018.worldbank.org/institutional/manuals/opmanual.nsf/)
[5] *Ibid.*

sustainable development. The 1993 paper states that the Bank will give priority to countries where water is scarce or where the problems of water allocation, service efficiency, or water quality degradation are serious. The Bank has identified water-conserving technologies and environmental protection as the policy categories for water pollution. In the category of water-conserving technologies, the Bank stresses the importance of water conservation, wastewater reuse, and overall approaches to reduce pollution, as water scarcity and waste disposal problems are becoming more acute. In the category of environmental protection, the paper states that as preservation of the environment and the resource base are essential for sustainable development, the conservation and restoration of water quality and the abatement of water pollution will be a focus of the Bank's water policy. In fact, the Bank is already supporting government efforts to improve and expand sanitation and the collection and treatment of wastewater. Likewise, the Bank is promoting the effective use of water through efficiency pricing and the introduction of the polluter-pays principle to encourage water conservation and reduce pollution. For industrial wastewater, the Bank is supporting projects designed to introduce guidelines for reducing wastewater and stimulating reuse.

The Operational Policy on Projects on International Waterways (OP7.50) is applied to water uses, as well as projects that involve potential pollution, of any river, canal, lake, bay or similar body of water that spans 2 or more countries. The policy is designed to ensure that development projects will not adversely impact the water quantity and quality in countries where such water bodies exist.

The Water Resources Management Operational Policy (OP4.07) contains key principles articulated in the policy paper on water resources management of 2000 and serves as a new operational strategy.

This policy has identified the following as the priority areas for the Bank's involvement in water resources development in relation to water pollution: restoration and preservation of aquatic ecosystems that give priority to the provision of adequate water and sanitation services for the poor; guarding against the overexploitation of groundwater resources; avoidance of water leakage and salinity problems associated with irrigation projects (by monitoring water tables and implementing drainage networks, adopting best management practices to control water pollution).

2-1-2 Overview of Selected Activities[6]

(1) Water Sector Reform Assistance Project in Colombia

This project has 2 major objectives. One is to improve efficiency in managing and operating water utilities, achieve sustainable development, and promote private sector participation in the management and operation of water utilities for financial improvement. The means to achieve this objective, in relation to water pollution control, include strengthening the sector

[6] World Bank Project Database (http://lnweb18.worldbank.org/ESSD/ardeyt.nsf/18ByDocName/Projects) (accessed in June 2005)

environmental management capacity through advisory services for water quality and effluent regulations and defining environmental goals and methodologies. The other major objective is to provide financial support to the construction of water supply and sanitation infrastructure in small and medium-sized cities within Colombia's Caribbean region.

(2) Coastal Cities Pollution Control Project in Croatia

This project is designed to improve the quality of Croatia's Adriatic coastal waters to meet European Union (EU) ambient quality standards and develop water supply and sanitation infrastructure in the participating municipalities in a financially and operationally sustainable manner. The project has 3 main components. The first component is the construction and expansion of sewerage networks, main collectors, pumping stations, wastewater treatment plants, and submarine outfalls. The second is strengthening the capacity of the Special Purpose Subsidiary Company (SPSC) involved by financing equipment, technical assistance and training. The third component is strengthening of the coastal waters monitoring network.

(3) Partnership

The World Bank is in partnership with governments, the private sector and NGOs to address water issues. Among such initiatives concerning water pollution is the Water and Sanitation Program (WSP)[7].

WSP is an international partnership designed to improve water supply and sanitation services for the poor. Its basic policy is to help poor people gain sustained access to safe drinking water and sanitation. The overall objective of WSP is to support institutional and policy reforms and investments in the relevant infrastructure for the benefit of the poor — the ultimate beneficiaries of such investments. To achieve this objective, WSP has three programs: (i) providing advice to help countries adopt improved policies and strategies and undertake institutional reform; (ii) offering water supply and sanitation solutions; and (iii) supporting strategic investments. WSP's strategic focus in the context of water pollution control is "Sanitation and Hygiene". In this sector, WSP is undertaking the Participatory Hygiene and Sanitation Transformation (PHAST) Initiative to address water issues among others in Botswana, Kenya, Uganda and Zimbabwe, in cooperation with WHO and UNICEF.

Asian Development Bank

2-2 Asian Development Bank (ADB)

2-2-1 Basic Policy on the Water Sector

In relation to ADB's basic policy on the water sector, ADB President Tadao Chino states in *Water in the 21st Century*:

[7] WSP website (http://www.wsp.org/)

> All efforts at reducing poverty would count for nothing if the basic needs of people for reliable drinking water and sanitation are not met. The vital importance of water must be recognized–equitable provision of water for human needs, protection of water quality, and conservation of a healthy natural environment are development prerequisites of the highest priority.

ADB
- Comprehensive water policy
- Support for subsidies
- Support for institutional reform
- Awareness building and education

ADB's Water Policy[8], approved by the ADB's Board of Directors in 2001, is a comprehensive water policy that recognizes the Asia and Pacific region's need to formulate and implement integrated, cross-sectoral approaches to water management and development.

This policy has 2 main objectives:

- To recognize water as a socially vital economic good in the context of seeking equitable economic growth and poverty reduction
- To advocate a participatory approach to water conservation and protection

In relation to water pollution control, ADB has the following strategic focuses:

1) Support for subsidies

ADB supports subsidies for public water services in the circumstances:

- Where treated water uses have beneficial external effects in preventing health problems
- Where the transaction costs of measuring usage are very high
- Where water quantity of treated water for the poor as a basic human need (BHN) is very limited

2) Support for institutional reform

For the benefit of both the consumers and the managers of water resources, the system of pricing, incentives, and penalties needs to be regulated. Regulatory systems need to be established to ensure that laws, standards, rules, and regulations are equitably and consistently applied. In most developing countries, such systems are absent, and the government plays the role of both provider and regulator. ADB promotes the establishment of regulatory systems through its policy dialogues with developing countries, and through its loan and technical assistance programs to establish regulatory frameworks for the maintenance and enhancement of water quality.

3) Awareness building and education

ADB supports wide-ranging public awareness and community education programs for women, youth, and farmer groups to convey the message that water is a resource that needs prudent management. In particular, environmental education helps communities understand the linkages between water, sanitation, health, and productivity.

[8] ADB Website (http://www.adb.org/Documents/Reports/Water/adb_evolving.asp) (accessed in June 2005)

2-2-2 Overview of Selected Activities[9]

(1) Pasig River Environmental Management and Rehabilitation Sector Development Program in the Philippines

The Pasig River, which runs through Metro Manila, is seriously polluted by industrial and domestic wastewater from the basin. In addition, many squatters live along the river, and they dispose of wastes and night soil into the river. To rectify the situation, ADB already extended loans for institutional capacity development to enhance the water quality of the Pasig River and for infrastructure development to reduce water pollution.

This program comprises a number of components, including: establishing 10-meter wide environmental preservation areas along the riverbanks; introducing a septic tank maintenance service and providing a septage treatment facility; eliminating the illegal dumping of municipal solid waste into the river system.

(2) Shandong Hai River Basin Pollution Control Project in China

Shandong Province is located in the northeastern part of China. The province is endowed with extensive water resources, including rivers and lakes. Yet rapid economic growth, industrialization and urbanization in recent years translate into a significant deterioration in water quality. Although the Chinese government recognizes that adequate environmental protection and pollution control are vital for sustainable development, the capacities of current wastewater treatment and solid waste management facilities in many cities in the province are inadequate to improve water quality and the urban living environment. Against this background, ADB has extended loans to improve these capacities.

This project includes: (i) construction of wastewater treatment facilities with a capacity of 800,000 m^3/day; (ii) installation of water recycling systems with a capacity by 60,000 m^3/day; (iii) development of appropriate solid waste management systems with a treatment capacity of 1,300 tons/day; (iv) integrated environment planning, (v) integrated water and wastewater management, (vi) sanitation and solid waste management; (vii) tariff reform and regulatory formulation, (viii) financing mechanism reform, (ix) management enterprise reform, (x) institutional strengthening, (xi) urban poor and social programs, and (xii) clean production technologies for industries [physical infrastructure development:(i)-(iii); policy support: (iv)-(xii)].

(3) Sanitation, Public Health, and Environment Improvement in Kiribati

This project is designed to: (i) implement institutional reforms in the management of public utilities and environmental resources; (ii) improve the quality and availability of safe drinking water; (iii) promote hygiene and sanitation through rehabilitation and expansion of sewerage and sanitation systems for better solid waste management.

[9] ADB website (http://www.adb.org/Documents/Profiles/)

2-3 Inter-American Development Bank (IDB)

Inter-American Development Bank

IDB:
Supports projects for rural and urban potable water supply and sewage treatment under the operational policy on Basic Environmental Sanitation

2-3-1 Basic Policy on the Water Sector

IDB's water policy is defined in three of the Bank's Sectoral Operational Policies[10] two under the category of Multisectoral Policies, namely, OP 703: Environment and OP 708: Public Utilities; and one under the category of Social Infrastructure Sectors, namely, OP 745: Basic Environmental Sanitation.

The policy for the water supply and sanitation sector, which has a direct bearing on water pollution, is based on OP 745: Basic Environmental Sanitation. In this Basic Environment Sanitation sector (OP 745), IDB supports the member countries in planning water supply and sanitation projects, strengthening their technical, financial, administrative and operating capacities, and encouraging health education and community promotion activities. In the context of water supply and sanitation, IDB supports projects in the fields of rural and urban potable water supply and sewage treatment (including the recycling of treated wastewater for irrigation purposes). The OP 745 policy states that water supply and sewerage projects must satisfy appropriate selection criteria that take account of a number of factors, including: (i) their relationship with the national development plans; (ii) the larger population centers without service; (iii) the availability of water sources of adequate volume and quality; and (iv) sanitation problems that require urgent attention.

With regard to water supply charging, the operational policy on Public Utilities (OP 708) mentioned earlier applies.

2-3-2 Overview of Selected Activities

IDB has invested almost 1 billion US dollars per year in water-related projects since 1961. The total amount of financing for water-related projects between 1961 and 1995 amounts to 32.3 billion US dollars, 25 % of which are through IDB loans. Investments in water supply and sanitation projects total 11.9 billion US dollars for the 35-year period, making them the second biggest investment category following investments in hydroelectric projects.

(1) Residual Water Treatment Bogota River Project

This project is designed to construct wastewater treatment plants at the mouths of the Salitre, Fucha and Tunjelo rivers at the points where they flow into the Bogota River. The project is 2-phased: the construction of plants for primary treatment (removing sedimentation) in Phase I and the construction of secondary treatment (biological treatment) in Phase II. The District of Bogota has awarded a 30-year concession to a private consortium composed of Lyonnaise des Eaux and Degremont S.A. to build, own and operate the plants.

[10] Refer to IDB "Policies" website.

(2) Decontamination of the Tiete River Project

The Tiete River in Sao Paulo, Brazil was seriously polluted by discharges of untreated industrial and domestic wastewater, giving off foul odors all year round. The water was so oxygen deficient that no fish could survive. To improve the river water quality, the Sao Paulo state government asked IDB for support. In response, IDB financed this sewage treatment project made up of two phases. In Phase I, IDB extended 400 million US dollars in loans for the construction of two sewage plants and the refurbishment of 3 existing plants. After the completion of Phase I, more than 250,000 people gained access to sewage treatment services, achieving a sewerage system with coverage of more than 60 %. In addition, the treated proportion of wastewater reached 50 %. In Phase II, IDB offered a loan of 200 million US dollars. As a result, the coverage of the sewerage system rose to 80 %.

(3) Promotion of Clean Production Processes Project (El Salvador)

This project is designed to promote the adoption of Cleaner Production (CP) processes among small and medium-sized enterprises (SMEs) in El Salvador. It consists of three components:

- Provision and promotion of CP technologies through training and skills development among local professionals
- Implementation and demonstration of CP systems, with on-site factory diagnosis and technical training aimed at pilot businesses
- Promotion, dissemination, and information dissemination of CP

2-4 United Nations Development Programme (UNDP)

United Nations Development Programme

UNDP
- The need for adequate supplies and management of fresh and salt water resources
- Integrated water management
- Capacity building

2-4-1 Basic Policy on the Water Sector

UNDP's water policy is based on a 1998 document entitled "Capacity Building for the Sustainable Management of Water Resources and the Aquatic Environment[11]".

In this document, UNDP recognizes that socioeconomic development simply cannot take place without adequate water supplies and the management of fresh and salt water resources. Based on this recognition, UNDP sets out 5 goals: (i) ensuring that the poorest 1 billion people in the developing world have access to adequate water and sanitation services; (ii) ensuring food security; (iii) abating the degradation of our finite freshwater and marine water resources; (iv) ensuring sustainable use and management to protect freshwater, marine and coastal systems for succeeding generations; and (v) implementing conservation processes and policies.

UNDP's water programs are in the process of transformation and reformation. The 1998 document states that UNDP's proposed new water strategy: (i) links the entire continuum of freshwater, coastal and marine environments; (ii) focuses on capacity building for the management of water

[11] UNDP website (http://www.undp.org/seed/water/strategy/foreword.htm) (accessed in June 2005)

resources and the water environment; (iii) builds on UNDP's proven strengths and capabilities from its experience; (iv) is linked to UNDP's 4 areas of focus — poverty, livelihoods, environmental protection and women; (v) embodies the international consensus on freshwater and oceans as represented by various conventions and agreements; and (vi) targets actions to address principal challenges associated with water scarcity and pollution — food security, human health, the decline of the water environment, and social, economic and political stability.

2-4-2 Overview of Selected Activities

UNDP has supported programs and projects in the water sector over the past 3 decades. It has also played facilitating roles in international initiatives. For example, UNDP chaired the steering committee of the UN Decade of Water and Sanitation between 1980 and 1990. It also serves as an implementing agency of the Global Environment Facility (GEF). UNDP has covered a wide range of subsectors, ranging from freshwater to coastal and ocean systems.

(1) Global Environmental Facility (GEF)[12]

GEF is an institution established in 1991 to manage funds for supporting projects and programs aimed at protecting the environment in developing countries. UNDP is one of the 3 Implementing Agencies of the GEF — the other 2 being the World Bank and the United Nations Environment Programme (UNEP). Through the GEF, UNDP supports the development and management of capacity building programs and technical assistance projects, which are 2 of the focal areas of UNDP.

The GEF's focal areas includes: (i) conservation of international waters; (ii) mitigation of global warming; (iii) protection of the ozone layer; and (iv) the maintenance of biodiversity. The priority areas for the first focal areas, which are closely related to water pollution, include:

- Degradation of transboundary water quality due to pollution from land-based activities
- Degradation of habitats in coastal areas, lakes and wetlands due to inappropriate management
- Introduction of non-indigenous species that affect aquatic ecosystems and human health
- Inadequate management (overfishing, etc.) and excessive exploitation of water resources

[12] UNDP website (http://www.undp.org/gef/index.html)

(2) Strategic Initiative for Ocean and Coastal Management (SIOCAM)[13]

SIOCAM is a global initiative that is designed to take advantage of the knowledge and skills of UNDP headquarters, UN Agencies, donors and other organizations to enhance the effectiveness of ocean and coastal management projects in promoting sustainable human development, particularly of the poor, in developing countries.

- Preparation of a Strategic Action Programme for the Dnieper River Basin in Russia, Belarus and Ukraine and the evaluation of priority issues for environmental problems:

  This program is designed to develop a Strategic Action Programme and a plan for developing a Transboundary Diagnostic Analysis (TDA) for the Dnieper River Basin. The program focuses on environmental issues for the transboundary river, including the management of land and vessels that serve as pollution sources for ground and surface water and the prevention of the disruption of ecosystems.

(3) Support through the Global Water Partnership (GWP)[14]

UNDP assists developing countries in implementing sustainable freshwater management programs through the GWP.

[Strengthening the GWP ability to assist developing countries]

- Support in terms of human and financial resources
- Administrative support
- Financial support for the World Water Forum

[Supporting the Water and Sanitation Program (WSP) — a key program of the GWP]

- Providing support for policymakers
- Strengthening the program

[Establishing an International Centre for Capacity Building in cooperation with the Dutch government]

- Designing and establishing a new program
- Providing education for people engaged in capacity building

United Nations Environment Programme

2-5 United Nations Environment Programme (UNEP)

2-5-1 Basic Policy on the Water Sector[15]

UNEP
Assistance for freshwater bodies follows cross-sectoral approaches that focus on 3 key areas: assessment, management and coordination

UNEP's assistance in the water sector, especially water pollution control, covers water problems in freshwater and seawater bodies and urban areas and those in the industrial sector.

The UNEP's water policy and strategy for freshwater bodies focuses on 3 key areas: assessment, management and coordination of actions. All 3 components stress the need for cross-sectoral approaches.

[13] UNDP website (http://www.undp.org/seed/water/region/siocam.htm) (accessed in June 2005)
[14] GWP website (http://www.gwpforum.org/servlet/PSP)
[15] UNEP website (http://www.unep.org/dpdl/water/)

The assessment approach is common to all policies and strategies for UNEP's activities in the water sector. This is implemented by assessment programs and projects in the sector by UNEP regional offices, collaborators and governments.

As for management, UNEP warns that if water management remains as inadequate as it currently is, the present water crisis will become a catastrophe that will prevent the achievement of sustainable development in many parts of the world. UNEP is committed to addressing water management through its regional offices and other organizations concerned.

In relation to coordination, UNEP stresses that sharing a common vision and perspectives on water issues requires the organization of regional and local forums that support action agendas and partnerships at all levels. In fact, UNEP plays a coordinating role in organizing the World Water Forum and other events.

UNEP addresses water pollution in coastal seas as a key focus since environmental pollution, including ecological destruction that stems from land-based human activities of all kinds, is threatening coastal areas among other areas.

As for water pollution in urban areas, UNEP promotes the use of eco-friendly and sustainable technologies.

In relation to water issues in the industrial sector, UNEP emphasizes that governments should seek both economic development and poverty alleviation without further aggravating the state of global resources. Specifically, UNEP promotes sustainable consumption and cleaner production that take account of the lifecycle approach.

2-5-2 Overview of Selected Activities

UNEP is in partnership with other UN agencies, UNEP regional offices and governments of developing countries to develop programs and databases as part of efforts to address water issues, including water pollution.

(1) GEMS/Water Programme: Global Environmental Monitoring System[16]

This is the only global monitoring program for freshwater quality, covering 104 countries. Since its establishment in 1997, the GEMS/Water Programme has to date accumulated freshwater quality data provided free from countries around the world participating in or cooperating with the program. This data is sent to the GEMS/Water Programme Office in Burlington, Canada, and is incorporated in a database.

(2) Assessment of the Pollution Status and Vulnerability of the Water Supply Aquifers of African Cities[17]

This is a joint project in collaboration with UNESCO's Division of the International Hydrological Programme as the implementing agency, UN-Habitat

[16] UNEP website (http://www.unep.org/dpdl/water/Assessment/index.asp) (accessed in June 2005)
[17] *Ibid.*

and the Economic Commission for Africa (ECA) as regional and political partners. The aims of this project are to: (i) determine the pollution status of groundwater supplies in major cities in six West African countries (Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger and Senegal) and Ghana, Ethiopia, Kenya and Zambia; (ii) establish a network for the exchange of related information; and (iii) develop suitable methodologies for the assessment and monitoring of the contamination of shallow and deeper wells.

(3) Global Programme of Action for the Protection of the Marine Environment from Land Based Activities (GPA)[18]

This GPA aims to prevent the degradation of the marine environment from land-based activities.

When this GPA was adopted in 1995, UNEP was given the task of leading coordination efforts through a GPA Coordination Office.

Based on the notion that preventing the degradation of the marine environment from land-based activities is a duty of developing as well as developed countries, the GPA is designed to be a source of conceptual and practical guidance to be drawn upon by national and regional authorities for devising and implementing action for such prevention. More specifically, it is recommended that governments:

- Identify and assess the causes of the degradation of the marine environment
- Establish priorities for action
- Set environmental management objectives for priority problems for pollution sources and affected areas based on established priorities
- Identify, evaluate and select strategies and measures to achieve these objectives
- Develop criteria for evaluating the effectiveness of strategies and measures

(4) Environmentally Sound Technologies Database[19] (maESTro)

This is a free searchable directory on Environmentally Sound Technologies (ESTs) maintained by UNEP's International Environmental Technology Centre (IETC). maESTro delivers environmental technology databases on indigenous technology, wastewater treatment, pollution, solid waste and other fields.

[18] UNEP website (http://www.unep.org/themes/marine/)
[19] UNEP website (http://www.unep.org/themes/urban/)

United States Agency for International Development

USAID
- Domestic Water and Sanitation
- A focus on water in USAID GOAL: "The world's environment protected for long-term sustainability"

2-6 United States Agency for International Development (USAID)

2-6-1 Basic Policy on the Water Sector

USAID has a long history of assistance in the water sector. As early as 1982, USAID issued a policy paper entitled "Domestic Water and Sanitation." Although USAID did not established a policy solely on the water sector by FY2001[20], water was given priority in "the world's environment protected for long-term sustainability"–one of the 6 strategic goals of the USAID Strategic Plan. Recently, USAID is making new attempts to address this issue, including a "Global Water Scarcity Focus," one of the 3 new initiatives that indicate a clearer focus on environmental problems.

To achieve its strategic goal of "the world's environment protected for long-term sustainability," USAID has set 5 objectives: (i) the threat of global climate change is reduced; (ii) biological diversity is conserved; (iii) sustainable urbanization, including pollution management, is promoted; (iv) the use of environmentally sound energy services is increased; and (v) the sustainable management of natural resources is increased.

USAID states that human activities contaminate the world's limited freshwater resources, making them unavailable for further human use and threatening the health of the lakes, rivers, and wetland ecosystems that they support. Coastal and ocean systems are also under threat from the impact of a broad range of human activities. USAID states that coastal systems are particularly vulnerable to degradation from land-based activities, climate change, overfishing, and damage to coral reefs. It also states that these require some kind of intervention to ensure sustainable development.

2-6-2 Overview of Selected Activities

USAID supports over 66 countries in the water sector by providing international leadership in promoting integrated water resources management. Historically, USAID has assisted in various aspects of water management, providing a total of at least 11 billion dollars over the last 30 years, and well over 350 million dollars annually in recent years. Through the Presidential Water for the Poor Initiative announced at the World Summit on Sustainable Development (WSSD) in Johannesburg in August 2002, USAID plans to invest 970 million dollars over 3 years between 2003 and 2005 to improve sustainable water resources management.

(1) Indonesia: Access to water and sanitation

In Indonesia, there was a need to consider the delivery of safe drinking water, sanitation and other environmental services in the context of employment creation. Based on this recognition, a total of some 1,700 labor-intensive projects for infrastructure development were developed. Assistance from

[20] USAID (1982) (http://www.usaid.gov/policy/ads/200/water/ws_introduction.htm/)

USAID and the World Bank will produce some 50 million person days of labor in East and West Java. These projects are expected to create local employment, provide much-needed access to water supplies and housing and improve sewage treatment facilities.

(2) Morocco: Improving sewage treatment

This USAID program has helped local governments to strengthen their capacity and better organize themselves to address environmental problems in Morocco. The subsequent construction of a state-of-the-art wastewater treatment plant in the Al Attaouia region has met local needs for sewage treatment. The plant has freed 15,000 people from the fear of water-borne diseases and the degradation of local landscapes and the natural environment in general.

(3) Jamaica: Improved effectiveness of wastewater management

In Jamaica, domestic wastewater from coastal areas, as well as agricultural wastewater is a major factor contributing to coastal water pollution. This problem, if left unaddressed, may affect tourism, the country's key industry. Against this background, USAID assists NGOs and community-based organizations in implementing water quality monitoring and wastewater purification. It also supports the strengthening of the policy development capacity of administrative bodies in charge of water environment management.

German Agency for Technical Co-operation

GTZ
- Support in the area of water and waste
- Giving priority to supporting water saving efforts and the repair, operation and maintenance of existing facilities

2-7 German Agency for Technical Co-operation (GTZ)

2-7-1 Basic Policy on the Water Sector

GTZ's activities in the water sector[21] traditionally focused on one of its priority areas, "water and waste" until FY2001, when it launched a cross-regional project called "ecosan" or Ecological Sanitation.

In the area of water and waste management[22], GTZ provides governments and public organizations with advice on strategic and conceptual issues in the water sector and on water rights issues. The recipients of GTZ assistance are diverse, ranging from the public sector, private business operators and specialists in charge of water and sewage, to all water users and waste generators and sewage dischargers, including NGOs.

GTZ's water policy gives priority to supporting water saving efforts and the repair, operation and maintenance of existing facilities rather than the development of new water resources.

Regarding water as an economically, socially and environmentally essential resource, the water policy has set out 6 objectives:

- To develop quantitative and qualitative data on the existing water resources for most effective water resources management

[21] GTZ website (http://www.gtz.de/themen/index-en.asp) (accessed in June 2005)
[22] GTZ website (http://www.gtz.de/themen/ebene3,asp?Thema=110&PrglectLD=188&spr=2) (accessed in June 2005)

- To support efforts to meet water demand with means for water storage and transmission
- To conserve the environment by such means as encouraging water users to save water, promoting measures for water resources protection and wastewater treatment, and preventing the contamination of surface and ground water resulting from erroneous waste management
- To support the establishment of eco-friendly (e.g., recycling-based) waste management systems in tandem with the water supply and sanitation sector
- To implement projects designed to establish storm-water drainage systems or introduce systems for flood control, erosion control and coastal conservation in order to mitigate the negative impacts of water
- To raise the awareness of the target groups in the recipient countries about water-related issues (e.g., the need for the concept of appropriate cost recovery in water pricing; efficient operation and management of water purification and sewage treatment plants; the importance of water loss control in the water sector; and the need for sanitation management)

2-7-2 Overview of Selected Activities

Over the years, GTZ has implemented a number of development projects in Africa, Asia, and Latin America. In relation to water pollution, the focuses on these projects are:

- Strengthening project implementing agencies: training and skills development of staff engaged in planning and operation, feasibility studies on economic and financial aspects, and creation of financing models (support for price setting, selection of appropriate technologies, community participation, and self-help capacity development)
- Water supply and sanitation: centralized and decentralized water supply; sewage systems, waste management, and sanitation management including hygiene education
- Water resources development: quantitative and qualitative conservation of water resources, and operation and management of related facilities

(1) ecosan: Ecological Sanitation[23]

For economic and environmental reasons, it is more important than ever to develop, analyze and disseminate approaches that will replace traditional wastewater treatment systems. To meet such a need, GTZ launched a sectoral project called “ecosan” in May 2001. The purposes of this project are to study ecological sanitation systems, reflect such study findings in the international guidelines concerned, and disseminate them. All activities in ecosan involve service users, stakeholders, politicians, the public sector, the private sector, bilateral and multilateral donors, and NGOs. The goals of the ecosan project

[23] GTZ website (http://www.gtz.de/ecosan/english/index.html) (accessed in June 2005)

include: (i) pilot projects; (ii) knowledge management; (iii) networking; and (iv) the dissemination of ideas and experience. Currently GTZ is implementing pilot projects for resource-conserving irrigation with photovoltaic pumping systems in place of traditional diesel-powered pumps in Ethiopia and Chile.

(2) GLOBWINET: Global Water Information Network[24]

GLOBWINET has been established as a forum for exchanging experiences and information in development assistance in the water sector. It aims to disseminate the principles of integrated water management (IWM) announced at Rio de Janeiro and Dublin and provide data useful for IWM and information on organizations and individuals engaged in IWM. GLOBWINET is an associated program of the Global Water Partnership (GWP) that is funded by the Ministry for Economic Cooperation (BMZ) and implemented by GTZ.

(3) The Philippines: Rural Water Supply and Sanitation Program[25]

This program is designed to provide much-needed safe drinking water to rural areas in the Philippines. It comprises three components: (i) improving the institutional framework for integrated water resources management (IWRM); (ii) strengthening a special-purpose water association that serves as a model for decentralization; and (iii) building and developing appropriate technologies and an institutional framework for water supply and sewage treatment systems for rural areas and small towns.

Ministry of Foreign Affairs of the Netherlands

MFA
- Playing a leading role in international discussions on water
- Promoting and implementing integrated water management

2-8 Ministry of Foreign Affairs of the Netherlands (MFA)

2-8-1 Basic Policy on the Water Sector

The Dutch government has been playing a leading role in international discussions on water, as exemplified by the fact that it organized the Second World Water Forum (WWF2). At the Ministerial Conference of WWF2, the Dutch government pledged to contribute 100 million guilders a year to water-related activities in developing countries for a period of 4 years from 2000. It also announced that its development cooperation would focus on support for institutional capacity building and the development of comprehensive strategies and policies towards achieving integrated water resources management (IWRM). The Dutch government has also committed itself to promoting donor coordination of private sector support in the water sector - another feature of the government's water policy.

The water policy of the Dutch government focuses on the promotion and implementation of integrated water management, as laid down in the World Water Vision and the Ministerial Declaration of The Hague on Water Security in the 21st Century.

The Netherlands has set up the Water Support Unit with 3 purposes: (i)

[24] GLOBWINET website (http://www.globwinet.org/) (accessed in June 2005)
[25] GTZ website (http://www.gtz.de/en/themen/umwelt-infrastraktur/umweltpolitik/616) (accessed in June 2005)

improve the coordination of the water program; (ii) translate the concept of integrated water management in policy making and implementation; and (iii) ensure that the program gives strategic focus on the objectives agreed on in the Ministerial Conference WWF2. The Unit (a temporary unit for a three- to four-year period) is designed to promote IWRM within the DGIS (Directorate-General for International Cooperation) and follow up on WWF2 and the Ministerial Conference.

The Dutch government is implementing a water sector program through both bilateral and multilateral programs. An example of multilateral programs supporting bilateral activities is the Netherlands-World Bank Water Partnership Program. This program is aimed at countries eligible for structural bilateral cooperation with the Netherlands, and notably those countries that have chosen water as a priority sector in development cooperation.

2-8-2 Overview of Selected Activities

In bilateral aid in the water sector, the Dutch government has shifted its focus from support for technical and infrastructural development in subsectors — such as improved access to potable water and more reliable supplies of irrigation water — toward integrated support that takes account of social, institutional, economic and environmental issues. A breakdown of the 1999 budget allocations for Dutch bilateral aid in the water sector shows that water supply and sanitation, which have a direct bearing on water pollution, account for the largest portion of 30 %. Yet the proportion for implementing water resources policy is on the rise.

(1) Egypt: Support for water management, and water supply and sanitation

In water management, the Dutch government focuses on developing strategies and institutional reforms. The Dutch input into the policy dialogue is highly appreciated, as exemplified by the role played by the Panel.

The Netherlands's assistance in relation to water pollution focuses on three major issues as articulated in the Ministerial Conference: (i) recommendations on basic needs and water quality by the Egyptian authorities, donors and civil society organizations; (ii) support for ecosystems protection, which will replace the structural bilateral assistance to Egypt after 2004; (iii) water allocation issues and a feasibility study on an Egyptian Water Partnership and collaboration with activities in the Rhine and Nile basins. Bilateral assistance in the water supply and sanitation sector focuses on institutional development at the regional level through technical and financial assistance, complementing the urban water supply and sanitation project by USAID.

(2) Mali: Support for the improved management of water resources

Mali was hit by severe droughts and famine between 1975 and 1985. After 1985, the country's dependence on rainfall was significantly reduced thanks to the construction of two dams (Manatali and Selingue) and the

establishment of the Office de Niger in an irrigation scheme. The Dutch government supports improved management of water resources through the following activities: (i) support to the Office de Niger to make more efficient use of irrigation water; (ii) introduction of a water quality control system in collaboration with the authorities of Guinea and Mali; (iii) construction of water conservation structures in northern Mali; and (iv) support for the improvement of village-level irrigation systems and pisciculture within the scope of the Special Programme for Food Security, which is financed by the Netherlands and implemented by FAO.

(3) Multilateral aid

Based on the international consensus on IWRM, the Dutch government provides support for action programs that meet the 7 challenges as identified during the Ministerial Declaration of The Hague in 2000:

- Meeting BHNs: Measures against diarrhea and other water-related diseases through the Water Supply and Sanitation Collaborative Council (WSSCC); UNICEF, the UNDP, World Bank Water and Sanitation Program and the Africa Water Utilities Partnership.
- Securing the food supply: The Dialogue for Water for Food and Environmental Security mainly promoted by the International Water Management Institution (IWMI); support for efforts to solve groundwater-related problems through the Netherlands-World Bank Water Partnership Program.
- Protecting ecosystems: Eco-friendly watershed development through the Water for Nature initiative of the International Union for Conservation of Nature and Natural Resources (IUCN); maintenance and improvement of water quality through UNEP's Global Programme of Action for Land-Based Marine Pollution; freshwater quality improvement through the water quality program of the Global Water Partnership (GWP).
- Sharing water resources: Support for regional cooperation efforts as highlighted by the Nile River Basin Initiative.
- Managing risks: Financial support for the Southern African Hydrological Cycle Observation System (SADC-HYCOS) by the Department of Water Affairs and Forestry of the Government of South Africa, the World Meteorological Organization (WMO), and the Southern African Development Committee (SADC).
- Valuing water
- Governing water wisely: Human resources development for IWRM through UNDP's international network "Capacity Building Network for Integrated Water Resources Management (CAPNET)"

Swedish International Development Cooperation Agency

Sida:
Focuses on:
- Improved water supply and sanitation
- IWRM
- Integrated Coastal Zone Management

2-9 Swedish International Development Cooperation Agency (Sida)

2-9-1 Basic Policy on the Water Sector

Sida has provided development assistance for improved water supply and sanitation for over 30 years. As the importance of integrated water resources management (IWRM) has been internationally emphasized in recent years, Sida has been increasing its focus on IWRM, which involves the sustainable management of water resources as a priority sector.

Sida states that hygiene problems are not solvable through the supply of clean water alone and that sanitation, including sewage treatment, must also be improved. The main focus of the Sida-supported Water and Sanitation Programme was traditionally placed on rural areas. However, rapid urbanization and the resulting problems of inadequate water supply, health/hygiene and sanitation have resulted in increased Sida involvement in development and the environmental problems of urban areas[26]. Sida's assistance for urban water issues is centered on water management, water pollution control, water pricing, institutional development and alternative sewage treatment. Recently, Sida has announced a new strategy for aid programs in the water and sanitation sector. This strategy focuses on small-scale projects regarding health, hygiene and eco-friendly production methods to address water and sanitation problems in large and medium-scale cities.

Sida also provides assistance for marine and coastal conservation based on the recognition that marine ecosystems are so seriously destroyed by all kinds of human activities that the very survival of the earth and the development of humans are at risk. In particular, Sida has announced the Coastal Zone Initiative, which has defined priorities and guidelines for Sida assistance for sustainable development in marine and coastal areas in developing countries. Apart from to its contribution to sustainable coastal development, the goal of the Coastal Zone Initiative is to provide a comprehensive policy for Sida. Sida has made it clear that priorities for action to achieve sustainable development in coastal areas should be based on the following:

- Integrated Coastal Zone Management (ICZM)[27], which provides a framework for approaching social, economic and environmental issues that traditional approaches to development have proven unable to address.
- A clear division of responsibilities between the different departments of Sida, in order to facilitate collaboration in developing new initiatives, as well as in implementing projects.
- A focus on new coastal management initiatives in East Africa and Southeast Asia, based on the experiences from ongoing programs and projects.

[26] Sida "Growing urban needs" (http://www.sida.se/Sida/jsp/polopoly.jsp?d=168&a=5281) (accessed in June 2005)
[27] Sida "Sustainable development in coastal areas" (http://www.sida.se/Sida/jsp/polopoly.jsp?d=168&a=5335) (accessed in June 2005)

2-9-2 Overview of Selected Activities[28]

Sida's projects that involve water pollution control among other issues have recently focused on countries in Africa and South Asia. Many of the projects are designed primarily to supply drinking water. Other projects involve eco-tourism planning or water body conservation.

(1) Afghanistan: A project for constructing shallow wells and enhancing knowledge of waterborne diseases

This project is designed to construct 1,131 shallow wells in rural areas and to improve the level of knowledge concerning waterborne diseases and the operation of drinking water supplies.

(2) Kenya: Project for sanitation and improved water supply

This project is designed to improve the health and water supply in the Homa Bay project area by installing 206 water tanks and through technology transfer by volunteers.

UK Department for International Development

DFID
- Providing water sector aid that enables poor people to lead healthier and more productive lives
- Addressing the water crisis

2-10 UK Department for International Development (DFID)

2-10-1 Basic Policy on the Water Sector[29]

The goal of DFID's activities in the water sector is "to enable poor people to lead healthier and more productive lives through the improved management of water resources and increased and sustainable access to water supply and sanitation." These activities (especially in the water resources and environmental hygiene sectors) are primarily implemented by the Infrastructure and Urban Development Department (IUDD). IUDD addresses priority issues in the DFID's water sector strategy and implements such activities as: (i) playing a leading role in developing sectoral policies that reflect a wide range of goals of DFID; (ii) working with and influencing international organizations including the World Bank, the European Commission, UNDP, the Water Supply and Sanitation Collaborative Council (WSSCC) and the World Water Partnership (GWP) in adopting appropriate policies; and (iii) implementing appropriate programs and managing IUDD's knowledge and research programs on water.

DFID's water strategy is articulated in the policy paper issued in March 2001, entitled "Addressing the Water Crisis." This is 1 of the 9 strategy papers DFID has developed based on its international development targets. The strategy paper has identified 5 challenges facing the water sector: (i) improving the management of water resources and the environment; (ii) avoiding conflicts over water resources; (iii) improving the allocation of water between different users; (iv) delivering sustainable water services and sanitation services to meet the needs of the poor; and (v) improving coordination among the international players. To address these challenges, the paper has set out 3 targets: (i) to have

[28] Sida "Examples of Water Projects" (http://www.sida.se/Sida/jsp/poloply.jsp?d=168&a=611) (accessed in June 2005)
[29] DFID website (http://www.dfid.gov.uk/)

comprehensive policies and strategies for integrated water resources management in the process of implementation in all countries by 2005; (ii) to reduce by half the proportion of people without access to safe drinking water by 2015; and (iii) to reduce by half the proportion of people without access to hygienic sanitation facilities by 2015.

To achieve these targets, DFID has identified 3 strategic priorities: (i) institutional transformation and capacity development by supporting reform and coordination and mobilizing political commitment; (ii) promotion of best practices through support for water projects and programs that address poverty; and (iii) generation and sharing of knowledge by encouraging the development of innovative and appropriate ideas and encouraging a wide range of dissemination strategies.

2-10-2 Overview of Selected Activities[30]

The recipient countries of DFID are predominantly low-income countries. More precisely, DFID focuses on low-income countries and LLDCs in sub-Saharan Africa. Another characteristic of these recipient countries is that they are dominated by former Commonwealth countries. A breakdown of the budget for projects related to water pollution control shows that water supply and sanitation projects in urban areas account for the largest portion of 39 %, followed by those in rural areas with 33 %.

(1) Colombia: Integrated groundwater management

Many parts of Colombia depend on groundwater for their water supply sources, but they are experiencing water quality deterioration due to water contamination and salt water intrusion. DFID has conducted pilot projects for integrated groundwater management on San Andres Island and in the Cauca Valley in cooperation with consulting firms, Columbian government agencies, and NGOs.

(2) A water supply and sanitation program in the Republic of South Africa

Since 1995, DFID has worked together to implement a water supply and sanitation program in South Africa. Because of its focus on healthy policy development by reviewing water laws and regulations, DFID is supporting the implementation of the Water Services Act in partnership with the government organizations concerned.

(3) Multilateral aid

Supporting business partnerships for development:

DFID pays attention to the roles that can be played by the private sector in the delivery of water and sanitation services to the poor and in improving water resources management. By 2010, the market for water and sewage infrastructure

[30] DFID “Addressing the Water Crisis” (http://www2.dfid.gov.uk/pubs/files/tspwater.pdf)

in the world is projected to reach 150 billion pounds. In order to encourage the private sector to play a greater role in service delivery to the poor, DFID invites businesses to participate in the new organization for such business partnerships. DFID also provides financial assistance to the organization.

Appendix 3 Basic Check List

The Basic Check List is intended for use in formulating development projects in the water pollution sector and examining requests for such projects from developing countries. The list is made up of 3 parts. The first part contains water quality parameters and their criteria for assessing the water pollution status in the target area. The second part is designed to assess the capacity of the recipient for the purpose of analyzing problems and identifying issues to be addressed. The third part provides background information that should be analyzed to identify priority projects.

The check list for assessing the state of water pollution

3-1 Water quality indicators for assessing the state of water pollution

Two questions should be answered before assessing the state of water pollution. The first question is: What water quality parameters should be used as pollution indicators? The second question is: What should be the maximum allowable level of each of these parameters above which water is judged to be polluted? In addition, the water quality of a given public body of water should be assessed from two perspectives: protection of human health and conservation of the living environment. There are different opinions as to what water quality parameters should serve as pollution indicators and what their criteria should be. Moreover, these two issues should be considered in the context of the country or region in question. Yet it is worth providing typical examples of water quality parameters and criteria. The following paragraphs therefore discuss these two issues based on Japan's environmental standards and WHO guidelines.

For an analysis for these water quality parameters, see Table A5-2, Appendix 5.

3-1-1 Criteria for Protecting Human Health

Concentrations of hazardous substances and other pollution levels are assessed based on quantitative data that is gained from water quality analysis. This provides essential information for objectively identifying problems and assessing how serious they are. Table A3-1 provides a typical example of major substances that may have a negative impact on human health and their criteria according to the Environmental Quality Standards for Human Health of Japan and the WHO Guidelines for Drinking Water Quality. It might be inappropriate to apply Japan's standards as they are to developing countries. Yet they at least provide a general picture of hazardous substances and a clue as to how the criteria should be established. Note that environmental standards are government targets that should be achieved to protect human health and

conserve the living environment. In this sense, they should be relevant to developing countries as well.

The Environmental Quality Standards for Human Health of Japan are a set of criteria that must be satisfied for all public waters in the country. They currently cover 26 pollutants, including metals, organochlorine compounds, and agrochemicals. Apart from public bodies of water, the Japanese government applies these criteria to groundwater resources as well in order to prevent them from being contaminated through percolation. The state of water pollution can be assessed by comparing the measured concentrations of these pollutants in the target water body with the criteria in Table A3-1.

3-1-2 Criteria for Conserving the Living Environment

Table A3-2 (a set of tables) provides a typical example of water quality parameters and their criteria for conserving the living environment. These criteria are designed to address water pollution that does not pose an immediate threat to human health but may have a negative impact on drinking water sources and the living environment. This set of tables is based on the Environmental Quality Standards for Conservation of the Living Environment of Japan. These standards provide different criteria for 9 parameters including pH, BOD and COD in relation to different kinds of public waters–rivers, lakes and coastal seas–and different water uses (natural environment conservation, drinking water, fisheries, industrial use, etc.). The water pollution status can be assessed by comparing the measured values of these parameters for the target water body with the criteria in Table A3-2.

3-1-3 Effluent Standards

(1) Japan's environmental standards and effluent standards

Japan's environmental standards are criteria the country has established as "standards, the maintenance of which is desirable for the protection of human health and the conservation of the living environment" under the Basic Environment Law. They are government targets that should be achieved to protect the water quality of rivers, lakes and coastal seas. In contrast, the country's effluent standards are maximum allowable values (regulatory standards) for pollutants in effluent discharged from factories and other establishments into public waters. Those that discharge effluent that is above these standards are subject to punitive action.

The Water Pollution Control Law provides that the effluent standards should apply throughout the country. However, the law also has a provision that where the national standards are deemed insufficient for protecting human health or for preserving the living environment, the governor of the competent prefecture may establish more stringent standards in a prefectural ordinance.

1) Effluent standards for protecting human health

The items (pollutants) subject to the Environmental Quality Standards for Human Health are also subject to effluent standards as harmful

substances under the Water Pollution Control Law. Effluent standards are applicable to any public water in Japan. As a matter of principle, effluent standards are set at 10 times the levels of the Environmental Quality Standards for Water Pollution. (As a rule of thumb, the actual standard values are 10 times the values of Japan's environmental standards shown in Table A3-1.) This is based on the assumption that the concentration of pollutants in effluent will be reduced to at least 1/10 of the levels at the end of pipe after they are discharged into public waters, because the effluent is diluted by, for example, river waters in the process.

2) Effluent standards for conserving the living environment

The effluent standards for conserving the living environment apply to all specified establishments under the Water Pollution Control Law. They have been established as minimum water quality standards that are deemed applicable from social, economic and technical perspectives. Take BOD, COD, nitrogen and phosphorus, for example. As households are a major source of these, the effluent standards for these are set at the levels achievable by treating domestic wastewater through a simple sedimentation process. For more information on the effluent standards, search "*haisui kijun wo sadameru shorei*" [in Japanese] on the website of the Ministry of the Environment.

(2) Considerations for effluent standards for developing countries

In Japan, effluent standards are based on environmental standards. The government set effluent standards at levels where environmental standards will be met even after the effluent is discharged into public waters. In setting effluent standards, the government takes account of the dilution and self-purification effects of rivers and waterways. Developing countries generally have more stringent effluent standards than Japan. One theory as to why this is the case is that developing countries review effluent standards in North America and Europe and then adopt the most stringent ones of these.

North American and European countries adopt standards that can be achieved by the Best Available Technology Economically Available or Best Available Technique (BAT). They think that substances harmful to the environment should not be discharged regardless of the level of environmental pollution. The problem is that many developing countries are not so technically advanced as to make full use of the BAT available in North America and Europe. This makes it difficult for indigenous factories to properly operate effluent treatment systems designed to meet the most stringent standards[31]. To gauge whether a developing country has appropriate effluent standards, it is insufficient just to check the numerical levels of the standards. It is also necessary to ascertain whether they are well observed, and if not, whether they are practical in the first place.

[31] Global Environmental Forum (2002) (http://www.env.go.jp/earth/coop/oemjc/index.html) (accessed in June 2005); Suzuki (2002)

Check List for Capacity Assessment

3-2 Check List for Capacity Assessment

The basic aim of technical cooperation is to develop the capacity (problem-solving ability) of the recipient country for a given development objective. As a donor, Japan should accurately analyze and assess the capacity of the recipient country and set appropriate targets for achieving development objectives at the planning stage, and support capacity development along these lines. It is essential that through this analysis and assessment process, Japan and the recipient country work together to identify which capacities are inadequate and therefore should be strengthened in relation to water environment management in order to develop an effective aid project. Such collaboration at the project formulation phase or the early stages of project implementation at the latest is an effective approach in that it allows the recipient country to develop its problem-identifying ability and ownership and promotes mutual understanding of the development interventions.

Table A3-3 provides 3 different levels of capacity, definitions of capacities, descriptions of capacities for water environment management, and the corresponding capacity assessment items[32].

Table A3-4 illustrates which criteria should be assessed in relation to Capacity Assessment items in Table A3-3. Note that Table A3-4 provides only a general set of criteria. The table should be tailored for each actor or project by adding or subtracting criteria as necessary. In the project formulation process, it is desirable that the counterpart take the initiative to prepare a check list appropriate for a given project[33]

Qualitative assessment of capacities based on qualitative information regarding the criteria requires significant technical expertise and experience. For this reason, Table A3-3 and Table A3-4 are designed to assess capacities using qualitative assessment of the criteria.

Take, for example, the capacity assessment item of "(3) Local government organizations" in the element of "Organizational forms and management" at the level of "Organizations". Here, the quantitative assessment of human, intellectual and physical assets is no easy task. Even if such an assessment is possible, it is difficult to make an overall assessment of the local government as an organization. It is more practical to gauge whether its capacity in relation to that item is adequate or not, based on a qualitative assessment of the current state of affairs, the track record and performance regarding the following criteria:

- Is there an environmental department at the local level in charge of water environment administration?

[32] For the conceptual framework and considerations for assessing capacities in the context of development, see JICA, Task Force on Aid Approaches (2004) and JICA, Institute for International Cooperation (2005b). Different levels of capacity in both Table A3-3 and Table A3-4 are based on these two documents. For a similar approach to a related sector, see JICA Institute for International Cooperation (2005a). This report provides a useful source of information on the significance, objectives, and actual applications of capacity assessment in the solid waste management sector.

[33] This is because the process of the recipient exercising ownership to identify criteria and conducting problem analysis itself can be considered as part of the overall capacity development process for the recipient.

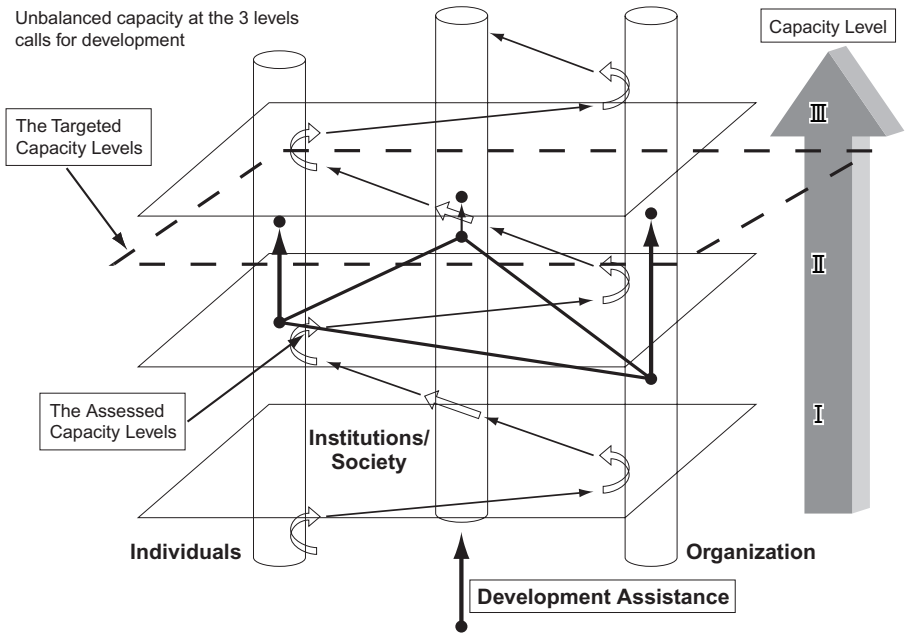
- Is water environment administration integrated? Is it conducted by a number of departments?
- Are the duties within the organization clearly defined?
- Does the local government have a clear environmental conservation policy, including a basic environmental ordinance and other environmental management ordinances?

(See the Table for the rest of the criteria.)

Table A3-6 provides an outline of Japanese laws related to water environment management (WEM). The idea is to facilitate capacity assessment from the aspect of the legal framework by comparing the legal framework and law enforcement arrangements for WEM in the recipient country with those in Japan.

Figure A3-1 represents the concept of how to use the Capacity Assessment findings in deciding the focus of development intervention. The overall capacity of a society to implement water pollution control will be maximized when the capacities at the 3 different levels of individuals, organizations, and institutions and social systems are improved in a balanced manner. In other words, the main purpose of Capacity Assessment is to compare the assessed capacity levels and the targeted capacity levels and then accurately identify on which capacity the development intervention needs to focus to achieve the maximum results.

Figure A3-1 Conceptual Illustration of Capacity Assessment



A comparison of the assessed capacity levels (the solid-line triangle) with the targeted capacity levels (the dotted-line parallelogram) suggests that inadequate capacity at the organizational level represents a major obstacle to raising the overall capacity. For this reason, development intervention that focuses on capacity at the organizational level will produce the maximum results in raising the overall capacity of the society.

Source: Produced by Senro IMAI.

The next question is: How do the issues that have come to the surface after the Capacity Assessment process relate to the means and methods of environmental management? To answer this question, Box A3-1 examines an example of the capacity assessment item of "(12) Water environment monitoring" in the element of "Intellectual" assets at the level of "Organizations" in Table A3-4. The "Criteria" in the Box are extracted from this table. "The corresponding means and methods" of environmental management in the Box can be potential candidates for project components or focuses for improvement. They also correspond to "Means and Methods for Achieving the Sub-targets" in the Development Objectives Chart. These means and methods provide clues to determining the details of development projects.

Box A3-1 Example of How the Criteria in the Capacity Assessment Checklist Relate to the Means and Methods of Environmental Management

Water Environment Monitoring

<Criteria>

(i) Is continuous monitoring of public waters actually conducted?
(ii) Is a monitoring database (DB) available?
(iii) Is there a group in charge of analyzing monitoring data?
(vi) To whom and to what extent are the findings of the monitoring data analysis made accessible?
(v) How accurate is the monitoring data? Is it accurate enough to be made public?
(vi) Are the findings of monitoring data analysis compiled into a report and put to use for strengthening water quality management?
(vii) Is a draft of the State of the Environment (SOE) presented for review to a cross-sectoral coordination mechanism such as a council of the government offices concerned?

Some of the means and methods of environmental management based on the assessment in relation to the above criteria are shown below:

<Corresponding means and methods>

(i) The leadership's awareness of issues: Compliance with laws and regulations; monitoring framework development
(ii) Design and utilization of DB: DB should be designed to meet the needs of monitoring data analysis
(iii) Limits to what government organizations can do: Building a framework for supporting groups of researchers; training in analytical techniques (the training subjects include everything ranging from manual development to the application of simple systems to simulations)
(iv) Preparation of a simple report on the state of the environment (SOE): Assessment of the situation; drawing up an SOE report that also suggests steps to be taken, posting it on a website, and ensuring free access to it
(v) Planning and implementation of quality control (QC) training: Offering full training and guidance for achieving ISO 17025 certification; developing the measuring system
(vi) Establishment of a task force (TF) and an advisory group (a departmental TF and a group of technical advisors from government offices concerned in partnership with universities and other research institutions)
(vii) Making arrangements to ensure regular reporting, devising proposals for corrective measures, and presenting them to forums for coordination (advisory panels to ministers, ministerial conferences, etc.)

Source: Produced by Senro IMAI.

Check List for Assessing and Judging the Priority of Proposed Projects

3-3 Check List for Assessing and Judging the Priority of Proposed Projects

Table A3-5 provides a checklist of background information that should be obtained as the criteria for objectively identifying the priority or relative importance of proposed projects in the project formation and selection processes. After identifying the relative importance of the project by checking these criteria, go back to Table A3-3 and Table A3-4, assess the capacity of the recipient, and then determine the project components so that the project will achieve maximum outcomes[34].

Placing the background factors into perspective is an essential element of the assessment and judgment of the priority of proposed projects. Focusing only on local water pollution hazards in the target area may result in a lower priority given to more immediate hazards elsewhere in the recipient country or pollution sources that need to be addressed more immediately. In this context, the following points need special attention in assessing the priority of the projects[35]:

(i) Has the central government committed itself to addressing water pollution?
(ii) Is the relevant legal framework in place that serves as a basis for translating the findings of the development study into action?
(iii) Does the central government or the target city have revenue sources or a mechanism to make them available for projects designed to address point-source pollution whose estimated costs are enormous?
(iv) Are there any other cities that are of more strategic importance than the target city?
(v) Are there any other bodies of water that are of more strategic importance than the target water body?
(vi) Is the scope of the development study appropriate? (Too large a scope may result in only part of the study findings being translated into action. This may not produce satisfactory outcomes in terms of water pollution control.)
(vii) What are the pollution levels? (Are the levels too high to produce satisfactory outcomes even if the findings of the development study are translated into action?)
(viii) Is the necessary scientific knowledge and basic data available for implementing a development study? (Is it more urgent to provide support for data accumulation than implementing such a study?)
(ix) What are the relationships between the authorities and other actors? What are the awareness levels of other actors? (Is it the case that citizens and other actors will not be interested in the development study and its findings? Are they thus being left behind by the authorities? In such cases, these findings may not be put to good use.)
(x) Is it really appropriate to implement a development study to solve the

[34] The reverse approach is also viable–analyzing problems and identifying constraints through the capacity assessment process and then formulating a project. For either approach, it is necessary to put into perspective the problem the project is designed to address in the target area in terms of the priority for the recipient country.

[35] These points are primarily for development studies. Yet they are largely relevant to other technical cooperation schemes as well.

problem? Should other technical cooperation schemes be given priority? Will these be more productive?

Table A3-1 Typical Example of Water Quality Parameters and Criteria for Protecting Human Health

<Explanation>
Purpose: This table provides a tool to determine the pollution levels of a given water body in the context of protecting human health.
WHO guidelines: Criteria for selected hazardous substances under the "WHO Guidelines for Drinking Water Quality" (2004) that may generally be detected in developing countries. Organic substances that are largely attributed to dry cleaning businesses are also included.
Japan's environmental standards: "Criteria based on Japan's Environmental Quality Standards for Human Health" (annual means).
Description and origin: Description of the substance and the origin of the water pollutants.
Typical uses: Providing an indication of the possibility that the pollutants will find their way into public waters if an industrial establishment involving these uses is located in the basin.

Type	Pollutant	WHO Guidelines	Japan's Environmental Standards	Unit	Description and Origin	Typical Uses
Heavy metals	Arsenic	0.01	0.01	mg/l	This substance may be detected in rivers and groundwater if these are contaminated through ground seepage, or from mineral springs, mine runoff or industrial wastewater. Natural fresh water contains 1- 30 ppb of arsenic and sea water approximately 2 ppb. Yet groundwater in volcanic regions, especially hotspring water, often contains levels of arsenic that are too high to meet the drinking water quality standards.	Semiconductors, agrochemicals, paints, glass (decolorants), and drugs
Heavy metals	Cadmium	0.003	0.01	mg/l	This substance is rarely detected in rivers and other bodies of water, but it may be contained in mine runoff or industrial wastewater. It is known as the agent that caused Itai-Itai disease.	Semiconductors, alloys, batteries, plating, paints, photographic chemicals, and PVC stabilizers
Heavy metals	Chromium	0.05	0.05	mg/l	This substance may be detected in a river or groundwater if it is contaminated with mine runoff or industrial wastewater.	Oxidants, plating, catalyzers, photographic chemicals, tannage, and lithography
Heavy metals	Copper	2	–	mg/l	This substance may be detected if the water is contaminated through ground seepage, or with copper mine runoff, industrial wastewater or agrochemicals, or if copper is dissolved into the water from copper pipes or brass instruments used for water supply.	Electric wire, batteries, plating, and heat exchangers
Heavy metals	Lead	–	0.01	mg/l	This substance may be detected in river waters if they are contaminated with mine runoff or industrial wastewater. It is not contained in tap water except, for example, when copper pipes are used for water supply.	Letter presses, water pipes, glass, vulcanizing agents for rubber, batteries, paints, and PVC stabilizers
Heavy metals	Mercury (total)	0.001	0.0005	mg/l	This substance may be detected in river and other waters if they are contaminated by rivers flowing through mercury deposit areas, industrial wastewater, agrochemicals or sewage. It is known as the agent that causes Minamata disease.	Electrolytic electrodes, gold and silver extraction, mercury lamp, paints, agrochemicals, rectifiers, thermometers, and dental materials
Heavy metals	Selenium	–	0.01	mg/l	This substance may be detected in river waters if they are contaminated with mine runoff or industrial wastewater.	Semiconductor materials, paints, pesticides, and catalyzers
Organic mercury compounds	Alkylmercury	–	Not detectable	mg/l	Many mercury compounds are toxic. Especially toxic are: mercuric chloride, an inorganic mercury compound, and alkylmercury or organomercuric compounds (methylmercury, ethylmercury, dimethylmercury, diethylmercury, etc.)	
Inorganic compounds	Cyanide	0.07	Not detectable	mg/l	This substance may be detected in rivers and other bodies of water if they are contaminated with industrial wastewater.	Plating, organic synthesis, fluorescent paints, alloys, and photographic chemicals
Organic mercury compounds	Nitrate (as NO_3-)	50	10 in total	mg/l	These substances may be detected in river and other waters if they are contaminated by nitrogenous fertilizers, decomposed animals and plants, domestic wastewater, or sewage. Nitrite is oxidized into nitrate. Conversely, nitrate changes into nitrite under conditions of oxygen deficiency. Under more anaerobic conditions, nitrite is further deoxidized into ammonium salts. Due to its water solubility, nitrate easily infiltrates into the ground. This means that an increase in nitrate levels in the ground results in higher levels of nitrite nitrogen and nitrate nitrogen in groundwater. For this reason, stringent standards are imposed on the discharge of nitrates and nitrites into closed waters as they cause eutrophication. High concentrations of nitrates or nitrites in drinking water may cause methemoglobinemia (cyanosis) in infants.	Inorganic fertilizers, gunpowder, color couplers, and domestic wastewater
Organic mercury compounds	Nitrite (as NO_2-)	3		mg/l		Nitrogenous fertilizers, food preservatives and domestic wastewater

Type	Pollutant	WHO Guidelines	Japan's Environmental Standards	Unit	Description and Origin	Typical Uses
Inorganic substances	Boron	0.5	1	mg/l	This substance may be detected in rivers and groundwater if these are contaminated by groundwater from volcanic areas, hot spring water, industrial wastewater, or other sources.	Metal surface-treatment agents, glass, the enameling industry, ceramics, semiconductors, and electrical insulators
Inorganic substances	Fluoride	1.5	0.8	mg/l	This substance may de detected in rivers and other bodies of water if they are contaminated through ground seepage or from industrial wastewater. The concentration of fluoride in inland water ranges from 0.05 to 1 ppm. That in seawater averages 1.3 ppm. Fluoride is abundant in volcanic gases, groundwater around volcanoes, and hot spring water, and the fluoride levels in some regions may exceed the water quality criterion under the Waterworks Law. It is believed that a certain intake of fluoride helps prevent dental caries. Yet high levels of fluoride may cause mottled teeth.	CFC production, surface-treatment agents, semiconductors, aluminum refining, and glass
Inorganic substances	Nitrilotriacetic acid (NTA)	0.2	–	mg/l	As phosphorus in wastewater causes eutrophication, this substance is used in place of phosphorus in detergents.	Phosphorus-free detergents, and boiler water treatment agents
Organochlorine compounds	Carbon tetrachloride	2.0	0.002	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	CFC material, wax, solvents, cleaners, and dry cleaning
Organochlorine compounds	1,1-Dichloroethane	0.03	–	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	PVC material, paints, cleaners, extractants, and agrochemicals
Organochlorine compounds	1,2-Dichloroethane	–	0.004	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	PVC material, paints, cleaners, extractants, and agrochemicals
Organochlorine compounds	1,1-Dichloroethylene	0.03	0.02	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	Polyinyliclene material, solvents, synthetic resins, and anesthetics
Organochlorine compounds	cis-1,2-Dichloroethylene	0.05	0.04	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	Solvents, aromatic chemicals, lacquer, synthetic resins, and anesthetics
Organochlorine compounds	Dichloromethane	0.02	0.02	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	Solvents, cleaners, extractants, pesticides, and paints
Organochlorine compounds	Polychlorinated biphenyl	–	Not detectable	mg/l	PCB is no longer in use since its production, sale, import and use are now banned. Existing products containing PCB are being recalled by the industries concerned.	Heating media and electrical insulators (transformers, capacitors, and fluorescent lamp ballasts)
Organochlorine compounds	Tetrachloro ethylene	0.04	0.01	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	Solvents, cleaners, and dry cleaning
Organochlorine compounds	1,1,1-Trichloroethane	0.07	1	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	Solvents, cleaners, and organic synthesis (vinylidene chloride)
Organochlorine compounds	1,1,2-Trichloroethane	0.07	0.006	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	Solvents, cleaners, organic synthesis (vinylidene chloride), refrigerants, and extractants for aromatic chemicals
Organochlorine compounds	Trichloroethylene	–	0.03	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	Solvents, refrigerants, cleaners, and agrochemicals
Volatile hydrocarbons	Benzene	10	0.01	mg/l	Used as a chemical synthesis agent, solvent, metal degreasing agent or in paints and in dry cleaning processes. Known as a groundwater pollutant.	Dyes, synthetic rubber, organic pigments, solvents, paints, and extractants
Organic substance	Microcystin-LR	0.001	–	mg/l	A toxic substance produced when *aoko* occurs (a phenomenon in which seawater turns blue as a result of an algal bloom.)	
Agrochemicals	1,3-Dichloropropene	–	0.002	mg/l	An organochlorine pesticide chiefly used for pest control in soils.	Insecticides
Agrochemicals	Thiuram	–	0.006	mg/l	Used on farmland and golf courses as a disinfectant for seeds, foliage and soils due to its powerful antibacterial properties.	Herbicides
Agrochemicals	Simazine	–	0.003	mg/l	Widely used as a herbicide on farmland and golf courses.	Herbicides
Agrochemicals	Thiobencarb	–	0.02	mg/l	Used as a herbicide for initial applications in rice paddies.	Herbicides

Source: Compiled by Haruo IWAHORI based on the Bureau of Waterworks, Tokyo Metropolitan Government, *Suishitsu Kijun* [water quality standards] (http://www.waterworks.metro.tokyo.jp/w_info/s_kijun.htm) and other references.

Table A3-2 Typical Example of Water Quality Parameters and Criteria for Conserving the Living Environment

<Explanation>
Purpose: This table provides a tool to determine the pollution levels of a given water body in the context of conserving the natural environment.
Criteria: For use in assessing the pollution level of a given water body. Although the criteria are based on Japan's Environmental Quality Standards for the Conservation of the Living Environment, the two are not identical.
How to use the table: Confirm the uses of a given water body (a river, lake or coastal sea). Then compare the measured water quality values with the criteria for the corresponding class to assess the pollution level. Groundwater is subject to Table A3-1.

(1) Pollution levels for rivers

Class	Water Use	Criteria (daily means)				
		pH	Biochemical Oxygen Demand (BOD)	Suspended Solids (SS)	Dissolved Oxygen (DO)	Total Coliform
			mg/l or less	mg/l or less	mg/l or more	MPN/100 ml or less
AA	Water supply class 1, Natural environment conservation, and uses listed in A-E	6.5-8.5	1	25	7.5	50
A	Water supply class 2, fishery class 1, bathing and uses listed in B-E	6.5-8.5	2	25	7.5	1,000
B	Water supply class 3, fishery class 2, and uses listed in C-E	6.5-8.5	3	25	5	5,000
C	Fishery class 3, industrial water class 1, and uses listed in D-E	6.5-8.5	5	50	5	–
D	Industrial water class 2, agricultural water, and uses listed in E	6.0-8.5	8	100	2	–
E	Industrial water class 3 and environmental conservation	6.0-8.5	10	Floating matter such as garbage should not be observed.	2	–

Descriptions of *water uses*

1. Natural environment conservation — Water suitable for nature exploration and other environmental conservation purposes
2. Water supply class 1 — Water requiring a simple purification process such as filtration
   Water supply class 2 — Water requiring conventional purification process including sedimentation and filtration
   Water supply class 3 — Water requiring advanced purification process including pretreatment
3. Fishery class 1 — Water suitable for aquatic organisms in oligosaprobic waters such as *Oncorhynchus masou masou* and *Salvelinus pluvius* and for aquatic organisms for fishery classes 2 and 3
   Fishery class 2 — Water suitable for aquatic organisms in oligosaprobic waters such as *Salmonidae* and *Plecoglossus altivelis altivelis* and for aquatic organisms for fishery class 3
   Fishery class 3 — Water suitable for aquatic organisms in beta-mesosaprobic waters such as *Cyprinus carpio* and *Carassius*
4. Industrial water class 1 — Water requiring conventional purification process including sedimentation
   Industrial water class 2 — Water requiring advanced purification process including chemical feeding
   Industrial water class 3 — Water requiring special purification process
5. Environmental conservation — Water that does not make people uncomfortable in their daily lives (including waterfront strolling)

(2) Pollution levels for lakes

Class	Water Use	Criteria (daily means)				
		pH	Chemical Oxygen Demand (COD)	Suspended Solids (SS)	Dissolved Oxygen (DO)	Total Coliform
			mg/l or less	mg/l or less	mg/l or more	MPN/100 ml or less
AA	Water supply class 1, fishery class 1, natural environment conservation, and uses listed in A-C	6.5-8.5	1	1	7.5	50
A	Water supply classes 2 and 3, fishery class 2, bathing, and uses listed in B-C	6.5-8.5	3	5	7.5	1,000
B	Fishery class 3, industrial water class 2, and uses listed in C	6.5-8.5	5	15	5	–
C	Industrial water class 2 and environmental conservation	6.0-8.5	8	Floating matter such as garbage shall not be observed.	2	–

Descriptions of *water uses*

1. Natural environment conservation — Water suitable for nature exploration and other environmental conservation purposes
2. Water supply class 1 — Water requiring a simple purification process such as filtration
   Water supply classes 2 and 3 — Water requiring conventional purification process including sedimentation and filtration or advanced purification process including pretreatment
3. Fishery class 1 — Water suitable for aquatic organisms in oligotrophic lakes such as *Oncorhynchus nerka nerka* and for aquatic organisms for fishery classes 2 and 3
   Fishery class 2 — Water suitable for aquatic organisms in oligotrophic waters such as *Salmonidae* and *Plecoglossus altivelis altivelis* and for aquatic organisms for fishery class 3
   Fishery class 3 — Water suitable for aquatic organisms in eutrophicated lakes such as *Cyprinus carpio* and *Carassius*
4. Industrial water class 1 — Water requiring conventional purification process, including sedimentation
   Industrial water class 2 — Water requiring advanced purification process including chemical feeding or special purification process
5. Environmental conservation — Water that does not make people uncomfortable in their daily lives (including waterfront strolling)

Class	Water Use	Criteria (daily means)	
		Total Nitrogen (mg/l or less)	Total Phosphorus (mg/l or less)
I	Natural environment conservation and uses listed in II-V	0.1	0.005
II	Water supply classes 1 and 2, Fishery class 1, bathing, and uses listed in III-V	0.2	0.01
III	Water supply class 3 and uses listed in IV-V	0.4	0.0
IV	Fishery class 2 and uses listed in V	0.6	0.05
V	Fishery class 3, industrial water, Agricultural water, and environmental conservation	1	0.1

Descriptions of *water uses*

1. Natural environment conservation — Water suitable for nature exploration and other environmental conservation purposes
2. Water supply class 1 — Water requiring a simple purification process such as filtration
   Water supply class 2 — Water requiring conventional purification process including sedimentation and filtration
   Water supply class 3 — Water requiring advanced purification process including pretreatment
3. Fishery class 1 — Water suitable for aquatic organisms such as *Salmonidae* and *Plecoglossus altivelis altivelis* and for aquatic organisms for fishery classes 2 and 3
   Fishery class 2 — Water suitable for aquatic organisms such as *Hypomesus nipponensis* and for aquatic organisms for fishery class 3
   Fishery class 3 — Aquatic organisms such as *Cyprinus carpio* and *Carassius*
4. Environmental conservation — Water that does not make people uncomfortable in their daily lives (including waterfront strolling)

(3) Water pollution levels for coastal seas

Class	Water Use	Criteria (daily means)				
		pH	Chemical Oxygen Demand (COD)	Dissolved Oxygen (DO)	Total Coliform	N-hexane Extracts (oil, etc.)
			mg/l or less	mg/l or more	MPN/100ml or less	
A	Fishery class 1, bathing, natural environment conservation, and uses listed in B-C	7.8-8.3	2	7.5	1,000	Not detectable
B	Fishery class 2, industrial water, and the uses listed in C	7.8-8.3	3	5	–	Not detectable
C	Environmental conservation	7.0-8.3	8	2	–	–

Descriptions of *water uses*
1. Natural environment conservation — Water suitable for nature exploration and other environmental conservation purposes
2. Fishery class 1 — Water suitable for aquatic organisms such as *Pagrus major, Seriola quinqueradiata* and *Undaria pinnatifida*, and for aquatic organisms for fishery class 2
   Fishery class 2 — Aquatic organisms such as *Mugil cephalus cephalus* and *laver*
3. Environmental conservation — Water that does not make people uncomfortable in their daily lives (including waterfront strolling)

Class	Water Use	Criteria (daily means)	
		Total Nitrogen (mg/l or less)	Total Phosphorus (mg/l or less)
I	Natural environment conservation and uses listed in II-IV (except fishery classes 2 and 3)	0.2	0.002
II	Fishery class 1, bathing, and the uses listed in III-IV (except fishery classes 2 and 3)	0.3	0.03
III	Fishery class 2 and the uses listed in IV (except fishery class 3)	0.6	0.05
IV	Fishery class 3, industrial water, and conservation of habitable environments for marine biota	1	0.09

Descriptions of *water uses*
1. Natural environment conservation — Waters suitable for nature exploration and other environmental conservation purposes
2. Fishery class 1 — Waters where a variety of aquatic organisms, including benthic fish and shellfish, can be caught in a balanced and steady manner
   Fishery class 2 — Waters where fish and other aquatic organisms, excluding certain benthic fish and selfish, can be caught in large quantities
   Fishery class 3 — Waters where certain aquatic organisms tolerant to pollution can principally be caught
3. Conservation of habitable environments for marine biota — Waters that the benthos can barely inhabit throughout the year

Source: Compiled by Haruo IWAHORI based on the Ministry of the Environment, *Suishitsu Odaku ni Kakaru Kankyo Kijun ni Tsuite* [Environmental Quality Standards for Water Pollution] (http://www.env.go.jp/kijun/mizu.html)

Box A3-2 Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)

BOD is a measure of the amount of oxygen necessary for microorganisms to break down organic matter in water. The lower the level of BOD, the less organic matter in the water. On the other hand, COD represents the amount of oxygen consumed to oxidize materials, especially organic ones, in water with an oxidizing agent. The lower the level of COD, the less organic matter in the water.

Environmental standards and effluent standards use BOD for rivers and COD for lakes and coastal seas. Here are the reasons. River water purifies itself as it flows. In this process, the oxygen contained in the water is consumed. This makes it important to set standards on the concentration of organic matter that can be broken down by microorganisms. On the other hand, organic matter is retained longer in lakes and coastal seas. Plankton there consumes oxygen through respiration, affecting the measurement of BOD. This is why COD, which measures the total quantity of organic matter, is used for lakes and coastal seas.

BOD and COD are positively correlated. Yet there is no formula for this correlation since it varies depending on the pollutant and the pollution level. Experience shows, however, that COD tends to be twice the BOD level in rivers whose pollution levels are in the order of a few ppm and that BOD and COD levels are almost the same when the main pollution source is household wastewater.

Table A3-3 Capacities and Capacity Assessment Items for Water Environment Management (WEM)

<Explanation>
Purpose This table provides 3 different levels of capacity, definitions of capacities, descriptions of WEM capacities, and corresponding Capacity Assessment items.
Capacity Assessment items may or may not match the *Sub-targets of Medium-term Objectives* in Development Objectives 1. *Unmatched sub-targets covered* show where unmatched sub-targets belong.

Level	Definition and Elements of Capacity	Description of capacity for Water Environment Management (WEM)	Capacity Assessment Items and Unmatched Sub-targets Covered	
Individuals	The will and ability to set objectives and achieve them using one's own knowledge and skills. Knowledge, skills and the will of individuals.	Knowledge, ability, skills, expertise, wisdom, will, a sense of responsibility, and linguistic competence of the individuals involved in WEM.	(1) Ability of individuals	
Organizations	The decision-making processes and management systems, organizational culture, and frameworks required to achieve a specific objective. Human, intellectual and physical assets required for these.	Organizational forms, management, leadership and awareness within the organizations are all required to put the following types of assets to good use	(2) Central government organizations	• Strengthening integrated water management • Clearly defining duties within organizations • Improving coordination with other organizations
			(3) Local government organizations	• Strengthening integrated water management • Clearly defining duties within organizations • Improving coordination with other organizations
			(4) Identification of water pollution problems and their factors	
			(5) Awareness of policymakers	
			(6) Corporate environmental management capacity	• Developing systems for the appropriate enforcement of the regulations • Building and strengthening corporate environmental management systems
		Human assets: Human resources in the engineering, management and planning sections in WEM	(7) Human resources and their capabilities in (central and local) government organizations	
			(8) Human resources and their capabilities in businesses	
			(9) Human resources and their capabilities in civil society organizations	
			(10) Human resources and their capabilities in universities and other research institutions	• Providing information to and seeking more engagement of, government, industry and the civil society
		Intellectual assets: Expertise in WEM; corporate environmental management; information on water pollution; research findings and manuals	(11) Water quality monitoring planning for public waters	
			(12) Water environment monitoring	• Building the framework for and improving the accuracy of water quality monitoring • Promoting the accumulation and utilization of water quality data and the disclosure of related information • Developing systems for the proper enforcement of the regulations
			(13) Monitoring of pollution sources (factories and other establishments)	• Developing systems for the proper enforcement of the regulations
			(14) Accumulation and dissemination of environmental information	
			(15) Improvement of scientific knowledge	• Developing research capabilities
			(16) Manuals for WEM	• Developing the capacity of the government officials in charge
		Physical assets: Finance, facilities and equipment are all required for WEM	(17) Financial measures by the central government for developing facilities	
			(18) Financial measures by local governments for developing facilities	• Financial planning
			(19) Operation and maintenance costs of facilities	• Adopting the Polluter-Pays Principle • Studying appropriate cost recovery options
			(20) Existing water pollution control facilities	
			(21) Development of laboratories	
Institutions and social systems	The environment and conditions necessary for demonstrating capabilities at the individual or organizational level; the decision-making processes, and systems and frameworks necessary for the formation/implementation of policies and strategies that are over and above an individual organization; and the frameworks, formal and informal institutions, structures, social capital, etc. required for execution.	Legal framework: The environmental legal system, basic laws, and sectoral laws	(22) Development of an effective legal and regulatory framework I (establishment of an environmental legal system and basic law)	
			(23) Development of an effective legal and regulatory framework II (establishment of sectoral laws)	• Developing systems for the proper enforcement of the regulations
		Standards: Environmental standards and effluent standards	(24) Development of an effective legal and regulatory framework III (establishment of environmental standards)	
			(25) Development of an effective legal and regulatory framework IV (establishment of effluent standards)	• Developing systems for the proper enforcement of the regulations
		Policies and politics: Policies, objectives and politics at central and local government levels	(26) Formulation of water management policy (basic policy and plan)	• Developing the capacity of the government officials in charge
			(27) Water quality management planning	• Developing the capacity of the government officials in charge
		Social infrastructure	(28) Basic infrastructure	
		Social organizations involved in WEM	(29) Environmental management capacity of communities	
			(30) Environmental education and learning	• Raising public awareness concerning water environment conservation
			(31) Promotion of environmental businesses	• Encouraging private participation in environmental management and promoting environmental conservation industries

Source: Compiled by Haruo IWAHORI based on JICA, Task Force on Aid Approaches (2004)

Table A3-4 Capacity Assessment Checklist

<Explanation>
Purpose: This table provides criteria and comments/remarks in relation to the capacity assessment items identified in Table A3-3.
How to use the table: Make a qualitative assessment of the current state of affairs, the track record and performance based on the criteria for each capacity assessment item. Then examine the assessment findings and gauge whether the capacity is adequate in relation to each capacity assessment item. This process should be preferably be implemented jointly with the recipient country.

Level	Elements	Capacity Assessment Items	Corresponding Medium-term Objective(s)	Criteria	Comments/Remarks
Individuals	Knowledge and skills	(1) Ability of individuals	1-2	Levels of knowledge, skills and expertise of the stakeholders in the counterpart organization and elsewhere	Note that assessing the ability of individuals is no easy task and that the sum of their abilities does not necessarily represent the overall ability of the organization. When the donor and the recipient work together to conduct capacity assessment at the project formulation phase, the preliminary study phase and at early stages of project implementation, it may not be practicable to measure and evaluate the ability of the individuals. A more practical approach is to make qualitative assessment of how many individuals have high levels of awareness and problem-solving ability and identify, among these, those who will potentially be the central counterparts in technical cooperation.
				Levels of awareness and a sense of responsibility on the part of the individuals	
				In what language can the individuals communicate? (How do they communicate with the donor in technical cooperation projects?)	
Organizations	Organizational forms and management	(2) Central government organizations Including the following sub-targets: • Strengthening integrated water management • Clearly defining duties within organizations • Improving coordination with other organizations	1-1 1-2	Is there an environment ministry or an equivalent organization in charge of water environment administration?	Gauge whether the central government as a whole is playing the leading role in environmental policy. Because water pollution control is implemented at the local level, the executing power has usually been granted to local governments. For reference, see the provisions of the Basic Environment Law, the Water Pollution Control Law, and other laws of Japan and check how such key words as *the State* (central government), *the Government, the Minister of the Environment, local governments, prefectural governors, municipalities* are used in the provisions. This facilitates an understanding of the roles of, and the division of responsibility between, the central and local governments in the legal framework of Japan.
				Is water environment administration integrated? Is it conducted by a number of government offices?	
				Are the duties within the organization clearly defined?	
				Is the organization fulfilling its responsibility for developing a legal framework, including a basic environment law and sectoral laws?	
				Is the organization fulfilling its responsibility for developing a national environmental management system, including a framework for unified measures?	
				Is there a mechanism for ensuring good coordination with other organizations concerned?	
				Does the central government have local offices for policy execution? Does it promote devolution by law?	
				Does it take financial measures and provide technical assistance to increase the executive capacity of local governments so that they can exercise power that has been granted to them by law?	
		(3) Local government organizations Including the following sub-targets: • Strengthening integrated water management • Clearly defining duties within the organizations • Improving coordination with other organizations	1-1 1-2	Is there an environmental department at the local level in charge of water environment administration?	Gauge whether the organization is fulfilling its responsibility for local environmental policy while taking account of the four processes of environmental management: monitoring, data evaluation and analysis, policy making, and policy implementation. Is the division of responsibility clearly defined between the central and local governments? Are they fulfilling their own responsibilities?
				Is water environment administration integrated? Is it conducted by a number of departments?	
				Are the duties within the organization clearly defined?	
				Does the local government have a clear environmental conservation policy, including a basic environment ordinance and other environmental management ordinances?	
				Is the organization fulfilling its responsibility for water environment management (WEM) at the local level? Is it taking measures tailored to meet local needs and conditions?	
				Is there a mechanism for ensuring good coordination with other organizations concerned to achieve water quality objectives?	
				Does the local government execute power granted to them? Notably, does it monitor both public waters and pollution sources and take necessary measures such as supervision, corrective orders and administrative guidance?	
		(4) Identification of water pollution problems and their factors	1-2	Can the organization explain water pollution problems in the target water body in question and their trends using data and analytical findings?	Does the organization keep track of water pollution based on data and data analysis findings? Does it take account of water pollution conceptually or intuitively? From an analysis of these questions, it may be concluded that the organization cannot come up with corrective measures or understand the challenges in implementing them.
				Can the organization explain what specific damage water pollution has inflicted (on water sources, groundwater, agriculture and fisheries)?	
				Has the organization identified the factors for the causes of water pollution? Can it explain what steps should be taken and the challenges in doing so?	

Level	Elements	Capacity Assessment Items	Corresponding Medium-term Objective(s)	Criteria	Comments/Remarks
Organizations	Organizational forms and management	(5) Awareness of policymakers	1-2	Is the leadership adequately aware of the issues? Do they need awareness building?	As water pollution control is generally given low priority, the key is whether the understanding and support of policymakers will be achieved.
				Are they committed to compliance with the laws and regulations?	
				Is the leadership's awareness of issues supported by data evaluation and analysis, laws and regulations, and financial measures? Or do they just resort to wishful thinking?	
				Do they stage information campaigns and conduct lobbying activities for environmental management?	Do the policymakers perceive the issues in relation to the available means to solve them (project funds, changes in budget allocations, project implementing arrangements, etc.)?
				Does the leadership play a leading role in putting solutions into practice?	
		(6) Corporate environmental management capacity Including the following sub-targets: • Developing systems for the proper enforcement of the regulations • Building and strengthening corporate environmental management systems	1-1 1-5	Has the business introduced in-house environmental management activities (5S, energy saving, CP, EOP equipment, ISO 14000, etc.)?	Though essential to economic development, production activities by businesses constitute a major source of pollution in the context of WEM. Japan once experienced tremendous water pollution. The after-the-fact response resulted in enormous damage and immense costs for remedial measures that could have been prevented. Prompt action to minimize such damage and the costs of environmental recovery is essential for economic development that protects the environment. The key here is to promote corporate environmental management systems and cooperation among businesses. Is there a framework or arrangements at work to ensure such promotion?
				Is the business prepared to accept technical assistance and guidance from the authorities?	
				Does the business have a mechanism for sharing experiences within the industry sector for promoting environmental management?	
				Does the business conduct voluntary monitoring and report its findings to the authorities?	
				Is the reliability of the findings of such voluntary monitoring put under scrutiny?	
				Is the business well organized for environmental management and pollution control? Is that due to the initiative of the business, administrative guidance or the legal framework?	
				Does the business evaluate its Environmental Performance (EP)? Is the evaluation of EP made public to consumers? Do the authorities evaluate the EP of the business?	
				Do the authorities have cooperative relationships with trade organizations, business associations, etc.?	Small and medium-sized enterprises are predominant in developing countries. Is there a system in place to encourage pollution control?
				Is an industrial association for environmental conservation or a similar organization in place to share experiences among businesses?	
				Is there a mechanism in place for financing and technical advice to promote investments in water pollution control by businesses?	
				Are programs in place to promote measures to reduce pollutant discharges (waste minimization, clean technology, etc.) for businesses in industrial areas?	Effluent standards based on BAT available in North America and Europe are often unattainable (see Appendix 3, 3-1-3).
				Does the business disseminate information to the civil society?	
				Does the business have in place a system that is equivalent to the Pollution Control Manager System of Japan?	
	Human assets	(7) Human resources and their capabilities in (central and local) government organizations	1-2	See the "criteria" for "(2) Central government organizations".	Qualitative assessment of human resources at government organizations, including their capabilities is a formidable task, except for experts in this field. This table is therefore designed to make a qualitative assessment of the human assets as a whole based on the assessment of the current state of affairs, the track record and performance in the light of the "criteria".
				See the "criteria" for "(3) Local government organizations".	
		(8) Human resources and their capabilities in businesses	1-2	See the "criteria" for "(6) Corporate environmental management capacity".	
		(9) Human resources and their capabilities in civil society organizations	1-6	See the "criteria" for "(30) Environmental education and learning".	
		(10) Human resources and their capabilities in universities and other research institutions Including the following sub-targets: • Providing information to and seeking more engagement of government, industry and the civil society	1-7	Does the institution have a list of people with a scientific knowledge of WEM?	
				Is there a mechanism in place for universities, public sector research institutions, and industrial research institutions to work together? Are seminars, workshops and other opportunities made available for this purpose?	
				Does the institution make public technical information regarding water pollution control as part of its research achievements?	
				Does the institution have a mechanism to mobilize its human resources and their capabilities?	

Level	Elements	Capacity Assessment Items	Corresponding Medium-term Objective(s)	Criteria	Comments/Remarks
Organizations	Intellectual assets	(11) Water quality monitoring planning for public waters	1-4	Is continuous monitoring of public waters (including groundwater) provided for by a relevant law?	In Japan, the Water Pollution Control Law calls for continuous monitoring. The law provides that the prefectural governor draw up a monitoring plan, conduct monitoring, make the monitoring findings public, and report them to the Minister of the Environment.
				Does the law clearly define who plans quality monitoring, who conducts it, and to whom the monitoring findings are reported?	
				Does the monitoring plan specify what, where and how to monitor and provide for making the monitoring findings public?	
		(12) Water environment monitoring Including the following sub-targets: • Building the framework for and improving the accuracy of water quality monitoring • Promoting the accumulation and utilization of water quality data and disclosure of related information • Developing systems for the proper enforcement of the regulations	1-1 1-4	If continuous monitoring of public waters (including groundwater) is provided for by law, is such monitoring actually conducted?	Is the monitoring a mere formality/effective? For comparison, visit the websites of the Ministry of the Environment and prefectural governments of Japan to check the types, quantities and accuracy of information on the water environment available on these sites.
				Is a monitoring database available?	
				Is there a group in charge of analyzing the monitoring data?	
				To whom and to what extent are the findings of monitoring data analysis made accessible?	
				How accurate is the monitoring data? Is it accurate enough to be made public?	
				Are the findings of monitoring data analysis compiled into a report and used for strengthening water quality management?	
				Is a draft of the State of Environment (SOE) presented for review to a cross-sectoral coordination mechanism such as a council of the government offices concerned?	
		(13) Monitoring of pollution sources (factories and other establishments) Including the following sub-target: • Developing systems for the proper enforcement of the regulations	1-1 1-4	Are factories and other establishments that discharge wastewater required by law to notify the authorities in writing?	In Japan, the Water Pollution Control Law provide for mandatory reporting, restrictions on the discharge of effluent, corrective orders, and monitoring of the pollution levels in effluent. Is the administrative action a mere formality. Or is it effective? Pollution source control in small-scale factories is the key as they dominate in developing countries. Small-scale factories often lack the technical and financial resources to observe the standards. Are arrangements in place to develop the technical, financial and human resources of businesses in stages? Imagine a case in which a sewage system has been constructed where the authorities do not take action to control the discharge of effluent from factories and other establishments in the form of supervision, corrective orders or administrative guidance. The sewage treatment plant within the system that receives such effluent may be grouped into factories and other establishments subject to effluent standards and held accountable accordingly.
				Is wastewater from factories and other establishments required by law to meet effluent standards?	
				Does the head of the local government have the authority to issue orders to take corrective measures or suspend the discharge of effluent altogether?	
				Are those who discharge effluent from factories or other establishments required by law to monitor and record the pollution levels in the effluent?	
				Is there a group of people who have sufficient knowledge and expertise to monitor pollution sources?	
				Does the head of the local government provide appropriate guidance to factories and other establishments that discharge pollutants?	
				Do the authorities keep track of their on-site inspections and follow-up measures (corrective orders, orders to suspend operations, financial penalties)?	
				Do the authorities keep track of pollutant discharges in the form of a database and use this database for water quality management?	
				Have the authorities made pollution maps on which major pollution sources for each river basin are plotted, together with pollution data for each pollution source, including the types and quantities of pollutants?	
				Have the authorities identified areas and businesses that need special attention in terms of water pollution?	
				Are programs in place to promote measures to reduce pollutant discharges (waste minimization, clean technology, etc.) for businesses in industrial areas?	
				Are regulatory standards appropriate in the light of the situation related to supervision, corrective orders and administrative guidance?	
				Do the authorities have the capacity to provide technical guidance to reduce pollution discharges in each industrial sector? Are manuals available for such purposes?	

Level	Elements	Capacity Assessment Items	Corresponding Medium-term Objective(s)	Criteria	Comments/Remarks
Organizations	Intellectual assets	(14) Accumulation and dissemination of environmental information	1-4	Are statistics and other information available regarding environment stress, the state of the environment and environmental management?	For comparison, visit the websites of the Ministry of the Environment and prefectural governments of Japan to check the types and accuracy of information on the water environment available on these sites.
				Is the state of pollution of public waters assessed at the central and local levels? Is such information made available to local people through environmental reports, websites and other media?	
				Is there a mechanism in place to warn local people in the case of a water pollution emergency?	
		(15) Improvement of scientific knowledge Including the following sub-targets: • Developing research capabilities • Developing the capacity of the government officials in charge	1-4 1-7	Is research on the water environment promoted? What is the track record of such research?	Research on the water environment is often insufficient in developing countries. In such cases, check whether efforts to address environmental issues are being made at the national level that involve industry, government and academia or whether the authorities have basic resources for environmental administration based on environmental science.
				Do businesses, universities, research institutions, and NGOs with a scientific background support the authorities as groups of environmental scientists and engineers?	
				Is scientific knowledge put to use for water pollution control strategies?	
				Is there an active academic society on the water environment?	
				Do the stakeholders have access to groups of environmental scientists and engineers?	
		(16) Manuals for WEM Including the following sub-targets: • Developing the capacity of the government officials in charge	1-2 1-4	What kinds of manuals are available and actually used?	Are the manuals standardized across the organization? Are they actually put to practical use? There is no point in make manuals available if they are not updated or are otherwise useless.
				Water environment monitoring; monitoring data analysis	
				Monitoring of pollution sources (factories and other establishments)	
				Corporate environmental management	
				Emergency response when a pollutant causing health hazards is discharged into a river system	
	Physical Assets	(17) Financial measures by the central government for developing facilities Including the following sub-targets: • Financial planning	1-3	Do the basic and sectoral laws provide that the central government take the necessary financial measures for environmental conservation efforts by local governments?	A water pollution control program is unlikely to produce tangible results without long-term and unremitting commitment to its implementation. A program that is implemented by a local government with inadequate financial resources is bound to be aborted unless the central government makes clear the details, targets and conditions of its financial assistance.
				Has the central government ever granted subsidies based on the above provision?	
		(18) Financial measures by local governments for developing the facilities Including the following sub-targets: • Financial planning	1-3	Has the target local government ever received subsidies from upper-tier organizations? Is it making efforts to secure such subsidies?	With dim prospects for securing funds, a development project for a facility will not be feasible even if it is judged so according to a feasibility study. It is almost impossible to construct a water pollution control facility using loans alone. Even if it is possible, it is usually difficult to sustain the operation and maintenance of the facility.
				Does the target local government have a financial program for water pollution control facilities?	
				Or does it depend solely on loans because of the absence of a financial program?	
		(19) Operation and maintenance costs of the facilities Including the following sub-targets: • Adopting the Polluter-Pays Principle • Studying appropriate cost recovery options	1-3	Is there an organization for operating and maintaining facilities?	Small and medium-sized entities are most likely to be unable to keep track of the balance and the operational status. In such cases, it may be possible to start a facility development project, but financial problems are bound to surface later. Large amounts of additional investments will only increase the operating and maintenance costs where the existing facilities are poorly operated and maintained. This is not a viable option. In general, the operating and maintenance of water pollution control facilities is given a particularly low priority. It is given top priority in reducing budget allocations at the time of budget deficits. Caution should be exercised where such facilities have been left dilapidated.
				Is the Polluter-Pays Principle provided for by law. Is it actually applied?	
				Has the local government established an appropriate cost recovery scheme for the operation and maintenance of facilities in its ordinances or elsewhere?	
				Does the local government keep track of the balance of the operation and maintenance costs of facilities and make it transparent?	
				Does the local government provide for measures to be taken when the operation and maintenance costs of the facilities are not fully recovered?	
				Are the facilities left dilapidated because operating and maintenance costs are not fully recovered?	
				Are the facilities in operation? If not, what is the reason?	

Level	Elements	Capacity Assessment Items	Corresponding Medium-term Objective(s)	Criteria	Comments/Remarks
Organizations	Physical assets	(20) Existing water pollution control facilities		Is the organization responsible for the operation and maintenance of the facility clearly defined?	If the organization in charge and the scope of operations of the facility are not clearly defined, the chances are that the problems with its operation and maintenance have not been identified.
				Are the area coverage, population coverage and throughput of the facility clearly defined?	
				Are the authorities and local communities doing what they can do, for example, by installing low-cost sanitation units?	
				What system is in place for stormwater drainage?	Imagine the situation in which people dump wastes into waterways and sewers and the authorities or local communities do nothing about it. If local communities only complain about poor sewerage, stormwater drainage or how polluted the waters are, then there is little chance that things will get better.
				Are the authorities and local communities trying to reduce pollution load generation?	
				Are the authorities resorting to making excuses, citing the lack of financial and human resources, for example?	
				Does each facility have an inventory of pollution sources?	
				Is the operation of the facility kept track of?	
		(21) Development of laboratories Including the following sub-target: • Developing capabilities for water examination, including water quality	1-4	Are laboratories for water quality monitoring and other related purposes in place at the national and local levels?	Are facilities and equipment available that ensure compliance with the relevant laws and regulations? Operation and maintenance costs for them are fully funded?
				Does the central government take financial measures or provide accuracy management support for local laboratories?	
				Do the laboratories have equipment with sufficient precision for the analysis parameters and operate and maintain it properly? (See Table A5-2)	
Institutions and social systems	Legal framework	(22) Development of an effective legal and regulatory framework I (Establishment of an environmental legal system and basic law)	1-1	Are basic and sectoral laws in place that constitute a legal system necessary for water environment management?	Many developing countries have environmental legal systems comparable in level to those in developed countries. Yet environmental laws in developing countries have been established largely by incorporating laws and standards in the developed countries of western industrialized societies. Such laws are most likely to prove ineffective in implementing environmental regulations without an adequate framework for environmental monitoring. Although the environmental legal system of Japan may not be the best for developing countries, it is worth reviewing the structure of Japanese laws related to WEM in order to understand how Japan's environmental legal system is organized. This provides an avenue to gauging whether the environmental legal system of the recipient country is workable and identifying where the drawbacks lie. See Table A3-6. Basic law • Basic Environment Law • Basic Environment Plan (at the national level) • Basic environmental ordinances (at the local level) Sectoral laws: • Water Pollution Control Law • Sewerage Law • Law Concerning Special Measures for the Conservation of the Environment of the Seto Inland Sea • Law Concerning Special Measures for the Conservation of Lake Water Quality • Law Concerning the Improvement of Pollution Prevention Systems in Specific Factories
				Does the basic law lay down basic principles?	
				Does the basic law define the responsibilities of the central government, local governments, corporations and the citizens?	
				Does the basic law provide for basic policy considerations for environmental conservation?	
		(23) Development of an effective legal and regulatory framework II (Establishment of sectoral laws) Including the following sub-target: • Developing systems for the proper enforcement of the regulations	1-1	Do the sectoral laws stipulate that factories and other establishments that discharge effluent into public waters notify the authorities in writing?	
				Do the sectoral laws allow the authorities to suspend the discharge of effluent that fails to meet the standards from factories and other establishments?	
				Do the sectoral laws provide that corporations be liable for compensation for damage if the effluent they discharge from their factories or other establishments causes damage to human health?	
				Do the sectoral laws stipulate that the authorities promote domestic wastewater control as part of their efforts to control the pollution of public waters (including groundwater)?	
				Do the sectoral laws stipulate that the authorities designate priority areas and establish a framework for pollution control?	
				Do the sectoral laws provide for both "carrots" such as subsidies and other incentives and "sticks" such as penalties?	
	Standards	(24) Development of an effective legal and regulatory framework III (Establishment of environmental standards)	1-1	Are environmental standards in place? Are they divided into standards for protecting human health and those for conserving the living environment?	Some argue that applying Japan's environmental standards to developing countries is inappropriate. Yet it may be helpful for developing countries to review these standards and understand their structure and the ideas behind them. See Table A3-2. Environmental standards are government targets that should be achieved to protect human health and conserve the living environment. In this sense, they should be relevant to developing countries as well.
				In the category of standards for conserving the living environment, are standards subdivided into classes according to the different uses of rivers, lakes and coastal seas?	
				Do the authorities disclose information on whether and to what extent the environmental standards are met for each water body or river?	
				Are the environmental standards appropriate in the light of whether and to what extent they are met?	
		(25) Development of an effective legal and regulatory framework IV (Establishment of effluent standards) Including the following sub-target: • Developing systems for appropriate enforcement of regulations	1-1	Do the effluent standards cover both water quality criteria regarding the conservation of the living environment and those regarding the protection of human health?	It is difficult to plan or implement water pollution control measures without effluent standards (realistic effluent standards to be precise) in place. Effluent standards based on BAT available in North America and Europe are often unattainable (see Appendix 3, 3-1-3).
				Are the effluent standards applied throughout the country? Or are local governments allowed to apply more stringent standards?	
				Given the state of compliance on the part of factories and other establishments, are the effluent standards set at realistic levels?	

Level	Elements	Capacity Assessment Items	Corresponding Medium-term Objective(s)	Criteria	Comments/Remarks
Institutions and social systems	Policies/politics	(26) Formulation of a water management policy Including the following sub-target: • Developing the capacity of the government officials in charge	1-1	Is there a national program for water pollution reduction or a similar program in place for water pollution reduction at the national level?	Water environment management (WEM) is most often given low priority in the developing world. It is therefore important that the central government announce its commitment to WEM and give it priority in relation to other related issues. Otherwise, the target city is unlikely to be able to secure support from the central government for its water pollution control projects.
				Have the central and local governments committed themselves to addressing water pollution in their policies?	
				Have they failed to translate such commitment into action due to an inadequate framework or arrangements for doing so?	
				Does the water management policy incorporate measures for encouraging businesses to address water pollution using economic incentives?	
				Are the authorities making sustained and incremental efforts?	
		(27) Water quality management planning Including the following sub-target: • Developing the capacity of the government officials in charge	1-1	Do local governments have water quality management plans?	Check the criteria while taking account of the 4 processes of environmental management: monitoring, data evaluation and analysis, policy making, and policy implementation.
				Have the authorities concluded pollution control agreements with major businesses?	
				Do the authorities have unified, organization-wide techniques for designing programs and analyzing water quality data?	
				Do the authorities take account of integrated water management in planning water quality management?	
				Is there a water quality conservation plan in place for the target water body?	
				Are there sewerage and other infrastructure development plans in place for the country and major cities?	
	Infrastructure	(28) Basic infrastructure		Road conditions and traffic accessibility in the target area	Gather information on the basic infrastructure in relation to water pollution control, the state of information disclosure, and access to information.
				Housing and population density	
				Water supply coverage in the target area	
				Means of communication and the percentage of people with access to them in the target area	
				The percentage of people with access to the Internet	
		(29) Environmental management capacity of communities	1-6	Does the community carry out information campaigns on deteriorating water environments and their impact on health and the living environment?	WEM is not possible with the efforts of the authorities alone. The widest range of actors is encouraged to participate in WEM so that the authorities and businesses can better address water pollution.
				Does the community have a mechanism for mobilizing human resources for WEM from a wide range of sectors?	
				Do the 4 key actors–government, industry, civil society and academia–share accurate environmental information?	
				Do the citizens clean rivers and waterways on their own initiative?	
				Are the citizens building their awareness and stepping up their pressure on pollution sources through basic water quality monitoring and other means?	
	Social organizations	(30) Environmental education and learning Including the following sub-target: • Raising public awareness concerning the conservation of aquatic environments	1-6	Do the central and local government prepare state of the environment reports and make them public to raise public awareness of water pollution?	Citizens are involved in water pollution as both victims and generators. It is important that each citizen tries to reduce pollution generation and at the same time avoid the associated hazards.
				Are teaching materials and manuals made available?	
				Are efforts being made to improve accessibility to environmental information (through the distribution of literature, offering opportunities for hands-on learning, mounting information campaigns and other means)?	
				Are efforts being made to train leaders?	
				Are networks in place for environmental education and learning?	
				Do schools offer environmental education courses?	
		(31) Promotion of environmental firms Including the following sub-targets: • Encouraging private participation in environmental management and promoting environmental conservation industries	1-5	Are reliable water quality analysis firms readily available?	Businesses usually do not have sufficient resources for the design, construction, operational management, and discharge monitoring of effluent treatment systems on their own, leaving much room for the development of private-sector environmental consultants.
				Are environmental consultants readily available?	
				Are consulting firms related to water pollution control readily available (that offer advice on cleaner production, water-saving technologies, etc.)?	
				Are official systems in place to certify private-sector engineers and technicians (pollution control managers, environmental measurers, etc.)?	

Source: Compiled by Haruo IWAHORI

Table A3-5 Check List for Assessing and Judging the Priority of Proposed Projects

<Explanation>
Purpose: This table is designed to assess and judge the priority of proposed projects by placing the background factors into perspective.
How to use the table: This check list is organized into a hierarchical structure, comprising the main categories, subcategories, criteria (background factors), and key considerations.

Main Category		Subcategory	Criteria (background factors)	Key Considerations
For the recipient country	Policies/ politics	Basic policy Basic plan	Is there a national program for water pollution reduction or a similar program in place for water pollution reduction at the national level?	Water environment management (WEM) is most often given low priority in the developing world. It is therefore important that the central government announce its commitment to water pollution reduction and give it priority in relation to other related issues. Otherwise, the target city is unlikely to be able to secure support from the central government for its water pollution control projects.
			Have the central and local governments committed themselves to addressing water pollution in their policies?	
	Legal and regulatory framework	Environmental legal system Basic law	Are the basic and sectoral laws in place that constitute the legal system required for water environment management?	Unless WEM is stipulated in the basic law, the sustainability of project implementation is called into question.
			Does the basic law define the responsibilities of the central government, local governments, corporations and citizens?	
		Sectoral laws	Are the sectoral laws that concern a proposed project in place?	Such sectoral laws include a water pollution control Law and the sewerage law if the project concerns sewerage.
		Environmental standards Effluent standards	Are environmental and effluent standards in place?	There is little rationale for planning and implementing water pollution control measures unless environmental and effluent standards are in place or without efforts to observe such standards.
			Do the authorities disclose information on whether and to what extent the environmental standards are met for each body of water or river?	
	Financial measures	Financial measures by the central government for developing the facilities	Do the basic and sectoral laws provide that the central government take the necessary financial measures for environmental conservation efforts by local governments?	A water pollution control program is unlikely to produce tangible results without long-term and unremitting efforts for its implementation. A program that is implemented by a local government with inadequate financial resources is bound to be aborted unless the central government makes clear the details, targets and conditions of its financial assistance.
			Has the central government ever granted subsidies based on the above provision?	
For the target city	Policies/ politics	Water quality management planning	Do local governments have water quality management plans?	Take a development study report, for example. Its value will depend on how the report will fit within the water pollution control program of the recipient country. Without such a program, the study will be in a precarious position. Check the criteria while taking account of the four processes of environmental management: monitoring, data evaluation and analysis, policy making, and policy implementation.
			Is there a water quality conservation plan in place for the target water body?	
			Are there sewerage and other infrastructure development plans in place for the country and major cities?	
	Legal and regulatory framework	Law enforcement	Where continuous monitoring of public waters (including groundwater) is stipulated by law, is it actually implemented?	A pollution load reduction program will be made useless by the absence or insufficient implementation of relevant laws. Imagine the case in which a sewage system has been constructed where the authorities do not take action to control the discharge of effluent from factories and other establishments in the form of supervision, corrective orders or administrative guidance. The sewage treatment plant within a system that receives such effluent must be grouped according to “factories and other establishments” subject to effluent standards and held accountable.
			Is wastewater from factories and other establishments required by law to meet effluent standards? Is such wastewater monitored for conformity?	
	Organizations	Local government organizations	Is there an environmental department at the local level in charge of water environment administration?	Gauge whether the organization is fulfilling its responsibility for the local environmental policy while taking account of the four processes of environmental management: monitoring, data evaluation and analysis, policy making, and policy implementation. Gauge whether the division of responsibility is clearly defined between the central and local governments and both are fulfilling their own responsibilities.
			Is the organization fulfilling its responsibility for water environment management (WEM) at the local level? Is it taking measures tailored to meet local needs and conditions?	
			Does the local government execute the powers granted to them? Notably, does it monitor both public waters and pollution sources and take necessary measures such as supervision, corrective orders and administrative guidance?	
		Policymakers' awareness and leadership	Is the leadership sufficiently aware of the issues? Do they need awareness raising?	As water pollution control is generally given low priority, the key is whether the understanding and support of policymakers can be obtained. Do the policymakers perceive the issues in relation to the available means to solve them (project funds, changes in budget allocations, project implementing arrangements, etc.)?
			Is the leadership’s awareness of the issues supported by data evaluation and analysis, laws and regulations, and financial measures? Or do they just resort to wishful thinking?	
			Do the leadership play a leading role in putting solutions into practice?	
		Administrators	What are the relationships like between the counterpart organization and the administrator of the target water body and those of water pollution control projects? Does the counterpart organization have clout over such administrators?	Take a development study report, for example. Its position and utility value largely depend on whether the counterpart organization serves as the administrator as well. If it does not, that constitutes a constraint on project implementation.
	Finance	Financial measures by local governments for developing the facilities	Has the target local government ever received subsidies from upper-tier organizations? Is it making efforts to secure such subsidies?	With no prospects for securing funds for water pollution control, the development study may not translate into a development project or have any result. It is almost impossible to construct a water pollution control facility using loans alone. Even if it is possible, it is mostly difficult to sustain the operation and maintenance of the facility.
			Does the target local government have a financial program for water pollution control facilities?	
			Or does it depend solely on loans?	

Main Category		Subcategory	Criteria (background factors)	Key Considerations
For the target city	Finance	Operation and maintenance costs of the facilities	Has the local government established an appropriate cost recovery system for the operation and maintenance of facilities in its ordinances or elsewhere?	In how much detail does the local government keep track of the balance? Is the user-pays principle in place? Small and medium-sized entities are most likely unable to keep track of the balance and the operational status. In such cases, it may be possible to start a facility development project, but financial problems are bound to surface later. The operation and maintenance of water pollution control facilities is given top priority in reducing budget allocations at times of budget deficits. Caution should be exercised where such facilities are left dilapidated.
			Does the local government keep track of the balance of operation and maintenance costs of facilities and make them transparent?	
			Are the facilities left dilapidated because operation and maintenance costs are not fully recovered?	
For the target water body	Basic information	Population	Distribution, growth rate, density	What is the total area of the highly-populated districts in the target city? Is the cost-effectiveness of the selected option high enough? Note that the maximum capacity of the on-site treatment option (septic tanks, etc.) is estimated at 100 liters per day in terms of per capita water consumption and at 250 to 300 people per hectare in terms of population density. As the population density increases in the urbanization process, the on-site treatment option will have to be replaced with off-site options (sewerage systems, etc.).
		Land area; districts	Residential districts of high and low income communities; highly-populated districts	What problems are occurring in which district? Are the problems appropriate targets for development interventions?
		Income	Per capita GDP	There is no direct association between the implementation of water pollution control and per capita GDP. Yet per capita GDP provides a useful indicator as to whether the recipient country is developed enough to mobilize financial resources for water pollution control. This is because social infrastructure development generally starts from the high priority sectors goes down to the low priority sectors [including water pollution control] in parallel with the country's economic development.
		Key industries	Existence of factories and other establishments	Effluent from factories and other establishments can be best controlled by ensuring that effluent regulations are strictly observed. Still, can the businesses in the target area afford to comply with them?
	Relative importance	Functions and features	Capital, industrial, commercial, etc.	Does the target city (often the capital or the second largest city) have essential functions? Is it appropriate as the aid recipient?
		Scale	Population size	How does the target city rank in terms of population across the recipient country? What features does it have? This is especially important for regional cities. If the target city is a regional one, does it have a special feature that highlights the importance of the project? For example, is it designated as an Environment Model City?
	Basic information	Name of the river system, river or lake	e.g., the Tone River system, the Edo River	How important is the river system, river or lake? Is it surpassed by others in terms of importance or symbolic value?
		Basin status	The length of the river channel or the area of the lake	How large? A comparison with rivers and lakes in Japan will provide a clear picture.
			The catchment area	What part of the basin does the development study cover? What implications does that have? Does it cover all the important areas? Does it include unnecessary areas?
		Health status	Prevalence of waterborne diseases according to the body of water and the region	Does the target water body deserve attention in terms of health status? Does the recipient country have a more important water body in this regard?
		States/provinces and cities involved		Is it an important region or city? Is it appropriate as a target of development assistance?
	Relative importance	Problems and pollution loads upstream	Water uses, pollution loads	Will the problem be solved within the geographical scope of the development study? Is there a major problem outside its scope? In the upper reaches of the river, for example?
		Water uses downstream	Drinking water sources, agriculture, fisheries	Is solving the problem in the target water body important in light of the water uses downstream?
		The national environment	Notable environmental conditions	Are there any animals or plants that need special protection?
	Pollution source	Types of pollution sources	Point source or non-point source	What are the major pollution sources? Have they been identified? (see Appendix 5)
		Pollution control at the source	Conditions of each of the household, industrial/business, municipal, and other types of pollution sources	What measures are being taken to control pollution at the source? Is there a possibility that such measures will be taken? (see Appendix 5)
	Pollution status	Accumulation and dissemination of environmental information	Is information available regarding environment stress, the state of the environment and environmental management?	For comparison, visit the websites of the Ministry of the Environment and prefectural governments of Japan to check the types and accuracy of information on the water environment available on these sites.
			Is the state of pollution of public waters assessed at the central and local levels? Is such information made available to local people?	
		Water quality criteria regarding the protection of human health	Inorganic substances, heavy metals, organochlorine compounds, etc.	Assess the levels of pollution of the target water body caused by hazardous substances in the light of the water quality parameters and criteria for protecting human health in Table A3-1. Data over a period of 5 years or more may be necessary to follow the trends.
		Water quality criteria regarding the conservation of the living environment	BOD, COD, total nitrogen, total phosphorus, etc.	Assess the levels of pollution of the target water body caused by hazardous substances in the light of the water quality parameters and criteria for conserving the living environment in Table A3-2. Data over a period of 5 years or more may be necessary to follow the trends.

Main Category		Subcategory	Criteria (background factors)	Key Considerations
For existing water pollution problems	Developments	Past occurrences	Description, timing, scale and frequency	Gather data on the changes in the pollution levels (as mentioned above) over the years and obtain a chronological account of water pollution occurrences. Gauge whether the levels are too high for the intended water uses. Too high a level of pollution in a lake is likely to cost a vast amount of money to reduce it. Developing countries may not be able to afford to implement pollution control for such a lake. In this context, Lake Teganuma in Chiba Prefecture, Japan provides a valuable lesson. The lake is rather small, with an area of 6.5 square kilometers(km^2). The basin is 150 km^2 in area, with a population of 480,000 (in 2001). Yet as much as 446.9 billion yen was spent for water quality conservation between 1984 and 2002.
		Present occurrences	Description and scale	
		Occurrence forecasts	Description and scale	
	Impact	Impact on the target area	Pollution levels of drinking water sources	Assess the impact on the drinking water sources, the living environment and the water environment given the pollution levels (as mentioned above) and the developments of the existing problem.
			The levels of pollution of the living environment	
			Pollution levels of the water environment	
		Impact on a wider area	Pollution levels of drinking water sources	Does the problem impact the target city only? Or does it impact a wider area, including the lower reaching of the river?
			The levels of pollution of the living environment	
			Pollution levels of the water environment	
		Impact on historical ruins and cultural assets		Will the historical ruins and cultural assets in the basin affected? Are there any other matters that need special attention?
		Comparison with other cities in terms of the incidence of water pollution	Description, scale and frequency	Is a similar problem occurring in other cities that are more important than the target city in terms of population or other factors? If so, why is a higher priority given to the target city? Is that priority appropriate in the face of hundreds of incidences of water pollution and hazards that may exist elsewhere in the recipient country?
	Magnitude of the problem	Urgency	Trend in the pollution levels over the years	Are the pollution levels increasing rapidly? Judging by Table A3-1, will that possibly impact human health?
		Seriousness	Water quality parameters below standards and their health effects	Judging by Table A3-1, is the problem having health effects?
		Risks in the case of taking no action	Pollution reduction potential; how high above the standards	Are the health effects on the rise? Is the pollution reduction potential low, once pollution occurs? Are there concerns that hazardous substances will accumulate?
	Information	Availability and the level of organization of the information		Are self-help efforts being made to address the problem, including gathering information and arranging it in the proper order?
Others	Attitude of local authorities and communities	Self-help	Do the citizens clean rivers and waterways on their own initiative?	Are wastes being dumped into waterways and sewers? Are the authorities or local communities doing anything about it? If local communities do not make such efforts and just complain about poor sewerage, stormwater drainage or how polluted the water is, then there is little chance that things will get any better.
			Are the authorities and local communities doing what they can, for example, by installing low-cost sanitation units?	
			Are the authorities and local communities trying to reduce pollution load generation?	
			Are the citizens building their awareness and stepping up their pressure on pollution sources through basic water quality monitoring and other means?	
			Are the authorities resorting to making excuses, citing the lack of financial and human resources, for example?	
	Cost-effectiveness	Scale of the development study	Population, pollution growth rate and pollution density of the target area	The purpose of a cost-benefit analysis of a public works project is to express the benefit of the project in terms of its monetary value in relation to the cost incurred. It the project formulation process, however, accurate cost estimation is difficult. Rough cost estimations can be made based on the population covered by the development study, including its growth rate and density.
		Utilization of the findings of the development study	The area of the target city; that of the water body	If the scope of the development study is too large, the chance is that a huge amount of funds will be required. If only part of the study findings are not translated into action for financial reasons, then there will be a long way to go before solving the problem. It is therefore necessary to ascertain whether the recipient country can afford to invest heavily in water pollution control and whether the study findings will be put to good use in the light of the level of economic development of that country.
			Scale of the pollution	If the scope and level of water pollution is too great, the chance is that a huge amount of funds will be necessary to control it. If only part of the findings of the development study are not translated into action for financial reasons, then its implementation will make only a minor contribution towards solving the problem. It is therefore necessary to ascertain: (i) whether the recipient country is developed enough to accumulate scientific knowledge and data; (ii) whether the country can afford water pollution control, and (iii) whether the study findings–notably the project to be formulated–are appropriate in the light of (i) and (ii).
	Possible coordination with other programs and projects	Existence of related programs and projects		Will the project alone solve the problem? Is it necessary to implement it in coordination with another project or projects?
		Moves by other donors		Are other donors interested? If not, the chances are that the target city has problems with its institutions, organizations or operational management.
	Timing of project implementation	In relation to the pollution level		Is the problem urgent in the light of the pollution levels?
		In relation to the magnitude of the problem		Is the problem urgent in the light of the seriousness of its impact?
		In relation to other programs and projects		Is the timing right to produce significant outcomes?

Source: Compiled by Haruo IWAHORI

Table A3-6 Japanese Laws Related to Water Environment Management and their Structure

<Explanation>
Purpose: This set of tables provides an insight into how the legal system can be structured for water environment management. Specifically, they are intended as a tool to understand the mechanism of the legal framework of Japan, covering such aspects as devolution, financial measures, supervision, corrective orders, administrative guidance and penalties. This will help project planners to better understand the legal systems of the recipient countries and thus improve their capabilities for capacity assessment. For the provisions of these laws, search the Internet.

Basic Environment Law (basic law)	
Chapter I	General Provisions
Article 1	(Purpose)
Article 2	(Terminology)
Article 3	(Enjoyment and Future Success of Environmental Benefits)
Article 4	(Creation of a Society that Ensured Sustainable Development with Reduced Environmental Load)
Article 5	(Active Promotion of Global Environmental Conservation through International Cooperation)
Article 6	(Responsibility of the State)
Article 7	(Responsibility of Local Governments)
Article 8	(Responsibility of Corporations)
Article 9	(Responsibility of Citizens)
Article 10	(Environment Day)
Article 11	(Legislative Measures, etc.)
Article 12	(Annual Report)
Article 13	(Prevention of Air Pollution and the like by Radioactive Substances)
Chapter II	Basic Policies for Environmental Conservation
Section 1	Guidelines for Policy Formulation
Article 14	
Section 2	Basic Environment Plan
Article 15	
Section 3	Environmental Quality Standards
Article 16	
Section 4	Environmental Pollution Control in Specific Areas
Article 17	(Formulation of Environmental Pollution Control Programs)
Article 18	(Promotion of the Attainment of Environmental Pollution Control Program)
Section 5	Implementation of Policies for Environmental Conservation by the State
Article 19	(Considerations in the Formulation of Policies by the State)
Article 20	(Promotion of Environmental Impact Assessment)
Article 21	(Regulations to Prevent Interference with Environmental Conservation)
Article 22	(Economic Measures to Prevent Interference with Environmental Conservation)
Article 23	(Promotion of Construction of Facilities and Other Projects for Environmental Conservation)
Article 24	(Promotion of the Use of Products Contributing to Reduction of Environmental Load)
Article 25	(Education and Learning on Environmental Conservation)
Article 26	(Measures to Promote Voluntary Activities by Private Organizations)
Article 27	(Provision of Information)
Article 28	(Implementation of Research)
Article 29	(Improvement in Systems for Monitoring and Other Matters)
Article 30	(Promotion of Science and Technology)
Article 31	(Settlement of Environmental Pollution Disputes and Relief from Damage)
Section 6	International Cooperation for Global Environmental Conservation, etc.
Article 32	(International Cooperation for Global Environmental Conservation, etc.)
Article 33	(Ensuring International Cooperation for Monitoring, Observation and Other Matters)
Article 34	(Measures to Promote Activities by Local Governments and Private Organizations)
Article 35	(Considerations in the Implementation of International Cooperation and Other Matters)
Section 7	Implementation of Policies by Local Governments
Article 36	
Section 8	Cost Bearing and Financial Measures
Article 37	(Cost Bearing by those Causing Damage)
Article 38	(Cost Bearing by the Beneficiaries)
Article 39	(Financial Measures for Local Governments)
Article 40	(Cooperation between the State and Local Governments)
Chapter III	Environment Council, etc.
Section 1	Environment Council
Article 41	(Central Environment Council)
Article 42	(Organization of the Central Environment Council)
Article 43	(Prefectural Environment Councils)
Article 44	(Municipal Environment Councils)
Section 2	Conference on Environmental Pollution Control
Article 45	(Establishment and Mandates)
Article 46	(Organization, etc.)

Water Pollution Control Law (sectoral law)	
Chapter I	General Provisions
Article 1	(Purpose)
Article 2	(Definitions)
Chapter II (1)	Regulation of the Discharge of Effluent, etc.
Article 3	(Effluent Standards)
Article 4	(Advice Concerning Effluent Standards)
Article 4-2	(Fundamental Policy for the Reduction of the Total Amount of Pollution)
Article 4-3	(Plan for Reduction of the Total Pollution Load)
Article 4-4	(Promotion of the Implementation of the Plan for the Reduction of the Total Pollution Load)
Article 4-5	(Total Pollutant Load Regulating Standards)
Article 5	(Report on the Installation of Specified Facilities)
Article 6	(Transitional Measures)
Article 7	(Report on Changes in the Structure of Specified Facilities, etc.)
Article 8	(Order to Change Plans, etc.)
Article 8-2	
Article 9	(Restrictions on the Installation of Facilities)
Article 10	(Report on Changes in the Name of Persons, etc.)
Article 11	(Inheritance)
Article 12	(Restrictions on the Discharge of Effluents)
Article 12-2	(Obligation to Observe Total Pollutant Load Regulation Standards)
Article 12-3	(Restrictions on the Permeation of Specified Percolated Water)
Article 13	(Orders for Improvement, etc.)
Article 13-2	
Article 13-3	(Guidance, etc.)
Article 14	(Measurement of the State of Pollution by Effluent, etc.)
Article 14-2	(Measures to be Taken in Case of an Accident)
Article 14-3	(Order to Take Measures, etc., Related to the Purification of the Water Quality of Groundwater)
Chapter II (2)	Promotion of Measures for Domestic Wastewater
Article 14-4	(Responsibilities of the National and Local Governments)
Article 14-5	(Responsibilities of the Citizens)
Article 14-6	(Efforts by those who Discharge Domestic Wastewater)
Article 14-7	(Designation of Important Areas for Domestic Wastewater Measures, etc.)
Article 14-8	(Drawing up of Promotion Plans for Domestic Wastewater Measures, etc.)
Article 14-9	(Promotion of Plans for the Promotion of Domestic Wastewater Measures)
Article 14-10	(Guidance, etc.)
Chapter III	Monitoring of the State of Water Pollution, etc.
Article 16	(Continuous monitoring)
Article 16	(Measurement Program)
Article 16-2	(Cooperation in taking Measurements)
Article 17	(Publication)
Article 18	(Emergency Measures)
Chapter IV	Compensation for Damages
Article 19	(Absolute Liability)
Article 20	
Article 20-2	(Considerations for Compensation)
Article 20-3	(Extinctive Prescription)
Article 20-4	(Application of Other Laws)
Article 20-5	(Exemptions)
Chapter V	Miscellaneous Provisions
Article 21	(Investigation and Deliberations, etc., by the Prefectural Councils on Environmental Pollution Control)
Article 22	(Report and Inspection)
Article 23	(Exemption from the Application of this Law, etc.)
Article 24	(Request for Data, etc.)
Article 25	(State Assistance)
Article 26	(Promotion of Research, etc.)
Article 27	(Transitional Measures)
Article 28	(Delegation of Work, etc.)
Article 29	(Relationship to the Regulations)
Chapter VI	Panel Provisions
Articles 30-35	

Sewerage Law (sectoral law)	
Chapter I (1)	General provisions
Article 1	(Purpose of the law)
Article 2	(Definitions)
Chapter I (2)	Comprehensive basin-wide planning of sewerage systems
Article 2-2	
Chapter II	Public sewerage systems
Article 3	(Management)
Article 4	(Authorization of implementation plans)
Article 5	(Matters to be specified in the implementation plans)
Article 6	(Authorization criteria)
Article 7	(Structure standards)
Article 8	(Water quality standards for the final effluent)
Article 9	(Public announcement, etc. of the start of operation)
Article 10	(Installation, etc. of house connections)
Article 11	(Tolerance obligations, etc. concerning discharges)
Article 11-2	
Article 11-3	(Obligations, etc. to convert to flush toilets)
Article 12	(Installation, etc. of pretreatment facilities)
Article 12-2	(Restrictions on sewage discharges from specified establishments)
Article 12-3	(Notification of the installation, etc. of specified facilities)
Article 12-4	(Notification of changes in the structure, etc. of specified facilities)
Article 12-5	(Order to change plans)
Article 12-6	(Restrictions on implementation)
Article 12-9	(Notification to basin-wide sewage works administrators)
Article 12-10	(Installation, etc. of pretreatment facilities)
Article 12-11	(Obligation, etc. to monitor water quality)
Article 13	(Inspection of house connections, etc.)
Article 18-2	(Polluter charges)
Article 19	(Sewer improvement payment by those discharging beyond the sewer capacity)
Article 20	(User fees)
Article 21	(Water examination, etc. of the final effluent)
Article 21-2	(Treatment of the generated pollution, etc.)
Article 24	(Restrictions, etc. on actions)
Article 25	(Matters provided for in ordinances)
Chapter II (2)	Basin-wide sewerage systems
Article 25-2	(Management)
Article 25-3	(Authorization of implementation plans)
Article 25-4	(Matters to be specified in implementation plans)
Article 25-5	(Authorization criteria)
Article 25-8	(Requests, etc. to investigate the causes)
Article 25-10	(Application of the same provisions)
Chapter III	Urban storm drainage systems
Article 26	(Management)
Article 27	(Designation)
Article 28	(Management standards, etc.)
Article 29	(Restrictions, etc. on actions)
Article 30	(Structure of specified drainage facilities connected to urban storm drainage systems)
Chapter IV	Miscellaneous provisions
Article 31-2	(Expenses borne by the municipalities)
Article 34	(Subsidies for systems of public sewerage, basin-wide sewerage and urban stormwater drainage)
Article 37-2	(Recommendations by the Minister of Health and Welfare or the Minister of Construction on the operation and management of sewage treatment plants)
Article 37-3	(Corrective orders, etc.)
Article 39-2	(Collection of reports)
Chapter V	Panel provisions
Articles 45-50	

Law Concerning Special Measures for the Conservation of the Environment of the Seto Inland Sea (sectoral law)	
Chapter I	General Provisions
Article 1	(Purpose)
Article 2	(Definitions)
Chapter II	Plan for the Conservation of the Environment of the Seto Inland Sea
Article 3	(Basic Plan for the Conservation of the Environment of the Seto Inland Sea)
Article 4	(Prefectural Plan for the Conservation of the Environment of the Seto Inland Sea)
Article 4-2	(Promotion of the Achievement of the Basic Plan and the Prefectural Plan)
Chapter III	Special Measures for the Conservation of the Environment of the Seto Inland Sea
Section 1	Restrictions on the Installation of Specified Facilities, etc.
Article 5	(Permit for the Installation of Specified Facilities)
Article 6	(Criteria for Permitting the Installation of Specified Facilities)
Article 7	(Transitory Measures Related to Specified Facilities)
Article 8	(Changes in the Structure, etc. of Specified Facilities)
Article 9	(Changes in the Name, etc.)
Article 10	(Succession)
Article 11	(Order of Measures against Contravention)
Article 12	(Application of the Water Pollution Control Law, etc.)
Article 12-2	(Restrictions, etc. on the discharge of effluent from specified facilities in de facto designated areas)
Article 12-3	(Reduction of the Total Amount of Pollution Load)
Section 2	Promotion of Projects for the Conservation of the Environment, etc.
Article 12-4	(Guidelines for the Reduction of Specified Substances)
Article 12-5	(Guidance, etc.)
Article 12-6	(Collection of Reports)
Section 3	Conservation of the Natural Seashore, etc.
Article 12-7	(Designation of Natural Seashore Conservation Areas)
Article 12-8	(Notification of Acts, etc.)
Article 13	(Special Consideration Given to Reclamation, etc.)
Section 4	Promotion of Projects for the Conservation of the Environment, etc.
Article 14	(Construction of Sewerage Works and Waste Disposal Facilities, etc.)
Article 15	(Financial Assistance, etc.)
Article 16	(Formulation of Plans for Projects Designed to Purify the Seto Inland Sea)
Article 17	Prevention, etc. of the Spillage of Oil through Marine Disasters)
Article l8	(Promotion of the Development of Technology, etc.)
Article l9	(Relief for Persons Engaged in Fisheries Suffering Damage Caused by Red Tides, etc.)
Chapter IV	Miscellaneous Provisions
Article 20	(Recommendations or Advice)
Article 2l	(Transitory Measures)
Article 22	(Delegation of Administrative Services, etc.)
Article 23	(The Seto Inland Sea Environmental Conservation Council)
Chapter V	Penal Provisions
Article 24-27	

Law Concerning Special Measures for the Conservation of Lake Water Quality (sectoral law)	
Chapter I	General provisions
Article 1	(Purpose)
Article 2	(Basic plan for the conservation of lake water quality)
Chapter II	Plans for water quality conservation in designated lakes
Article 3	(Designated lakes and areas)
Article 4	(Plans for the conservation of lake water quality)
Article 5	(Implementation of activities)
Article 6	(Promotion of efforts toward the successful completion of plans for the conservation of lake water quality)
Chapter III	Special Measures for the conservation of lake water quality
Article 7	(Establishment of regulation standards)
Article 8	(Exceptions to orders, etc. to change plans concerning specified establishments in lake basins)
Article 9	(Obligation to observe regulation standards)
Article 10	(Exceptions to corrective orders, etc. concerning specified establishments in lake basins)
Article 11	(Exemption, etc. from their application)
Article 12	
Article 13	(Provisions regarding the Water Pollution Control Law)
Article 14	(Restrictions, etc. on the discharge of effluent from specified facilities in de facto designated areas)
Article 15	(Report on the installation of specified facilities)
Article 16	(Transitional measures)
Article 17	(Notification of changes in the structure, etc. of specified facilities)
Article 18	(Succession)
Article 19	(Obligation to observe standards)
Article 20	(Corrective recommendations and orders)
Article 21	(Reporting and inspection)
Article 22	(De facto designated facilities)
Article 23	(Reduction of the total amount of pollution load)
Article 24	(Guidance, etc.)
Article 25	(Protection of the natural environment)
Chapter IV	Miscellaneous provisions
Article 26	(Advice and other actions)
Article 27	
Article 28	(Cooperation, etc. among the administrative bodies concerned)
Article 29	(Promotion, etc. of research)
Article 30	(Transitional measures)
Article 31	(Delegation of administrative work, etc.)
Article 32	(Relationship to ordinances)
Chapter V	Penal provisions
Articles 33-38	

Law Concerning the Improvement of Pollution Prevention Systems in Specific Factories (sectoral law)	
Article 1	(Purpose)
Article 2	(Definition)
Article 3	(Appointment of pollution control supervisors)
Article 4	(Appointment of pollution control managers)
Article 5	(Appointment of senior pollution control managers)
Article 6	(Appointment of agents)
Article 6-2	(Succession)
Article 7	(Qualifications of pollution control managers)
Article 8	(National examination)
Article 9	(Obligations, etc. of pollution control supervisors)
Article 10	(Order to dismiss pollution control supervisors)
Article 11	(Reporting and inspection)
Article 12	(Guidance, etc. from the central government)
Article 15-19	(Penal provisions)

Appendix 4 State of Water Pollution Control and Priorities by Region

Appendix 4 summarizes the state of water pollution in each region of the world (actually each regional grouping of developing countries), drawing on the *Study on Development Assistance in the Water Sector*[36] and the information on the sectors of environment, water and sanitation available from the World Bank website on *Countries and Regions*[37]. It also reviews priorities for water pollution control by region based on the website on JICA's activities by region[38] and the Country Assistance Programs (CAP) of the Ministry of Foreign Affairs (MOFA)[39]. Table A4-1 provides key indicators related to water pollution by region.

Southeast Asia, East Asia, and Oceania

4-1 Southeast Asia, East Asia, and Oceania

(1) Natural, Meteorological and Hydrological Aspects

This vast region of Southeast Asia, East Asia and Oceania largely has a monsoon climate. Yet inland China has a continental climate with little precipitation throughout the year. Oceania, which abounds in volcanoes and coral reefs, has an oceanic tropical or subtropical climate.

(2) General Aspects of Water Pollution

- Inadequate sanitation facilities in urban areas
- River pollution in China
- Eutrophication of lakes in China

This region has a total population of 1.9 billion. About 1.2 billion people, or 2/3 of the population, live in rural areas. Gross national income totals some 1,700 billion dollars, making the region better off than any other regional grouping of developing countries. Regional economic growth for 2004 was forecast at over 7 %, the highest level since the global economic crisis of 2000.

In this region, more than half a million children die every year from waterborne diseases attributable to polluted water. Of these deaths, 60 % result from a chronic scarcity of water in rural areas, and 30 % from inadequate sanitation facilities in urban areas. Water pollution of coastal seas is adversely affecting coral reefs, mangrove forests and other valuable ecosystems.

The state of water pollution by subregion is shown below:

[Southeast Asia]

Thailand and Viet Nam have experienced rapid and sustained economic development. In recent years, these 2 countries achieved high economic growth

[36] JICA Institute for International Cooperation (2002)
[37] World Bank (http://web.worldbank.org/WEBSITE/EXTERNAL/COUNTRIES) (accessed in June 2005)
[38] JICA, "Kunibetsu Chiikibetu Torikumi" [JICA's activities by country and region] (http://www.jica.go.jp/about/torikumi/index.html)
[39] Ministry of Foreign Affairs, "Japan's ODA" (http://www.mofa.go.jp/policy/oda/index.html)

thanks in large part to remarkable progress in industrialization. At the same time, such fast-paced industrial growth has resulted in serious environmental pollution due to the waste, smoke and effluent emitted from factories. There are growing concerns about environmental degradation not only within the government, but also among the citizens at large. Among other environmental issues, water pollution is causing serious problems. For example, rapid rural-to-urban migration has entailed increases in domestic wastewater and untreated industrial effluent in the cities, contaminating bodies of groundwater that provide domestic water sources. Floods force wastewater to overflow from drainage channels, aggravating sanitary conditions. In Viet Nam, BOD, a major pollution indictor for river waters, is very high, recording 25-45 mg/l in Hanoi and 20-150 mg/l in Ho Chi Minh. This compares with an average of 6.4 mg/l for the Ayase River, the river deemed the most polluted in Japan.

[East Asia]

China has been undergoing rapid economic development since the reform and open policy of 1978, posting an astonishing 10 % annual growth on average. On the other hand, China has seen–apart from widening economic disparities between the regions–deteriorating environmental conditions including water pollution due in large part to population growth in the cities.

China has seven major river systems: the Yangtze, Yellow, Huai, Hai, Liao, Songhua, and Zhu Jiang. The total catchment area of these 7 systems stands at 4,333,687 square kilometers (km^2), accounting for over 45 % of the surface area of the country. More than 1,100 million people live in these catchment areas, representing almost 90 % of the total population. Water pollution has been on the rise in these river systems. In the 1990s, the proportion of bodies of water that failed to meet China's water quality standards (and were therefore unfit for humans to be in direct contact with) was constantly high. In 2001, it reached 70.5 %, the highest proportion ever. Water pollution of lakes is also serious in China. A recent study of 130 lakes across the country showed that 51 lakes, or 39 %, were eutrophicated. In terms of the total lake area, this represented about 34 %[40].

[Oceania]

Many of the countries in this subregion are small in terms of land area, population and economy. These economies depend on primary industries such as agriculture and fisheries, both of which are vulnerable to changes in the weather and international prices. Many parts of Oceana are poor. Due in large part to unsanitary waste management, water resources are increasingly contaminated with wastewater. Securing safe drinking water is an urgent issue.

This subregion is endowed with coral reefs and other valuable tourism resources. Increasing numbers of tourists, however, are contributing to pollution of the coastal seas, posing a challenge for the conservation of the coral reefs.

[40] Overseas Agricultural and Rural Development Center (http://www.jiid.or.jp/j/ARDEC/ardec26/key_note.htm)

(3) Regional Priorities for Water Pollution Control

This region has achieved substantial economic growth. This growth, however, has significantly increased environmental stress and adversely affected sustainable development of the region. Water pollution is one of the environmental challenges facing this region.

The priorities for water pollution control by subregion are described below:

[Southeast Asia]

Water pollution in this subregion is mainly caused by discharges into the rivers of industrial effluent from factories and other sources, as well as domestic wastewater from households and commercial establishments such as hotels, markets, restaurants and other commercial establishments. In this subregion, water and sewage systems are not in place, except for some parts of urban areas in Thailand, Malaysia and other middle-income countries. Such systems, if any, are often in disrepair. There are many problems with industrial and commercial wastewater as well. First of all, the Polluter-Pays Principle is not fully observed due to the inadequate statutory regulations and the fragile financial base of corporations, which precludes investment in pollution control. In addition, effluent treatment systems, if any, are not fully operational in many cases.

All these facts suggest the continuing need to support developing countries in this subregion in the construction of water and sewage systems that are sustainable and maintainable by the countries on their own. As has already been delivered to Thailand, Malaysia and Viet Nam, assistance for industrial effluent control, including cleaner production promotion, should be continued. Capacity development for environmental management, including water pollution control has achieved a measure of success in Thailand, thanks in part to technical cooperation extended by a range of donors, including Japan, over a period of more than 10 years. Yet support for integrated capacity development for environmental administration is particularly necessary for Myanmar, Laos, Cambodia and other countries that have inadequate capacities in terms of national environmental policy, legal framework, regulations and institutions.

This subregion has an international river, the Mekong. Sustainable development of this river basin demands, among others things, integrated river basin management, including water pollution control, that transcends national borders and is supported by coordinated assistance from Japan and other donors.

[East Asia]

In Mongolia, migration from rural to urban areas, especially to the capital city of Ulan Bator, is resulting in urban environmental problems such as the dumping of municipal and industrial wastes and water pollution.

Industrial wastewater that includes hazardous chemical substances from small-scale heating facilities, wool processing plants, tanneries, cashmere processing plants, and apparel and shoe factories is causing the pollution of local bodies of water. This calls for technical cooperation in sewage treatment,

including such industrial effluent.

In China, water pollution seriously affects lakes and rivers. The contributing factors for this include: (i) operational and maintenance problems with effluent treatment and other pollution controls; (ii) the low level of environmental awareness of local governments and businesses, key investors in pollution control; and (iii) the inadequate oversight capacity of the environmental authorities. These problems call for effective assistance in such aspects as: (i) environmental management by the public and private sectors; (ii) accumulation of environmental information such as water quality data for lakes and rivers; and (iii) research on water pollution control. In fact, Japan has to date helped China with the development of human resources for environmental conservation and the promotion of environmental technologies through such hubs as the Japan-China Friendship Environmental Protection Center. Japan has also supported China in controlling its water pollution and developing a framework for collecting and assessing environmental information through the Japan-China Environmental Model Cities Plan and the Project for Improvement of the Environmental Information Network. In addition, Japan has assisted in the promotion of high-performance domestic flush toilet and non-toilet wastewater treatment tanks as part of efforts to improve the water quality of Lake Taihu. While making the most of the achievements of these activities, Japan should continue to address the above-mentioned problems.

[Oceania]

The priorities for water pollution control in this subregion include pollution control for water sources and the conservation of coral reefs. Unsanitary waste management and wastewater from households and establishments are believed to be the main cause of the destruction of coral reefs. This requires water pollution control in tandem with proper waste management. Countries in the subregion have governance problems, notably weak policies and the inadequate financial and managerial capacities of the environmental authorities. Technical cooperation is needed in such areas as policymaking and institution building for water pollution control, technologies for water pollution control, management of water quality data and other information, and water quality monitoring.

The Country Assistance Program (CAP) of the Ministry of Foreign Affairs has the following focal areas in relation to water pollution:

[Indonesia] (CAP, announced in November 2004)

- Supporting capacity development and institution building for the central and local governments in charge of natural resources management; human resources development; and the promotion of environmental education at all levels among the population
- Supporting the public administration of environmental affairs and environmental management in general, including the establishment of an environmental monitoring framework, which covers, among other

aspects, water pollution in urban settings
- Supporting a better living environment for city dwellers, including the inhabitants of slums (also in the context of natural disaster preparedness)

[Thailand] (CAP, announced in March 2000)
- Promoting environmental conservation for sustainable development
- Offering a range of types of assistance, including the development of human resources for environmental management

[Philippines] (CAP, announced in August 2000)
- Poverty reduction (water supply and sanitation in rural areas, among others)
- Developing an environmental monitoring framework as part of capacity development of the environmental authorities, including human resources development for this purpose
- Encouraging measures to reduce water pollution and industrial pollution associated with mine development, etc.

[Malaysia] (CAP, announced in February 2002)
- Supporting the sustainable exploitation of marine biological resources
- Supporting the development of the social infrastructure, including water and sewage systems, and human resources development and capacity development for the government departments concerned

[Mongolia] (CAP, announced in November 2004)
- Supporting public administration of the urban environment, including human resources development
- Supporting waste management systems
- Supporting efforts directed towards water quality improvements, etc.

[China] (CAP, announced in October 2001)
- Supporting the reasonable use of rivers, groundwater bodies and other water resources
- Supporting efforts towards a water-saving society, including the promotion of the treatment and reuse of wastewater
- Working with the World Bank and the Asian Development Bank in environmental conservation, including water pollution control

4-2 Southwest Asia

Southwest Asia

- The region ranks the lowest in term of access to sanitation facilities among the regional groupings of developing countries
- The development of wetlands is threatening the diversity of aquatic ecosystems
- Pollution of water sources
- Fluoride contamination of groundwater

(1) Natural, Meteorological and Hydrological Aspects

Southwest Asia largely has a monsoon climate. The precipitation is significantly dependent on seasonal winds. For example, monthly precipitation in Dhaka, Bangladesh is less than 5 millimeters (mm) in January[41] and some 400 mm in July. Karachi in Pakistan is one of the driest areas in this region, with an annual rainfall of only 170 mm. In contrast, the northeastern area and the mountainous region on the west coast of India have high rainfall, with an annual precipitation of over 4,000 mm.

[41] Japan Meteorological Agency, “Sekai no Heinenzu to Heinenchi” [the world’s normal climate maps and climate indicator values] (http://www.data.kishou.go.jp/climate/monitor/norm/norm_map.html)

(2) General Aspects of Water Pollution

Southwest Asia has a population of some 1.4 billion. About half of the world's poor (people below the poverty line: 1 US dollar per day) live in this region. The population rate of 1.7 % makes the region the second fastest growing region following the region of Middle East and North Africa. Most Southwest Asian countries have posted around 5 % economic growth in recent years. Yet this has done little to reduce poverty.

The gross national income (GNI) of this region as a whole is about 640 billion US dollars or 460 US dollars per capita. For this reason, the region is classified as belonging to the group of low-income countries. Though a largely monsoon region, Southwest Asia is short of accessible water resources. The amount of internal renewable water resources stands at 2,700 cubic meters (m^3) per person per year, making it the most water-scarce region next to the region of the Middle East and North Africa.

In this region, 16 % of the population is without access to safe drinking water and 66 % is without access to sanitation facilities. These are the lowest levels among all regional groupings of developing countries.

Southwest Asia abounds in aquatic species. In fact, the region boasts the most important wetlands in the world, which provide the ecosystems for this diversity of species. Such ecological diversity is threatened by land development projects around the wetlands. To make matters worse, the consumption of large volumes of water is desiccating water sources and aggravating water pollution. In addition to the serious pollution of water sources, inadequate maintenance, or even the fracture of water supply pipes, results in bacterial contamination of the water. In fact, diarrhea and parasitosis are the 2 major waterborne diseases in the river systems. In Bangladesh, for example, 110,000 children under the age of 5 die of diarrhea every year. In West Bengal State, India, over 1 million cases of diarrhea are reported annually.

Another major problem in relation to water pollution is contamination by arsenic of groundwater in Bangladesh, the West Bengal State of India and elsewhere. The Bangladeshi government estimates that some 20 million people suffer from such contamination, which demands prompt action. The Ministry of Water Resources of India says that 13 states are susceptible to endemics attributable to natural fluorine contamination. The ministry estimates that nearly half a million people are suffering from chronic diseases caused by fluoride in the water.

(3) Regional Priorities for Water Pollution Control

Although most Southwest Asian countries have recorded around 5% economic growth in recent years, the level of poverty in this region has remained high. Poverty eradication is high on the agenda across the region. The top priority should be given to securing access to safe drinking water–a key Basic Human Need (BHN). Water pollution and inadequate water purification plants in headwater areas stand in the way of securing sources of safe drinking water. In this context, it is important to develop sewage systems as well as water supply systems.

Arsenic contamination of groundwater in Bangladesh, the West Bengal State of India and elsewhere has been addressed by the World Bank and other donors. In this context, priority should also be given to the development of a water quality monitoring framework, the sharing of data among monitoring institutions, and the proper management of such data and other information.

The Country Assistance Program (CAP) of the Ministry of Foreign Affairs has the following focal areas in relation to water pollution:

[India] (Provisional CAP, announced January 2005)

- Supporting water and sewage systems
- Improving urban environments
- Environmental conservation of rivers and lakes

[Pakistan] (CAP, announced in December 2004)

- Constructing and improving water supply systems
- Improving sewage treatment

[Bangladesh] (CAP, announced in March 2000)

- Working closely with other donors (bilateral and multilateral) and NGOs to address arsenic contamination of the groundwater

Central America and the Caribbean, and South America

4-3 Central America and the Caribbean, and South America

(1) Natural, Meteorological and Hydrological Aspects

Central America and the Caribbean have a tropical savanna climate or a tropical oceanic climate. This subregion is vulnerable to hurricanes. The Pacific coast of Central America is susceptible to earthquakes. In fact, this area has been hit by great temblors and suffered huge economic losses.

About 3/4 of South America has a tropical climate. The high-altitude mountain range on the Pacific side has a range of climates depending on the altitude and other topographical features.

(2) General Aspects of Water Pollution

- Inadequate water supply system in rural areas
- Water pollution of closed water areas in Brazil
- A focus on water supply systems

This region has a total population of about 530 million. The proportion of the urban population is higher than any other regional grouping of developing countries. Some 76 % of the population lives in cities.

Economically, this region ranks high among all regional groupings of developing countries, with its Gross National Income (GNI) being about 1.7 trillion US dollars or 3,300 US dollars per capita. This is because the region includes such middle-income countries as Mexico, Brazil and Argentina. The region also has poor countries with low socioeconomic indicators, including Nicaragua, Bolivia and Paraguay. In this region, 14 % of the population has no access to safe drinking water and 23 % has no access to sanitation facilities.

[Central America and the Caribbean]

This subregion experienced civil wars for more than 10 years from the second half of the 1970s, ravaging these countries and devastating economies.

The peace process went smoothly during the 1990s. Now all the countries in this subregion except Cuba have a democratic government. Economic devastation has also come from hurricanes, major earthquakes and other natural disasters. As a result, many countries have an inadequate social infrastructure, including water supply systems, making assistance from developed countries crucial.

Water supply systems are inadequate in Central America and the Caribbean, except for cities in Mexico. In most of the rural areas in the subregion, people obtain water from common wells that are usually far from their homes. Sewage systems are rare. In Nicaragua, many lakes and groundwater bodies are seriously contaminated with domestic wastewater and sewage. As a legacy of civil wars, people are unwilling to pay for public services such as water and sanitation services and solid waste management. This is now a major issue for countries in the subregion.

Mexico is a middle-income country according to the definition of the World Bank. This is highlighted by its status as a signatory of the North American Free Trade Agreement (NAFTA) and its membership in the Organization for Economic Cooperation and Development (OECD). It is estimated, however, that about 28 % of the people are poor. There are underdeveloped areas in southern Mexico, and there are large economic disparities between these areas and other areas. People lack access to safe drinking water and sanitation in rural and poor areas in Mexico.

[South America]

South America comprises countries at different stages of economic development. Some countries are rather dependent on primary industry as they have abundant natural resources. Many others, including Brazil and Argentina, are rather industrialized and classified by the World Bank as middle-income countries. However, large cities such as Sao Paulo in Brazil and Santiago in Chile have shantytowns unique to this subregion. Wastewater from these towns is discharged without treatment, and solid waste is treated in an unsanitary way, if at all. Such water pollution, solid waste and other urban environmental problems have become more conspicuous than ever in this subregion. For example, water pollution is seriously affecting Guanabara Bay, which faces Rio de Janeiro, Brazil, as wastewater from the city is discharged into this enclosed coastal sea. In Chile, Bolivia, Peru, Brazil and other mining countries, acidic mine runoff and effluent from mining mills that both contain heavy metals are causing the pollution of public water bodies.

(3) Regional Priorities for Water Pollution Control

This region is facing a number of environmental challenges, including water pollution, as a result of industrial and economic modernization and development and rural-to-urban migration. Addressing these challenges is an urgent issue for governments in the subregion.

Priorities for water pollution control by subregion are shown below:

[Central America and the Caribbean]

This subregion has a wide gap between urban and rural areas as exemplified by Mexico, as already mentioned. Providing access to safe drinking water in rural areas is an urgent issue. In this context, measures should also be taken immediately to control pollution at the sources of the water. Mexico, which economically excels over other countries in the subregion, has no choice but to squarely address the issue of industrial effluent control if it wants to pursue sustainable industrial development. In particular, Mexico is advised to introduce cleaner production to save on water use and reduce the volume of effluent.

[South America]

The subregion, which includes many middle-income countries, faces water pollution and other urban environmental problems as a result of the concentration of the population in the cities. Priority should be given to sewerage systems in urban areas as part of efforts to control water pollution. At the same time, industrial effluent should be properly treated, especially in middle-income countries. Proper treatment is also needed for mine runoff in mining countries.

The Country Assistance Program (CAP) of the Ministry of Foreign Affairs has the following focal areas in relation to water pollution:

[Nicaragua] (CAP, announced in October 2002)

- Improving the living environment (development of the basic infrastructure including water and sewage systems and waste treatment and disposal facilities)
- Agricultural and rural development (groundwater resources development at the grassroots level)
- Healthcare (including improvement of the infrastructure for a better living environment and hygiene)

[Peru] (CAP, announced in August 2000)

- Poverty reduction (offering aid that focuses on infrastructure development for water supply and small-scale irrigation and the construction of water and sewage systems)
- Control of water and industrial pollution under the Initiatives for Sustainable Development (ISD)[42] toward the 21st Century

[42] Ministry of Foreign Affairs (http://www.mofa.go.jp/mofaj/gaiko/kankyou/kiko/cop3/kyoto2.html) (accessed in June 2005)

Sub-Saharan Africa

- The region has been left behind in terms of access to water and sanitation
- Typhoid, dysentery and other waterborne disease are rampant in this region
- Fluoride contamination poses a constraint on groundwater development
- Access to safe water is high on the agenda

4-4 Sub-Saharan Africa

(1) Natural, Meteorological and Hydrological Aspects

Sub-Saharan Africa covers various climatic zones (and vegetation zones), ranging from the arid zone (including deserts) to the hot and humid tropical rainforest zone. Annual precipitation varies widely from the arid zone to the tropical rainforest zone, ranging from 80 mm in Nouakchott, Mauritania and 260 mm in Djibouti to 2,800 mm in Cocobeach, Gabon.

(2) General Aspects of Water Pollution

In Sub-Saharan Africa, a number of civil wars have erupted in the recent past, disrupting political stability and sustainable development. Even now, some 15 million people are internally displaced. In addition, there are 4.5 million displaced people who are living outside their own countries.

Sub-Saharan Africa has a total population of 700 million. The annual growth rate stands at 2.6 %, higher than any other region in the world. Economically, this region ranks the lowest among all regional groupings of developing countries, with its gross national income (GNI) being 307 billion US dollars or 450 US dollars per capita. The region has also been left behind in terms of water supply and sanitation, with 58 % and 53 % of the population with no access to safe water and sanitation facilities, respectively.

The semi-arid Sahel, which is largely a French-speaking region and is inhabited by Muslims, is prone to waterborne diseases such as guinea worm, malaria, typhoid and dysentery. Access to safe water is so limited in this area that local people can be described as being deprived of basic human rights for survival. Another problem is fluoride contamination of the groundwater. In general, the fluoride concentrations in groundwater can range from well under 1 ppm to more than 35 ppm. In Kenya and South Africa in this region, the levels can exceed 25 ppm. In fact, the high levels of fluoride have been identified as a constraint on groundwater resources development.

(3) Regional Priorities for Water Pollution Control

Water scarcity is serious in arid areas in Sub-Saharan Africa. The supply of drinking water by tapping groundwater resources has been and will be an important development issue. In the face of the many reported cases of groundwater pollution, water quality improvements should also be given priority. Specifically, the aid components should include: water quality assessment during the project formulation phase; establishment of water quality standards and proper decision-making concerning the application of such standards; hygiene education for local communities; continuous water quality monitoring; and the development and practical use of simple water treatment units at the village level. In relation to water quality monitoring, donors are advised to support the establishment of water quality analysis centers at the national or state level so as to create institutional arrangements that can cope with changes in water quality.

Many African countries are making efforts to establish new environmental policies with support coming from bilateral and multilateral donors. Yet manpower, expertise, funds and equipment are often too limited to enforce such policies and the related regulations. Capacity building for water pollution control is therefore an important consideration for donors.

Environmental monitoring and sewage treatment are increasingly required around lakes in the Great Rift Valley (Lake Victoria, Lake Nakuru, etc.). These lakes are becoming eutrophicated as a result of population growth and farmland development in the areas bordering them and this is also affecting ecosystems (birds, fish, etc.) and thus fishery resources.

Sub-Saharan Africa has the largest proportion of poorest countries among all regions of the world. It is therefore essential to ensure that the poor have access to safe water and improved sanitation facilities. To this end, it is necessary to take a pro-poor approach in the context of sustainable development. Such an approach involves, among other elements, support from NGOs, sufficient research and analysis of the problems facing the poor, and greater organization and awareness building among the local residents.

Japan hosted the third Tokyo International Conference on African Development (TICAD III)[43] between September and October 2003. TICAD identified the following priority issues for Sub-Saharan Africa in relation to water pollution:

[Selected priority issues confirmed at TICAD III]

- By 2005, provide access to safe water supply and sanitation for at least 80 % of the population
- Increase the number of safe water supply points and strengthen the capacity of communities to maintain water facilities, and improve environmental health in urban areas by improving waste disposal and sanitation facilities

The Country Assistance Program (CAP) of the Ministry of Foreign Affairs has the following focal areas in relation to water pollution:

[Ghana] (CAP, announced in June 2000)

- Supply of safe water
- Education and awareness building concerning hygiene
- Supporting the framework for operating and maintaining water supply facilities

[Kenya] (CAP, announced in August 2000)

- Improving the urban sanitation environment to reduce the levels of pollution in lakes and rivers
- Constructing water and sewage systems to conserve water quality

[Zambia] (CAP, announced in October 2002)

- Providing water supply facilities

[43] Ministry of Foreign Affairs, TICAD III (http://www.mofa.go.jp/region/africa/ticad/index-tc3.html) (accessed in June 2005)

• Supporting capacity development for the operation and maintenance of facilities with community participation

[Tanzania] (CAP, announced in June 2000)

• Constructing water and sewage systems in cities
• Forest conservation

Middle East and North Africa

4-5 Middle East and North Africa

(1) Natural, Meteorological and Hydrological Aspects

This region generally has an arid or semiarid climate. Annual precipitation is 67 mm in Abu Dhabi, United Arab Emirates. The Mediterranean coastal areas have a Mediterranean climate, which is characterized by a dry summer and a humid winter. These areas have more rain than the arid parts of the region. Jerusalem in Israel has an annual rainfall of 650 mm.

(2) General Aspects of Water Pollution

- This region has the smallest amount of water resources of all the regional groupings of developing countries
- Deterioration in water quality at the sources
- Water pollution of enclosed coastal seas
- Securing access to safe water in urban and rural areas
- Industrial pollution control

In this region there are two major factors contributing to political instability–the Iraq War and the Israel-Palestine conflict. The region is the richest in the world in terms of oil and natural gas reserves, but the poorest in terms of freshwater resources of all the regional groupings of developing countries. Internal renewable water resources per person stand at only 1,400 m^3 per year. The region has a total population of about 306 million, with an annual growth rate of 2.3 %, the second highest rate following Sub-Saharan Africa. The gross national income (GNI) for this region totals 670 billion US dollars, ranking low among the regional groupings of developing countries. Yet per capita GNI stands at 2,230 dollars, the second highest following the region of Central America and the Caribbean with South America.

With regard to water pollution, wastewater remains largely untreated in both urban and rural areas. To make matters worse, solid waste is dumped in the open, polluting water sources. As a result, the amount of drinkable and irrigable water is diminishing, and water pollution is occurring mainly in urban areas. At any rate, access to safe water and sanitation will always pose a potential challenge for this region.

This region has two major enclosed seas–the Mediterranean and the Red Sea. Excessive use of fertilizers and chemical fertilizers and haphazard land development are contributing significantly to the pollution of these seas.

(3) Regional Priorities for Water Pollution Control

As with other arid areas, this region is faced with water pollution as a result of diminishing river flow rates, as well as falling groundwater levels. The Middle East and North Africa, or any other developing parts of the world for that matter, are trapped in a vicious circle in which the inadequate sewerage infrastructure allows untreated sewage to pollute the precious water sources of rivers and groundwater bodies and this in turn further limits access to safe water. Rapid groundwater development has resulted in salt water intrusion, ground

subsidence, and lower groundwater levels. Recent years have seen an increasing number of cases of contamination of groundwater with arsenic and nitrates.

As pollution levels in this region are rising rapidly, the per capita amount of water resources, which was small from the beginning, is diminishing further. As the development of fresh water resources is nearing its limit, it is essential to formulate plans for the integrated development and management of water resources and to take appropriate measures. Such plans should involve, among other components: rational use of agricultural water, which accounts for the bulk of water consumption; the saving of municipal water, including a reduction in water supplies that are unaccounted for; reuse of treated sewage for industrial, agricultural and other purposes; improved recovery and reuse of industrial water; and the desalination of brackish water and seawater.

The Country Assistance Program (CAP) of the Ministry of Foreign Affairs has the following focal areas in relation to water pollution:

[Egypt] (CAP, June 2000)

- Water quality conservation of the Nile
- Providing sustainable access to safe drinking water and sanitation facilities in urban and rural areas
- Establishing an environmental monitoring framework that covers water quality monitoring
- Industrial pollution control

[Tunisia] (CAP, October 2002)

- Industrial pollution control in Gabes, Sfax, Gafsa and other industrial cities in central Tunisia (olive oil producing plants, etc.)
- Industrial effluent treatment in the metropolitan area; water pollution control in tourist resorts such as Sousse and Djerba

Europe, Central Asia and Caucasia

4-6 Europe, Central Asia and Caucasia

(1) Natural, Meteorological and Hydrological Aspects

This region is diverse in climate and vegetation. Central Asia has an arid climate with an annual precipitation of 50-500 mm, while Europe has a temperate or subarctic climate with an annual rainfall of 500 mm or more.

(2) General Aspects of Water Pollution

- Water pollution can be attributed to haphazard water use planning and inappropriate industrial water control during the Soviet era
- Salinization of the Aral Sea
- Environmental pollution control in Europe in line with the EU standards

This region was long dominated by the former Soviet Union after World War II. Under the planned economy controlled by the central government, the communist republics were integrated into a solid division-of-labor structure. After the disintegration of the Soviet Union, the newly independent states not surprisingly lacked part of the necessary industrial infrastructure, or even some basic functions as a nation. Before long, these countries, especially those in Eastern Europe, moved ahead with economic and social reforms amid waves of decommunization and the transition to a market economy.

This region has a total population of about 476 million. The annual

population growth rate is 0.3 %, the lowest among the regional groupings of developing countries. GNI of the region totals 1,080 billion US dollars or 2,160 US dollars per capita. This ranks this region the third highest among all the regional groupings of developing countries, following Central America and the Caribbean with South America, and the Middle East and North Africa. Internal renewable water resources per person in the region stand at 14,000 m^3 per year, twice the world average of about 7,000 m^3 per year[44].

It is said that haphazard water use planning and inappropriate industrial water control during the Soviet era are behind the water pollution that is found throughout this region. Yet water pollution has manifested itself differently in different places. In Europe, coastal areas around the Black Sea and areas along the Danube, a transboundary river, have been experiencing water pollution for half a century. The water pollution is caused by domestic and industrial wastewater in urban areas. In rural areas, it is caused by agricultural runoff that contains high levels of nitrogen and phosphorus as a result of the excessive use of pesticides and chemical fertilizers. Such water pollution has damaged ecosystems and increased the incidence of waterborne diseases, dealing a devastating blow to tourism and fisheries in the riparian countries.

In Central Asia, an agriculture-based region, water pollution is largely attributed to farming. Heavy use of irrigation water has resulted in saline concentrations in soils. In fact, the bulk of the farmland soils in Central Asia are classified as saline-alkali soils. Salinization is especially serious in the Aral Sea, which is actually shrinking. It is said that the salinization is the result of haphazard and excessive water withdrawals from the rivers flowing into this lake during the Soviet era.

In Kazakhstan, the Irtysh and Nura rivers in the northeastern part of the country have serious water pollution problems. The Irtysh River is contaminated with mercury, zinc, arsenic and other heavy metals because caustic soda plants and factories in the basin, which were built during the Soviet era, discharge industrial effluent into the river. The Nura River is contaminated by mercury. A synthetic rubber plant in the basin used an estimated 3,000 tons of mercury while it was in operation (it is now out of operation). The effluent flowed into the Nura River. This problem surfaced when the authorities tried to tap this river to make up for the shortage of municipal water sources for the new capital of Astana.

Water pollution arising from mine development has been reported in many other places in Central Asia, which is endowed with oil and other underground mineral resources.

(3) Regional Priorities for Water Pollution Control

This region is diverse in political and economic terms as well. Development assistance that focuses on water pollution control should take account of political and economic conditions of the target areas.

[44] World Bank (2003)

In Europe, 10 countries, including the Baltic states (Estonia, etc.), the Czech Republic, Hungary and Poland joined the EU in May 2004 after pressing ahead with internal reforms with the support of other countries. This makes it necessary to shift the focus of development assistance to less developed countries, including those in the Balkans, and Ukraine and Bulgaria. Albania, Bulgaria, Macedonia, Moldova and Romania are some of the poorest countries in Europe. The reform process is slow in these countries due in part to civil wars in the recent past. Priority should be given to the basic infrastructure, including water and sewage systems that focus on water quality improvements.

In Central Asia, the main issue is how to provide access to safe water in order to maintain the health of the local people. In Kazakhstan, for example, it is not easy to secure water sources that are suitable for drinking. Development assistance for water pollution control should take such water scarcity into account.

4-7 Indicators Related to Water Pollution for Each Region

The general picture of water pollution in developing countries can be obtained by looking at national socioeconomic indicators, the availability of water resources, and other indicators for the UN Millennium Development Goals that concern water pollution. Table A4-1 shows a comparison among regions of the major indicators that provide basic background information for assessing the state of water pollution for the target areas.

Table A4-1 Comparison of Basic Indicators Related to Water Pollution Control by Region

	Indicators	Unit	Calculation Method	Definition of the Indicators and Remarks	SEA / EA / Oce	SWA	CAm / Crb / SAm	SSA	ME / NAf	Eur / CAs / Cau	Source*
(Indicators related to the Millennium Development Goals)											
1	Population below international poverty line	%	Poor population / total population	The international poverty line is set at the minimum cost of living–the sum of real consumption expenditures necessary to meet basic human needs. This line is estimated at 1 or 2 dollars a day–the typical standard in low-income countries–which is measured in 1985 international prices and adjusted for purchasing power parity using the Penn World Tables.	17.7 (Vietnam)	36.0 (Bangladesh)	Below 2.0 (Dominica)	19.9 (Tanzania)	Below 2.0 (Tunisia)	19.1 (Uzbekistan)	1 (% of the population living on less than 1 US$ per day)
2	Under-5 Mortality Rate	‰	Deaths under 5 / 1000 live births	This is the probability that a newborn baby will die before reaching the age of 5. It is expressed as a rate per 1,000.	44	99	34	171	54	38	2
3	Population using Improved Drinking Water Sources	%	Population with access to safe water / total population	The percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, or rainwater collection.	76	84	86	58	88	91	2
4	Population using Adequate Sanitation Facilities	%	Population with access to sanitation / total population	The percentage of the population with at least adequate excreta disposal facilities (private or shared, but not public) that can effectively prevent human, animal, and insect contact with excreta.	46	34	77	53	85	N / A	2
5	Malaria prevalence rate	No. of cases per 100,000 people	No. of Malaria cases / 100,000 people	The number of malaria cases per 100,000 people	95 (Vietnam)	40 (Bangladesh)	N / A (Dominica)	1,207 (Tanzania)	1 (Tunisia)	1 (Uzbekistan)	3
(Socioeconomic Indicators)											
6	Total population	Million people		The current population level of the country, which counts all residents regardless of their legal status or citizenship–except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin.	1,838	1,401	527	688	306	476	2
7	Urban population rate	%	Urban population / Total population	The proportion of the urban population in the total population of the country	37	28	76	32	58	63	1
8	Annual population growth rate	Annual %	Annual population increase / Population	The average annual growth rate of the population of the country	1.2	2.0	1.6	2.6	2.3	0.3	4 (Average annual growth rate from 1990 to 2001)
9	Population density	People per km^2	Population / Land area	The population per square kilometer in the country	116	293	26	29	28	20	2
10	Gross National Income (GNI)	Billion US$	Gross domestic product (GDP) + net factor income from abroad	GNI is the sum of the Gross Domestic Product (GDP) and the net factor income from abroad (compensation of employees and property income gained by compatriots abroad less those gained by foreigners within the country).	1,741	641	1,727	307	670	1,030	2
11	Per capita GNI	US$	GNI / Total population (Atlas Method)	Per capita GNI of the country	950	460	3,280	450	2,230	2,160	2 (Indicators related to water resources)
(Indicators Related to Water Resources)											
12	Internal renewable water resources per person	m^3	The amount of freshwater resources / Total population	Internal freshwater resources refer to internal renewable resources (internal river flows and groundwater from rainfall) in the country plus river flows from other countries. Internal freshwater resources per capita are calculated using the World Bank's population estimates.	6,020	2,777	31,530	8,306	1,413	13,465	1
13	Annual water use	Billion m^3		Annual water use includes total water use excluding evaporation from reservoirs. It also includes water from desalination plants in countries where such plants provide a significant source of water.	54.3 (Vietnam)	14.6 (Bangladesh)	8.3 (Dominica)	1.2 (Tanzania)	2.8 (Tunisia)	58.1 (Uzbekistan)	1
14	Water use per sector as % of total use			The proportion of water use in each sector–agriculture, industry and domestic–in total water consumption							1
	Agriculture use as % of total use	%	Agricultural water use / Total water use	The proportion for the agricultural sector (irrigation and stockbreeding)	81	94	74	85	88	57	
	Industry use as % of total use	%	Industrial water use / Total water use	The proportion for the industrial sector (including use for cooling purposes at thermoelectric power plants)	14	3	9	6	5	33	
	Domestic use as % of total use	%	Domestic water use / Total water use	The proportion for the domestic sector (household consumption, plus use for drinking, local governments and public services and use at commercial facilities)	5	4	18	10	7	10	
(Indictors Related to water pollution)											
15	Organic water pollutant (BOD) emissions as kilograms (kg) per day	kg per day	∑ (Measured sectoral BOD load per unit of employment x sectoral employment numbers from UNIDO's industry database)	An indicator based on organic water pollution measured at the plant level (BOD data–the most readily available and reliable data that allow for international comparison). The data comes from an international study of industrial emissions that includes data from developing countries. This data was updated in 2000 by the World Bank's Development Research Group.	N / A (Vietnam)	273,082 (Bangladesh)	N / A (Dominica)	35,155 (Tanzania)	46,025 (Tunisia)	N / A (Uzbekistan)	1

*Sources: 1. World Bank (2003) 2 World Bank (2005) 3 UNDP (2004) 4 UNICEF (2004)

SEA/EA/Oce: Southeast Asia / East Asia / Oceania **SWA**: Southwest Asia **CAm/Crb/SAm**: Central America / Caribbean / South America **SSA**: Sub-Saharan Africa **ME / NAf**: Middle East and North Africa **Eur / CAs / Cau**: Europe, Central Asia, Caucasia

Appendix 5 Technologies Applicable to Developing Countries

Affordability and easy operation and maintenance (O&M) are 2 important elements of water pollution control in developing countries. For example, the transfer of a sewerage system from Japan to a developing country as it is would incur high costs for its construction, operation and maintenance. This would be a substantial financial burden on that developing country. The likelihood is that the system would not be operated and maintained in a sustainable manner. Such a transfer would not be an appropriate option.

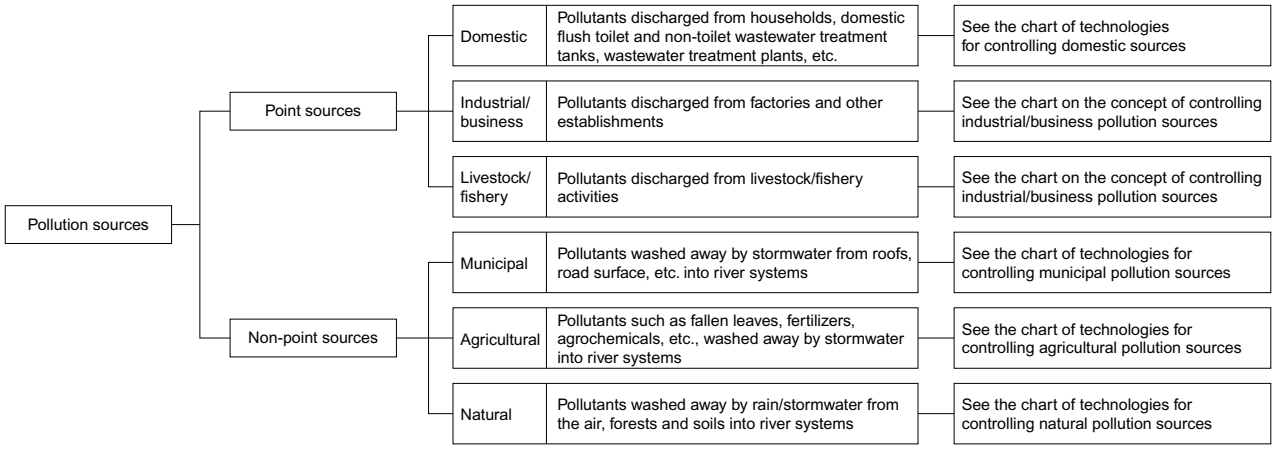
It is crucial for bilateral and multilateral donors to select water pollution control technologies that emphasize sustainability, if they want to make their assistance more effective. To this end, donors needs to thoroughly study the recipient countries with respect to: the status of water quality, the hydro-meteorological characteristics, the operational and maintenance capacity, the ability of local communities to pay for services, and the charging systems, among other aspects.

Again, affordability and easy operation and maintenance (O&M) are essential for water pollution control technologies for developing countries. With this in mind, this appendix reviews technologies associated with water pollution control that are applied in Japan or other countries. Then their applicability to developing countries is examined. By discussing pollution sources and corresponding control technologies in a systematic manner, this appendix allows the reader to gain a general picture of such technologies and readily examine specific options.

5-1 Comprehensive Chart of Pollution Sources

The sources of pollutants are classified into point-sources, or sources that can easily be identified such as domestic and industrial wastewater, and non-point sources, or sources that cannot easily identified, such as runoff from built-up areas, farmland and forests. The proportion of point-sources in terms of pollution load is higher in developed areas, while that of non-point sources is higher in underdeveloped areas. It is clear what needs to be done to control the former whereas the former requires large amounts of funds. On the other hand, controlling the latter defies clear solutions. In fact, it is often impossible to control pollution from non-point sources.

Figure A5-1 Comprehensive Chart of Pollution Sources



Source: Compiled by Haruo IWAHORI.

5-2 Comprehensive Chart of Options for Point Source Control

Source control is the essential and best solution to reducing pollution from point sources. This chart covers a wide range of technologies applicable in Japan or developing countries to offer a systematic picture of pollution control technologies. Brief descriptions of such technologies and their applicability to developing countries are provided in Table A5-1.

(1) Controlling domestic pollution sources

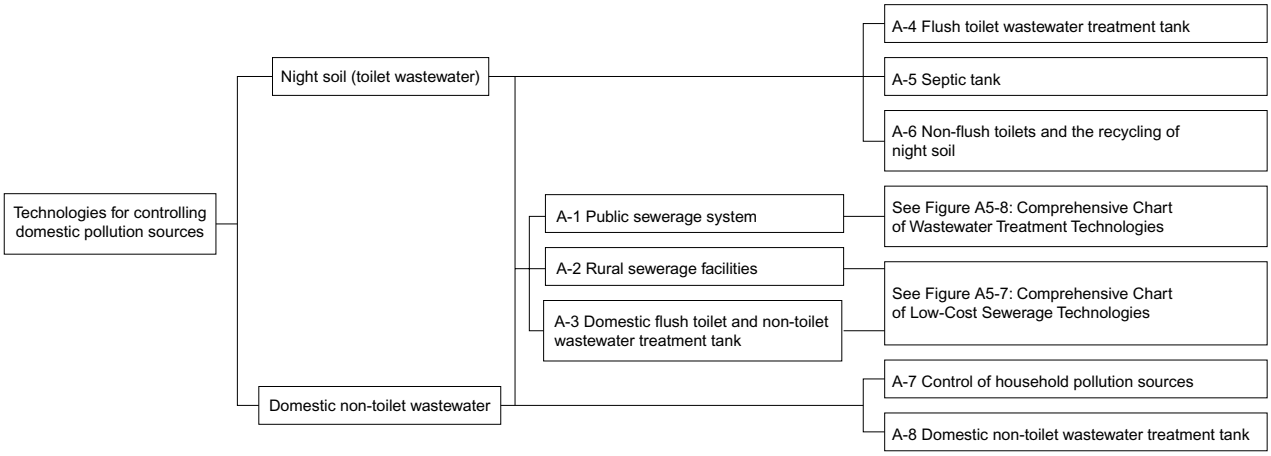
Domestic sources can be divided into toilet wastewater and domestic non-toilet wastewater. In Japan, the following discharge standards are applied to the design of wastewater treatment facilities. It is clear from the standards that the BOD level is usually higher in domestic non-toilet wastewater than in night soil. This means that treating toilet wastewater alone will not reduce pollution loads.

BOD: 27 g for domestic non-toilet wastewater + 13 g for toilet wastewater = 40 g/person/day

Nitrogen: 2.0 g for domestic non-toilet wastewater + 8.0 g for toilet wastewater = 10 g/person/day

Phosphorus: 0.2 g for domestic non-toilet wastewater + 0.8 g for toilet wastewater = 1.0 g/person/day

Figure A5-2 Comprehensive Chart of Options for Point Source Control

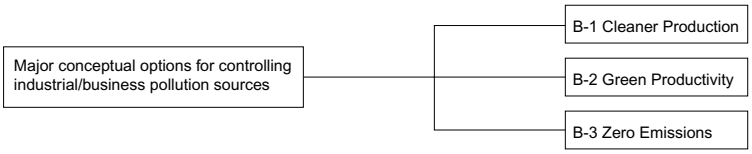


Source: Compiled from Motohashi (2001) by Haruo IWAHORI.

(2) Controlling Industrial/Business Pollution Sources

Effluent from factories and other commercial establishments should primarily be addressed by ensuring that effluent regulations are strictly observed. In fact, this is the best solution. Yet there will be a wide variety of optimal solutions depending on the specific pollution source or pollutant. For this reason, major conceptual options for pollution control are provided.

Figure A5-3 Comprehensive Chart of Conceptual Options for Controlling Industrial/Business Pollution Sources



Source: Compiled by Haruo IWAHORI.

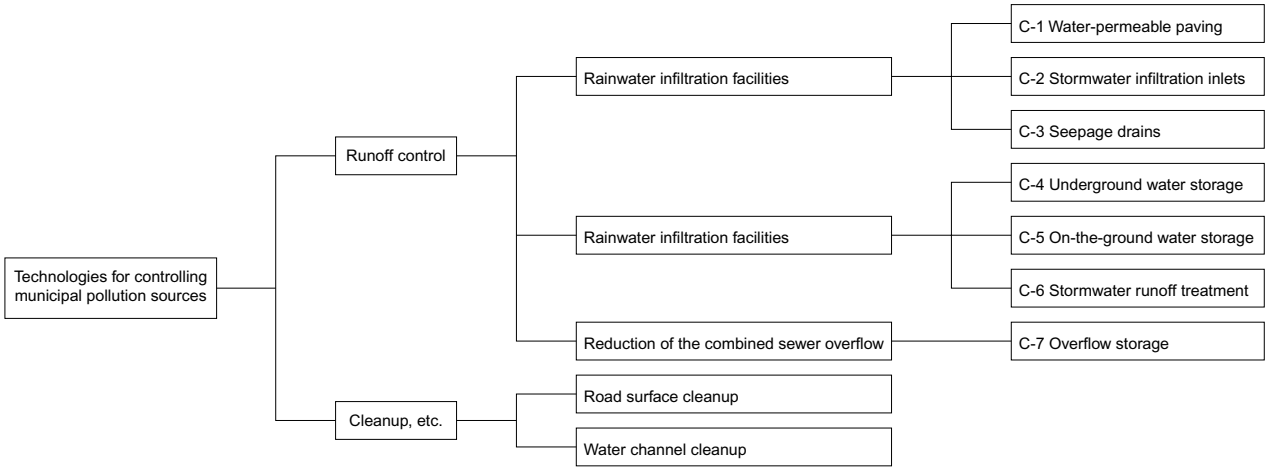
5-3 Comprehensive Chart of Options for Non-Point Source Control

Effluent regulations are irrelevant in relation to non-point pollution sources. Pollution loads from such sources will not be reduced without raising awareness among the administrators of cities, farmland, forests and other areas.

(1) Options for controlling municipal pollution sources

Since pollutants are carried by rainwater runoff into river systems, runoff control is essential. Stormwater detention is especially effective as heavy rains sweep pollutants away and into aquatic systems.

Figure A5-4 Comprehensive Chart of Options for Non-Point Source Control

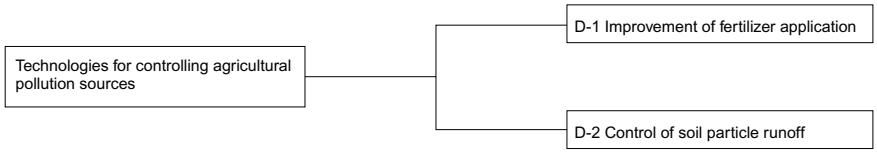


Source: Compiled by Haruo IWAHORI.

(2) Options for controlling agricultural pollution sources

Agricultural and natural pollution sources are widely distributed and the mechanism of pollutant load runoff is complex. For this reason, it is difficult to quantify pollutant loads, let alone reduce them.

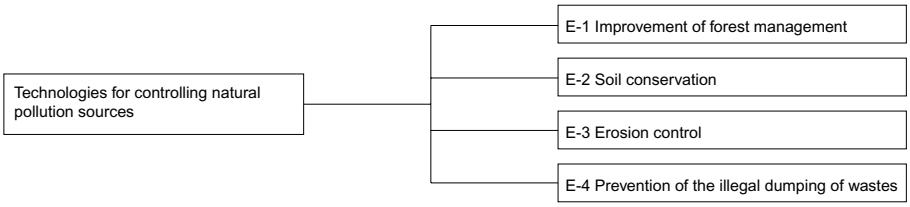
Figure A5-5 Comprehensive Chart of Options for Controlling Agricultural Pollution Sources



Source: Compiled by Haruo IWAHORI.

(3) Options for controlling natural pollution sources

Figure A5-6 Comprehensive Chart of Options for Controlling Natural Pollution Sources



Source: Compiled by Haruo IWAHORI.

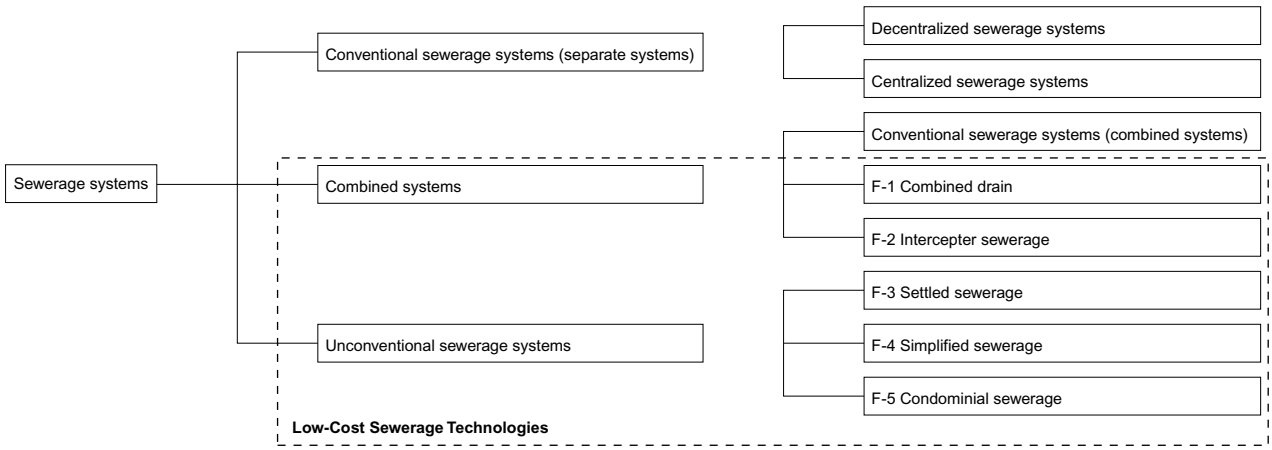
5-4 Comprehensive Chart of Sewerage Options

Sewerage systems provide the most effective means of reducing pollution loads from point sources. Yet sewerage systems entail high construction costs and O&M. Large scale investment is necessary over the long term to significantly reduce pollution loads.

(1) Low-Cost Sewerage Technologies

In developing countries, high rates of urbanization are often associated with deterioration in the sanitation environment. In this context, it is important to improve the water environment and secure water resources. Moreover, there is a growing need for wastewater treatment in the suburbs in addition to the city centers. Yet conventional sewerage systems are too expensive for most developing countries. This is where low-cost sewerage technologies come into play. These technologies are designed to reduce costs by such means as taking advantage of existing conduits or drainage canals and constructing conduits at low cost.

Figure A5-7 Comprehensive Chart of Low-Cost Sewerage Technologies

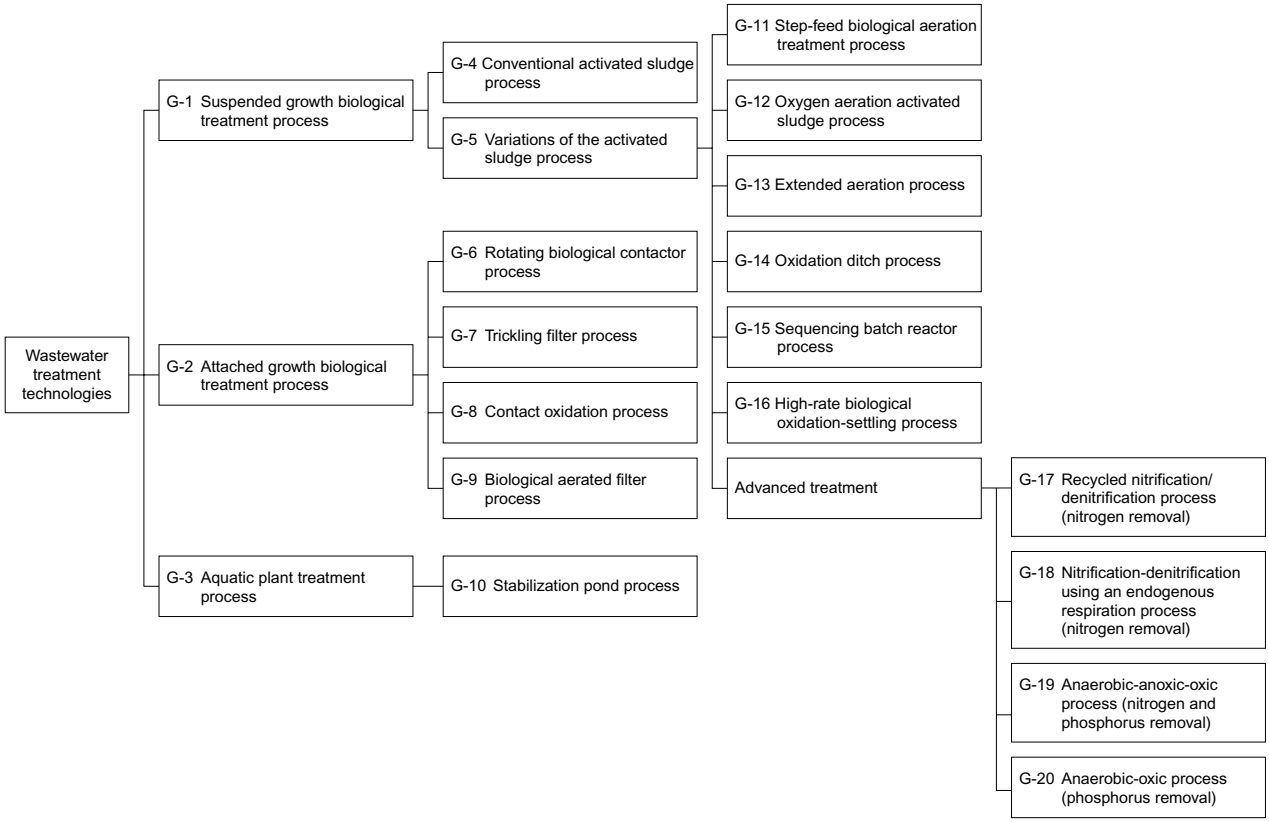


Source: Compiled from the Ministry of Land, Infrastructure and Transport and the Infrastructure Development Institute-Japan (2004) sources by Haruo IWAHORI.

(2) Wastewater Treatment Technologies

Wastewater treatment methods come in many varieties, including the conventional activated sludge process and its variations. Yet the number of technologies that are applicable in developing countries is limited. The conventional activated sludge process and oxidation ditch process each account for 40 % of sewerage treatment in Japan. The former is often used for treatment plants whose daily capacity is 10,000 cubic meters (m^3) or more. The latter is often used for those with a daily capacity of less than 10,000 m^3.

Figure A5-8 Comprehensive Chart of Wastewater Treatment Technologies



Source: Compiled from the Japan Sewage Works Association (2002) by Haruo IWAHORI.

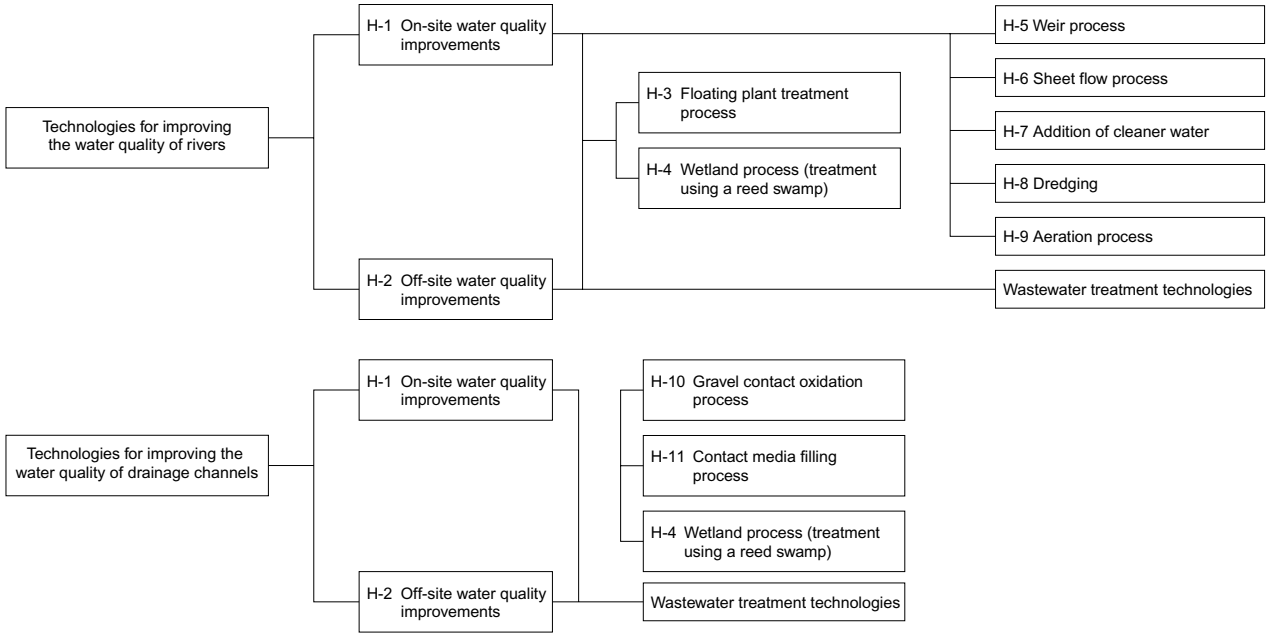
5-5 Comprehensive Chart of Options for Improving the Water Quality of Public Bodies of Water

Many people in developing countries observe a deterioration in the quality of their public water bodies along with economic and population growth. In these countries, sewerage system coverage tends to be low, contributing to the aggravation of problems with water environments. In Japan, attempts have been made to improve the water quality of public bodies of waters after their water environments were degraded to serious levels due mainly to the inadequate infrastructure for conserving water quality. Such attempts are being made even today.

Pollutant loads from point and non-point sources should primarily be reduced where such loads are high, that is, at the source. In fact, this is the best solution. Efforts to improve the water quality of public bodies of water are largely efforts to reduce the widespread sources of low levels of pollution. This requires a substantial investment in the construction, operation and maintenance of facilities to support such efforts. At any rate, there are still many options to improve the water quality of public water bodies. Yet no option has been identified as being the best in terms of effectiveness and operationability. In fact, no option has proved to be highly effective in improving water quality. In this sense, directly addressing the pollution of public waters may be the last option after all the other options have been exploited.

(1) Technologies for Improving the Water Quality of Rivers and Drainage Channels

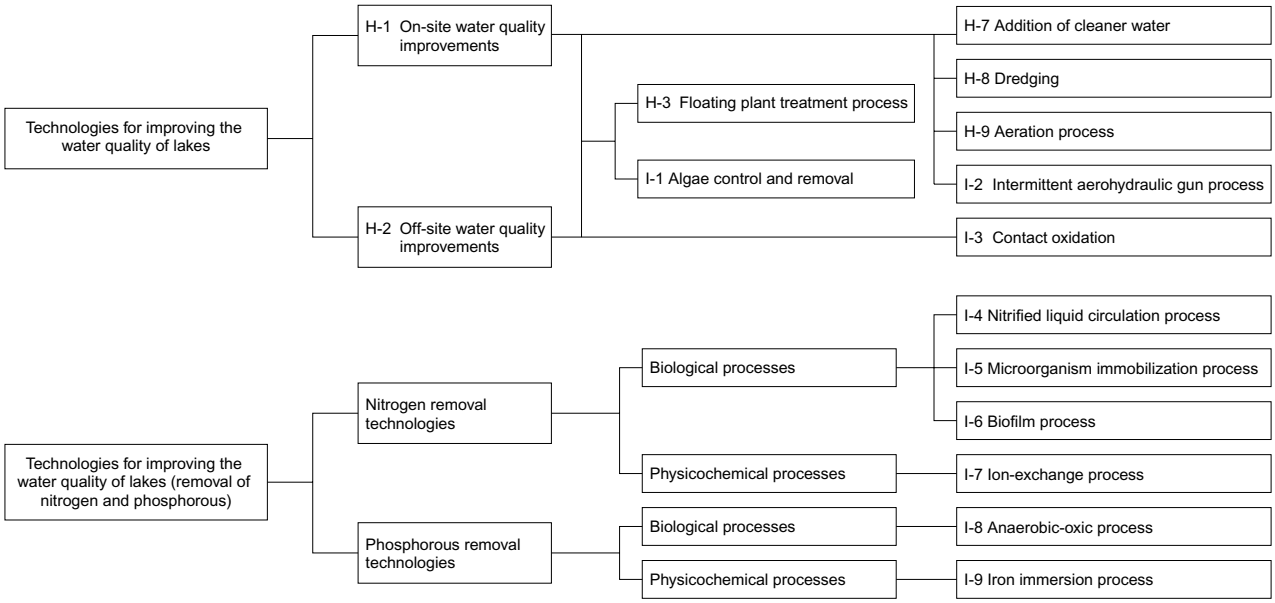
Figure A5-9 Comprehensive Chart of Technologies for Improving the Water Quality of Rivers and Drainage Channels



Source: Compiled from Motohashi (2001) by Haruo IWAHORI.

(2) Technologies for improving the water quality of lakes

Figure A5-10 Comprehensive Chart of Technologies for Improving the Water Quality of Lakes



Source: Compiled from Motohashi (2001) by Haruo IWAHORI.

5-6 Water Quality Analytical Techniques

Table A5-2 (1) provides a list of techniques for analyzing pollutants that appear in Table A3-1 and Table A3-2 in Appendix 3. A brief description and the features of these analytical techniques are shown in Table A5-2 (2).

5-7 Peripheral Technologies for Water Pollution Analysis

Table A5-3 shows major peripheral technologies for water pollution analysis.

Table A5-1 Brief Descriptions of Water Pollution Control Technologies and their Applicability to Developing Countries

The numbers in the left column correspond to those in the earlier charts.
The marks in the right column indicate the level of applicability of the technology in question:
○: Highly applicable.
△: Some conditions have to be met to make it applicable.
Unmarked: Unlikely to be applicable.

Technologies for Controlling Domestic Pollution Sources

Number	Name	Description/Features	Applicability to Developing Countries
A-1	Public sewerage system	Sewerage system that is managed by local authorities to drain and treat wastewater from built-up areas. It has a wastewater treatment plant and the drainage conduits are mostly covered or closed.	△ This option is effective in urban areas, but incurs high construction and O&M costs.
A-2	Rural sewerage facilities	A facility (or a set of facilities) designed to treat domestic wastewater from rural communities and others. The major purposes are: (i) to prevent wastewater from flowing onto farmland and into agricultural drainage canals as part of efforts to improve the living environment; and (ii) to remove nitrogen and phosphorous from wastewater in order to conserve the quality of public waters and the living environment in rural areas.	△ The maximum population density for on-site treatment is estimated at 250-300 persons per hectare(ha). Rural sewerage costs may be disproportionately high in areas with a lower population density.
A-3	Domestic flush toilet and non-toilet wastewater treatment tank [*gappei-johkasou*]	An on-site tank designed to treat domestic wastewater, including both toilet wastewater and non-toilet wastewater (wastewater from the kitchen, bath, washing, etc.). Because the revisions to the Johkasou Law of 1983 prohibit the new installation of *tandoku-johkasou* [flush toilet wastewater treatment tank], *johkasou* now effectively refers to a *gappei-johkasou* [domestic flush toilet and non-toilet wastewater treatment tank].	△ This technology incurs high installation costs and requires regular maintenance. It is therefore difficult to apply it as it is to developing countries. Yet it may be applicable to tourist resorts.
A-4	Flush toilet wastewater treatment tank [*tandoku-(shinyo-) johkasou*]	An on-site tank connected to the toilet and designed to treat toilet wastewater using only microbial decomposition processes.	△ This option is applicable, but is insufficient in controlling water pollution because it does not treat domestic non-toilet wastewater.
A-5	Septic tank	A technology for conveying night soil into a tank and digesting it using the anaerobic process. Septic tank effluent infiltrates into the ground through a soakaway. This may cause groundwater contamination.	○ Septic tanks are commonly used in areas in developing countries with no access to sewerage systems. It is necessary though to establish a maintenance framework, covering such aspects as the proper disposal of sludge accumulated inside the tanks.
A-6	Non-flush toilets and the recycling of night soil	A technology in which bacteria from the human body (intestines) decompose human excreta (feces and urine, plus toilet paper) into carbon dioxide, water, and solid matter. The solid matter is then turned into organic fertilizers and applied over the ground. Popularly known as a biotoilet, this technology requires no electricity, fuel or any other energy sources.	○ This technology has already been applied at various types of sites in Japan, including camping sites, parks, mountain huts, farmhouses, and other buildings not connected to sewer mains.
A-7	Control of household pollution sources	Household efforts to reduce the pollutant load from the kitchen, bath, etc., which is a major factor in water pollution. Among such efforts are: reducing the generation of kitchen refuse, properly disposing of waste cooking oil, and using phosphorus-free detergents for washing the laundry. The pollutant load is highest from the kitchen.	○ Pollutant loads should primarily be reduced where such loads are high, that is, at the source. In fact, this is the best solution. To this end, adequate education and awareness building are necessary for local residents.
A-8	Domestic non-toilet wastewater treatment tank	An on-site tank designed to treat domestic non-toilet wastewater (wastewater from the kitchen, bath, washing, etc.), which is a major factor in water pollution. This type of tank comes in many varieties, including roughing tanks, soil-cover settling tanks, contact aeration settling tanks, and treatment tanks combined with soil trenches.	The installation costs tend to be high. In addition, adequate education and awareness building are necessary for local residents.

Source: Compiled from Motohashi (2001) by Haruo IWAHORI.

Technologies for Controlling Industrial/Business Pollution Sources

Number	Name	Description/Features	Applicability to Developing Countries
B-1	Cleaner Production (CP)	A concept or approach of taking account of the product life cycle and even inter-industrial relationships to reduce the total environmental loading and eventually reduce costs. CP calls for continuous implementation of an integrated environmental strategy of preemptive pollution control in relation to goods and services and their life cycles, as well as production processes, in order to pursue economic, social, health, safety and environmental benefits. This means that CP is aimed at not only improving production processes but also addressing a much wider range of issues.	○ Efforts are being made in many countries to further disseminate the concept of CP and promote its technical application. Accumulation of technical information is part of such efforts. (http://www5a.biglobe.ne.jp/~outfocus/page-ku.htm)
B-2	Green Productivity (GP)	A concept or approach of improving productivity while respecting the environment. CP is advocated by the Asian Productivity Organization (APO), which was inspired by the Earth Summit concept that both economic development and environmental protection are key components of sustainable development. To promote CP, the APO has identified three focal areas for action: (i) promoting the concept of combining technologies designed to produce environmentally friendly goods and services with appropriate management techniques; (ii) supporting member states in integrating environmental concerns into productivity enhancement; and (iii) building the capacity of NPOs to address issues involving productivity and environmental protection.	△ A feasible approach for Japan is to take every opportunity to offer its advanced environmental technologies and share its experiences in environmental education with developing countries. This requires partnerships not only at the central government level, but also at various levels, involving local governments, businesses, the civil society and NGOs. (http://eco.goo.ne.jp/word/ecoword/E00298.html)
B-3	Zero Emissions	A concept advocated by the United Nations University. It aims to pursue production activities that emit no waste as a whole by ensuring that all wastes and byproducts generated by one industry are put to good use by other industries.	△ It is necessary to offer knowledge-based support to developing countries so that waste generation can be minimized. In this context, zero emissions models will play an important role. (http://www.toda.co.jp/level1/news/news_topics/html/zero_emi/)

Sources: Compiled by Sanpei NAKANISHI from the websites shown above.

Technologies for Controlling Municipal Pollution Sources

Number	Name	Description/Features	Applicability to Developing Countries
C-1	Water-permeable paving	Designed to infiltrate stormwater into the ground so as to control runoff and pollution loading and to recharge groundwater.	△ A feasible concept. Requires examination in terms of the cost of construction and materials.
C-2	Stormwater infiltration inlets	Designed to infiltrate stormwater into the ground by taking advantage of permeable geological layers. Aimed at complementing an inadequate capacity for stormwater drainage.	Requires examination in terms of the structure and the cost of construction and materials.
C-3	Seepage drains	Designed to infiltrate stormwater into the ground by increasing the permeability of ground layers. Aimed at complementing an inadequate capacity for stormwater drainage.	Requires examination in terms of the structure and the cost of construction and materials.
C-4	Underground water storage	Storing stormwater underground with the aim of mitigating urban stormwater flooding, water quality deterioration and groundwater depletion.	Requires examination in terms of the structure and the cost of construction and materials.
C-5	On-the-ground water storage	Storing stormwater on the ground with the aim of mitigating urban stormwater flooding, water quality deterioration and groundwater depletion.	△ Costs less than underground water storage. Feasible where land is readily available.
C-6	Stormwater runoff treatment	Channeling stormwater runoff to a storage basin or a treatment plant, treating the water there, and discharging the treated water into public waters, since the pollution load of such runoff is high during the early stages of a storm.	Applicable only where a sewerage system is in place. Irrelevant where untreated wastewater is discharged into public waters.
C-7	Overflow storage	In a combined sewer system, part of the sewerage that has been diluted with stormwater overflows into rivers or seas. Such overflow water–especially water with a high pollution load during the early stages of a storm–is temporarily stored as far as possible so that it can be later channeled to a treatment plant.	Applicable only where a sewerage system is in place. Irrelevant where untreated wastewater is discharged into public waters.

Source: Compiled by Haruo IWAHORI.

Control of Agricultural Pollution Sources

Number	Name	Description/Features	Applicability to Developing Countries
D-1	Improvement of fertilizer application	Reducing or preventing fertilizer runoff and nitrate contamination of the groundwater due to the application of a greater amount of fertilizer than the standard amount.	△ A number of criteria need to be satisfied, including: fertilizer application in accordance with farming standards, overall improvement of fertilizer application, and soil and water management.
D-2	Prevention of soil particle runoff	Controlling the runoff of soil particles, which contain nutrients and other sources of pollution, by improving the structure of upland fields and paddy fields.	△ Stormwater runoff control during the rainy season is essential.

Source: Compiled from Motohashi (2001) by Haruo IWAHORI.

Options for Controlling Natural Pollution Sources

Number	Name	Description/Features	Applicability to Developing Countries
E-1	Improvement of forest management	Forests generally have great potential for water quality conservation through such functions as water purification, groundwater recharging and soil erosion control. The proper management of forests can improve these functions.	○ Proper management is particularly necessary for tropical rainforests.
E-2	Soil conservation	Unrestrained logging damages the ground surface. This in turn erodes topsoil that contains organic substances and nitrates, causing water pollution.	△ Once tropical rainforests are damaged, the topsoil erodes rapidly.
E-3	Erosion control	Erosion control is aimed at preventing topsoil from entering the river system.	Affordable erosion control is necessary.
E-4	Prevention of the illegal dumping of wastes	Waste dumped in forests is a source of pollution (not a natural pollution source to be strict) when stormwater drains it into rivers and lakes. In this context, illegal dumping should be prevented, and waste that has already been dumped should be removed.	○ This can prove to be a quite effective option, as illegal dumping is widespread.

Source: Compiled by Haruo IWAHORI.

Low-Cost Sewerage Technologies

Number	Name	Description/Features	Applicability to Developing Countries
F-1	Combined drain	A stormwater drainage channel that also conveys wastewater. It has a recessed part with a trapezoidal or semicircular cross section along the center of the bottom of the channel. This facilitates the flow of wastewater when the water level is low because there is no stormwater.	○ Regular channel maintenance is essential. This requires the understanding and support of local communities.
F-2	Intercepter sewerage	A sewerage system that builds on the existing stormwater drainage system made up of storm sewers, channels and drainage facilities to intercept wastewater before it flows into rivers. The intercepted wastewater is in turn channeled to a treatment plant.	○ This option has been implemented in Yogyakarta, Indonesia with grant aid from Japan.
F-3	Settled sewerage	A system designed to collect only the supernatant fluid of household sewage. Settleable and suspended solids are removed by solids interceptor tanks that are mounted on house connections. This system costs much less than conventional sewerage systems. Usually it is not connected to a wastewater treatment plant.	○ Maintenance is relatively easy. In fact, maintenance is largely limited to the inceptor tanks.
F-4	Simplified sewerage	A system designed to receive household sewage as it is, without solids being removed in the settling process as in settled sewerage. Sewers with an inside diameter of 10-20 centimeters (cm) are laid at a shallow depth of 40-50 cm along narrow alleys. They are known as shallow sewers. This system can cut costs by 20-70 %. Regular maintenance and cleanup of branch sewers by local communities are essential. Usually it is not connected to a wastewater treatment plant.	○ Less expensive than on-site treatment in areas with a population density of 160 or more persons per ha.
F-5	Condominial sewerage	A type of simplified sewerage system in which a house connection to a sewer is shared by a number of households, unlike conventional sewerage systems where a house connection is used by a single household. With fewer house connections needed, this system is less expensive than conventional sewerage systems. Yet community support is even more necessary, since the total length of the pipes laid under private properties tends to be longer. This system is practiced in Brazil as it involves lower construction costs. Usually it is not connected to a wastewater treatment plant.	○ The understanding and support of local communities are essential for its construction and maintenance.

Source: Compiled from the Ministry of Land, Infrastructure and Transport, the Infrastructure Development Institute-Japan (2004) and the Japan Sewage Works Association (1997) by Haruo IWAHORI.

Low-Cost Sewerage Technologies

Number	Name	Description/Features	Applicability to Developing Countries
G-1	Suspended growth biological treatment process	A process of oxidizing and decomposing organic substances with suspended microorganisms called activated sludge under aerobic conditions, notably in an aeration tank [bioreactor]. Microorganisms adhere to each other to form a mass called “floc.” When the oxidative decomposition reaction is completed, microorganisms and the treated water are separated from each other by force of gravity. Then some of the separated microorganisms are fed back to the bioreactor for the continued removal of organic substances.	See the processes classified under this process.
G-2	Attached growth biological treatment process	A process of treating wastewater using microorganisms attached to the surface of stones or plastic plates that fill the reactor. Solid-liquid separation is easier than in the suspended growth biological treatment process.	See the processes classified under this process.
G-3	Microorganic/algal process	A process of sedimentation separation and oxidative decomposition of organic substances with acid fermentative bacteria, methane bacteria or algae. This process takes advantage of the food chain of a natural ecosystem.	See the processes classified under this process.
G-4	Conventional activated sludge process	A typical example of the suspended growth biological treatment process. In this process, a mixture of wastewater and activated sludge is aerated so that organic substances in the wastewater are absorbed into the activated sludge, where they are oxidized and assimilated as a source of nutrients for the microorganisms there. This process is often used in treatment plants with a capacity of 10,000 m^3 or more per day.	○ This purifies wastewater efficiently but generates large amounts of sludge. It also requires high power costs for aeration and advanced techniques for operation and maintenance (O&M).
G-5	Variations of the activated sludge process	The treatment mechanism is the same as that of the activated sludge process. The only difference is that the treatment method is modified in view of such factors as construction costs, O&M costs, and operationability and maintainability.	See the processes classified under this title.
G-6	Rotating biological contactor process	A process of rotating a plastic disc half-submerged into the wastewater in the tank so that organic substances in the water are taken up by the aerobic microorganisms in the microbial biofilm on the disc. As the disc rotates, these microorganisms decompose the organic substances using the supply of oxygen from the air above the water. The microorganisms grow and the biofilm gradually thickens. When the biofilm is too thick for the oxygen to penetrate, the biota changes, making the biofilm exfoliate from the disc so that microorganisms will be revealed for regeneration.	△ This is rather easy to operate and maintain. Yet the treatment capacity is limited since it is structurally difficult to have a large surface area of the contact media that holds the biofilm.
G-7	Trickling filter process	A process of trickling wastewater over a filter bed on which a biofilm is formed. As the water flows over the surface of the biofilm, pollutants in the water are absorbed into the biofilm for removal.	This costs less in terms of construction, operation and maintenance. Yet it may not be an applicable option unless an adequate buffer zone can be secured since it generates offensive odors and flies.
G-8	Contact oxidation process	A process of putting a filler in the tank and supplying oxygen to microorganisms on the surface of the filler for treatment with an air diffuser.	△ This is rather easy to operate and maintain. Yet the treatment capacity is limited since it is structurally difficult to have a large surface area of the contact media that holds the biofilm.
G-9	Biological aerated filter process	A process that adds a filtering function to the contact oxidation process, making it possible to remove organic substances and suspended solids at the same time. This process is coming into wider use as a small-scale wastewater treatment method largely because it does not requires a sedimentation tank.	This is rather easy to operate and maintain. Yet the treatment capacity is limited since it is structurally difficult to have a large surface area of the contact media that holds the biofilm.
G-10	Stabilization pond process	Although a large tract of land is necessary, a wastewater stabilization pond can be constructed at low cost, and it is easy to operate and maintain. In addition, the quality of the treated water is stable. Influent wastewater is detained for 10-30 days depending on its BOD. Oxygen is supplied by surface aeration and the photosynthesis of algae. If the influent water quality is high, it may be possible to reduce the size of the site area and improve treated water quality with the use of a facultative pond only and the supply of oxygen by mechanical aeration.	○ This allows for easy operation and maintenance, as the mechanical or electrical equipment is largely limited to the pump.
G-11	Step-feed aeration process	This process is quite similar to the conventional activated sludge process. The only difference is that the returned sludge is fed intermittently from several inlets so that the microbial biomass is distributed evenly. This process allows for a smaller tank.	△ Advanced techniques are required for operation and maintenance.
G-12	Oxygen aeration activated sludge process	In this process, gas with a high level of oxygen is supplied instead of using air, allowing for the efficient and stable treatment of the wastewater. In the conventional activated sludge process, air is used as the source of oxygen. The problem is that the level of oxygen in air translates into low solubility of the oxygen in wastewater.	The major drawbacks include the need for equipment that supplies high levels of oxygen and the need for advanced techniques for O&M.
G-13	Extended aeration process	A process designed to promote the auto-oxidation of activated sludge with an extended detention time of 16-24 hours for the reactor and thus to reduce the generation of excessive activated sludge. This process is usually applied to small-scale wastewater treatment plants that cannot afford meticulous O&M and to plants that receive varying amounts of wastewater depending on the day.	Since this is a small-scale form of treatment, the process does not provide a fundamental solution to water pollution control over a wide area.
G-14	Oxidation ditch process	A form of the extended aeration process with an oval-shaped activated sludge reactor. Wastewater is aerated using mechanical aeration equipment such as rotors, and the wastewater and activated sludge are mixed together and circulated. Then the floc is separated in the final sedimentation tank, and microorganisms are fed back to the reactor. This process is suitable for treatment plants with a daily capacity of 10,000 m^3 or less.	○ Without a primary sedimentation tank, the structure of the plant as a whole is simple. Operation and maintenance is easy. This process dominates small-scale treatment plants in Japan.
G-15	Sequencing batch reactor process	The treatment theory is the same as that of the conventional activated sludge process. A 4-step cycle–wastewater feeding, aeration, activated sludge sedimentation, and treated water discharge–is repeated by a single aeration tank. The system is simple as the aeration tank also serves as a sedimentation tank.	△ Easy maintenance and low cost are among the advantages.
G-16	High-rate biological oxidation-settling process	The aeration tank and the sedimentation tank are integrated with each other, eliminating the need for a sludge returning device. This process requires a smaller land area, making it easy to add facilities. Yet it may not accommodate variations in the flow of influent wastewater. It is applicable only to treatment plants with a relatively low capacity.	This has costs for equipment, construction and O&M. It also requires advanced O&M techniques.

Number	Name	Description/Features	Applicability to Developing Countries
G-17	Recycled nitrification/denitrification process (nitrogen removal)	In this process, the reactor is divided into an anoxic tank and aerobic tank. The aerobic tank is designed to oxidize ammonia nitrogen in wastewater into nitrite nitrogen or nitrate nitrogen with the action of nitrite or nitrate bacteria. The water is then fed into the anoxic tank where the denitrifier consumes nitrite nitrogen or nitrate nitrogen and emits nitrogen gas into the air.	In developing countries where secondary treatment of wastewater is not in place as part of the conventional activated sludge process or its variations, priority should be given to this secondary treatment. In such cases, advanced treatment is applied to limited purposes, such as improvement of the water quality of lakes. For reference, the number of treatment plants that use any of these advanced processes (G-18-21) as of 2000 is shown below. It is clear that the anaerobic-aerobic activated sludge process dominates. Total number of advanced treatment plants: 85 G-17=13/85 G-18=3/85 G-19=9/85 G-20=60/85
G-18	Nitrification-denitrification using an endogenous respiration process (nitrogen removal)	A process in which the bioreactor is made up of an aerobic nitrification tank, an anoxic denitrification tank, and an aerobic reaeration tank in this order, so that organic substances absorbed into the activated sludge or those accumulated within the cells are used as a source of organic carbon for the denitrification reaction.	
G-19	Anaerobic-anoxic-oxic process (nitrogen and phosphorus removal)	A process in which the bioreactor is made up of an anaerobic tank, an anoxic tank and an aerobic tank. This process can remove nitrogen and phosphorus at the same time because it is a combination of the recycled nitrification/denitrification process (nitrogen removal) and the anaerobic-oxic activated sludge process (phosphorus removal).	
G-20	Anaerobic-oxic activated sludge process [A/O process] (phosphorus removal)	A phosphorus removal process that takes advantage of the phenomenon in which microorganisms take in “too much” phosphorus when they grow. This process is based on a combination of an anaerobic tank and an aerobic tank. In the anaerobic tank, phosphorus-accumulating bacteria in the activated sludge take in organic substances in the influent water and release phosphorus from within. In the aerobic tank, phosphorus-accumulating bacteria take in more phosphorus than is released in the anaerobic tank, and this excess sludge is drawn out of the system.	

Source: Compiled from the Ministry of Land, Infrastructure and Transport, the Infrastructure Development Institute-Japan (2004) and the Japan Sewage Works Association (1997) by Haruo IWAHORI.

Technologies for Improving the Water Quality of Rivers and Drainage Channels

Number	Name	Description/Features	Applicability to Developing Countries
H-1	On-site water quality improvement	The approach of improving water quality with on-site facilities installed in the body of water.	See the processes classified under this approach.
H-2	Off-site water quality improvement	In this approach, an off-site treatment plant receives part or all of the polluted water from a body of water, treats it and returns the treated water to the water body.	See the processes classified under this approach.
H-3	Floating plant treatment process	A process of reducing the nutrients in water by removing floating plants that have grown vigorously or algae that have bloomed. The removed plants and algae should be put to good use.	A promising option where labor costs are low or there is an agricultural zone nearby since the removed plants and algae can be used as a fertilizer.
H-4	Wetland process (reed bed process)	A process of using a natural reed bed or a constructed wetland to purify water by contact sedimentation with the plants serving as the contact medium. Beside contact sedimentation, this process has additional but inadequate purification effects through the roots and soil by directly absorbing nitrogen and phosphorus, with the soil serving as a filter.	This process requires a vast area of land. It is also effective during the plant growing period.
H-5	Weir process	In this process, a weir is built across a river channel. Upstream of the weir, the water flow slows, accelerating the sedimentation of pollutants. Over the weir, the water falls downstream and is aerated in the process, accelerating bio-oxidation of the remaining pollutants in the water. The sedimentation and aeration processes both work together to purify the water. This option should be considered in the context of local flood control.	Suspended solids that accumulated on the river bed may provide a source of pollution in the river. Such polluted sedimentation needs to be dredged. This process may require other types of maintenance as well.
H-6	Sheet flow process	In this process, the river channel is widened as the river flows into a lake or a similar water body so that the water depth is about 10 centimeters (cm) and the flow velocity is 30-50 cm per second. This allows the biofilm on the gravel of the river bed to oxidize and decompose organic substances in the water.	Maintenance is required, such as removing the biofilm adhering to the river bed.
H-7	Addition of cleaner water	A process of channeling cleaner river water or highly treated wastewater into a polluted and low-velocity river. The water quality will improve through dilution. Even in Japan, the applicability of this option is limited since it is difficult to secure clean and sustainable water sources.	It is quite difficult to secure clean river water on a sustainable basis for this purpose.
H-8	Dredging	A process of dredging sludge that has accumulated on the bed of a river or a lake out of the water body. This sludge may become a source of water pollution in such forms as odor emissions, violent or gradual dissolution, and consumption of dissolved oxygen	It is necessary to ensure that the dredged sludge will not contaminate groundwater or cause other damage to the lower reaches of the river.
H-9	Aeration process	A process of mechanically supplying oxygen to accelerate bio-oxidation so that organic substances are mineralized. This process is effective where the oxygen saturation concentration is low. In such cases, it can reduce the dissolution of phosphorus from the bottom sediment.	This process requires aeration equipment that can maintain high oxygen saturation concentrations and prevent clogging. Effective aeration calls for heavy power consumption, which means high costs.
H-10	Gravel contact oxidation process	A process of developing biofilms of microorganisms on gravel and thus accelerate bio-oxidation. It is highly effective in removing suspended solids but much less so in reducing BOD and nitrogen and phosphorus levels.	Disposing of the accumulated sludge and cleanup are no easy task.
H-11	Contact media filling process	The theory is the same as that of the gravel contact oxidation process. In this process, resin media of various shapes take the place of gravel to accelerate bio-oxidation and settle pollutants through contact sedimentation. With regular disposal of accumulated sludge, this process can be highly effective in removing suspended solids and reducing BOD. It is also quite effective in removing nitrogen and phosphorus.	Debris tends to become stuck between the media, which are also often covered with sedimentation. Careful operation and maintenance are necessary.

Source: Compiled from Motohashi (2001) and the Infrastructure Development Institute-Japan (2003) by Haruo IWAHORI.

Technologies for Improving the Water Quality of Lakes

Number	Name	Description/Features	Applicability to Developing Countries
I-1	Algae control and removal	Algae control: Blocking the sunlight that is needed for algae growth or spraying copper sulfate or other chemicals to kill the growing algae. Algae removal: Removing and collecting blue-green algae and other phytoplankton using a special boat.	This is only a provisional measure. It is important not to overburden this option with more promise than it can deliver.
I-2	Intermittent aerohydraulic gun process	A process of pumping the air into the lake water with a compressor to stir the thermocline and circulate the water between the epilimnion and the hypolimnion. In this way, the growth of algae, a major source of water pollution, in the epilimnion is controlled. The pumping of the air into the hypolimnion prevents nutrients on the lake bottom from dissolving into the water. In addition, the pulsating effect of intermittent pumping creates moderate vibrations, making the system resistant to clogging.	△ This process consumes less energy than the aeration process because it has a larger pump displacement for the same amount of air flow. Studies show that the process is effective where the water depth is 5 meters (m) or more, preferably 10 m.
I-3	Contact oxidation	In this process, the water is drawn into a tank filled with contact media such as gravel and charcoal, where suspended solids in the water are sedimented and absorbed. The solids are then oxidized and decomposed by attached or fixed microorganisms in the tank.	The applicability is low in terms of both adaptability and construction and O&M costs.
I-4	Nitrified liquid circulation process	A nitrogen removal process used in a facility made up of three types of tanks: a denitrification tank, nitrification tank and sedimentation tank. A nitrified liquid is circulated in the denitrification tank, where the carbon source in the influent water is used to remove the nitrogen. This process accelerates nitrification and denitrification reactions common in the natural environment. Nitrogen is emitted into the air in the form of non-hazardous nitrogen gas.	Although it is highly adaptable, this technology has rarely been put to practical use. It is still at the field experimental level.
I-5	Microorganism immobilization process	A denitrification process using nitrifying or denitrifying bacteria in a polymeric material or other porous media. This technology has not been put to use for the water quality improvement of public water bodies, either at the laboratory or practical level. Yet it has great potential as a denitrification technology.	In Japan, this process has been put to practical use for wastewater treatment, but not for the water quality improvement of public water bodies, either at the laboratory or practical level.
I-6	Biofilm process	Contact aeration process: In this process, aerated wastewater with high levels of dissolved oxygen is circulated within a reactor filed with contact media. As the water comes into contact with the media, it is purified by the biofilm formed on the media. Biological filtration process: In this process, the reactor is filled with a filtering material to which microorganisms are attached in a membrane form. The air is pumped into the reactor to promote the activity of the microorganisms. The microorganisms nitrify and denitrify suspended solids, which are filtered through the filtering material.	The contact aeration process has often been put to practical use, but the biological filtering process has not. The latter should further be improved for practical application.
I-7	Ion-exchange process	A denitrification process in which the water is passed through an ion exchange unit, and nitrate ions in the water are absorbed for removal. This process comes in two forms: the zeolite process, which removes only NH4-N; and the ion exchange resin process, which removes both NH4-N and NO3-N.	The operation and maintenance of this system are not easy.
I-8	Anaerobic-oxic process	A phosphorus removal process that takes advantage of the phenomenon in which microorganisms take in “too much” phosphorus when they grow. This process is based on a combination of an anaerobic tank and an aerobic tank. In the anaerobic tank, phosphorus-accumulating bacteria in activated sludge take in organic substances in the influent water and release phosphorus from within. In the aerobic tank, phosphorus-accumulating bacteria take in more phosphorus than is released in the anaerobic tank, and this excess sludge is drawn out of the system.	The most common process in Japan and Europe among all biological phosphorus removal processes.
I-9	Iron immersion process	In this process, an iron material is immersed in the water. As the material corrodes, ferric ions are generated in the water. These ions are combined with phosphate ions in the water to form insoluble amorphous solids such as iron phosphate, which are settled together with the sludge for removal. With no use of chemicals, O&M costs are low.	There is room for improvement before it is put to practical use for public water bodies.

Source: Compiled from Motohashi (2001) and the Infrastructure Development Institute-Japan (2003) by Haruo IWAHORI.

Table A5-2 Water Quality Analytical Techniques (1)

Parameters	Method(s) of Analysis [The method in the left column is more common where two or more methods are provided.]		
pH value	Glass Electrode Method	Colorimetry	
BOD	Titration Method		
COD	Titration Method		
DO	Titration Method		
Suspended Solids (SS)	Gravimetric Method		
Total Coliform	Culture Method		
Taste	Sensory Method		
Odor	Sensory Method		
Color	Transmitted Light Measurement Method		
Turbidity	Integrating Sphere Photoelectric Photometry		
Nitrate Nitrogen	Absorptiometry	Ion Chromatography	
Nitrite Nitrogen	Absorptiometry	Ion Chromatography	
Total Nitrogen	Absorptiometry		
Total Phosphorus	Absorptiometry		
Normal Hexane Extracts	Gravimetric Method		
Chloride Ions	Ion Chromatography	Titration Method	
Hardness (Ca, Mg)	Titration Method		
Zinc	Electrothermal Atomic Absorption Spectrophotometry	ICP Atomic Emission Spectroscopy	CP Mass Spectrometry (ICP/MS)
Cadmium	Electrothermal Atomic Absorption Spectrophotometry	ICP Atomic Emission Spectroscopy	
Cyanide	Ion Chromatography	Absorptiometry	
Lead	Electrothermal Atomic Absorption Spectrophotometry	ICP Atomic Emission Spectroscopy	ICP Mass Spectrometry (ICP/MS)
Chromium (Cr6+)	Electrothermal Atomic Absorption Spectrophotometry	ICP Atomic Emission Spectroscopy	ICP Mass Spectrometry (ICP/MS)
Copper	Electrothermal Atomic Absorption Spectrophotometry	ICP Atomic Emission Spectroscopy	
Arsenic	Atomic Absorption Spectrophotometry (Hydride Generation Method)	Atomic Absorption Spectrophotometry (Flameless Method)	
Total Mercury	Atomic Absorption Spectrophotometry (Cold Vapor Method)		
Alkyl Mercury	Gas Chromatography (GC)		
PCB	Gas Chromatography (GC)		
Dichloromethane	Gas Chromatography Mass Spectrometry (GC/MS)		
Carbon Tetrachloride	Gas Chromatography Mass Spectrometry (GC/MS)		
1, 1-dichloroethane	Gas Chromatography Mass Spectrometry (GC/MS)		
1, 2-dichloroethane	Gas Chromatography Mass Spectrometry (GC/MS)		
1, 1-dichloroethylene	Gas Chromatography Mass Spectrometry (GC/MS)		
Cis-1, 2-dichloroethylene	Gas Chromatography Mass Spectrometry (GC/MS)		
1, 1, 1-trichloroethane	Gas Chromatography Mass Spectrometry (GC/MS)		
1, 1, 2-trichloroethane	Gas Chromatography Mass Spectrometry (GC/MS)		
Trichloroethylene	Gas Chromatography Mass Spectrometry (GC/MS)		
Tetrachloroethylene	Gas Chromatography Mass Spectrometry (GC/MS)		
1, 3-dichloropropene	Gas Chromatography Mass Spectrometry (GC/MS)		
Thiuram	High-Performance Liquid Chromatography Mass Spectrometry (HPLC)		
Simazine	Gas Chromatography Mass Spectrometry (GC/MS)		
Thiobencarb	Gas Chromatography Mass Spectrometry (GC/MS)		
Benzene	Gas Chromatography Mass Spectrometry (GC/MS)		
Selenium	Atomic Absorption Spectrophotometry (Hydride Generation Method)	ICP Atomic Emission Spectroscopy	
Fluorine	Ion Chromatography	UV/Visible Spectrophotometry	
Boron	Atomic Absorption Spectrophotometry (Flameless Method)	ICP Atomic Emission Spectroscopy	
Nitrilotriacetic Acid	Gas Chromatography mass Spectrometry (GC/MS)		
Microcystin-LR	Gas Chromatography mass Spectrometry (GC/MS)		

Source: Compiled by Haruo IWAHORI.

Table A5-2 Water Quality Analytical Techniques (2)

Major Techniques	Description
Glass Electrode Method	A thin glass membrane is placed between a solution and a reference solution. The pH of the former solution can be determined by measuring the difference in potential between the two solutions that is generated according to the difference in pH between them.
Titration Method	A quantitative analytical method to measure the mass of a chemical substance using a chemical reaction. To determine the Chemical Oxygen Demand (COD) of a solution, for example, an oxidizing agent is put into a solution to oxidize and decompose substances, especially organic ones, in the solution. The COD can be determined by measuring the amount of oxygen consumed in this process.
Gravimetric Method	The sample is filtered through a filter paper and the mass of the substances remaining on the paper is weighed. The measured mass is then converted to the unit per liter.
Culture Method	The sample is first cultured in a medium. Then the total coliform is counted in terms of the Most Probable Number (MPN) per 100 milliliters of the sample water.
Sensory Method	A measuring method using the 5 senses of humans.
Absorptiometry	In this method, a color reagent is added to the sample to initiate a chemical reaction with the target substance. Under appropriate conditions, the substance develops a color. The intensity of the coloration is in proportion to the concentration of the substance. As the light of the complementary color (monochromatic light) passes through the color reagent, the light is absorbed. The amount of this absorption (absorbance) is proportional to the concentration of the substance. For this reason, the concentration of the substance can be determined by measuring the absorbance. The instrument to measure the absorbance is called a photoelectric spectrophototometer.
Ion Chromatography	A method of measuring an ionic material with a combination of an ion exchange resin and a conductivity detector. As the sample is passed through the resin, ions are absorbed into the resin through ionic bonding. As an eluent is then passed through the resin, each type of ion is separated from the resin depending on its different affinities to the resin and is discharged from the resin according to its particular rate. This process is detected by the conductivity detector. The qualitative analysis is made based on the discharge time and the quantitative analysis of the peak area.
Atomic Absorption Spectrophotometry	In this analytical method, the sample is sprayed into a flame or otherwise heated so that the target element will be dissociated into atoms in the ground state. The atoms absorb the resonance line emitted from the same element. The absorbance of the target element is proportional to the concentration of the atoms in the flame. In other words, by measuring the absorbance, the concentration can be measured. The flameless method uses a carbon furnace or the like for heating. It has a higher accuracy of measurement than the flame method. Without the flameless method, adequate accuracy cannot be obtained. Yet some developing countries do not have instruments for the flameless method.
Gas Chromatography Mass Spectrometry (GC/MS)	A method for the qualitative and quantitative analysis of organic compounds (especially those of low molecular weight). It uses a combination of a Gas Chromatograph (GC) and a Mass Spectrometer (MS). The sample is separated into its components by the GC. The MS spectrum of each component is measured to determine the components qualitatively. The quantitative analysis, on the other hand, is made based on the ion intensity detected by the MS.
ICP Atomic Emission Spectroscopy & ICP Mass Spectrometry	Inductively Coupled Plasma (ICP) is a high-temperature plasma that can be obtained by two steps: (i) turning the sample gas into a plasma by applying a high voltage; and (ii) applying a variable magnetic field of a high frequency so that the Joule heat will be generated within the plasma by an eddy-current. In ICP atomic emission spectroscopy, ICP atomizes and thermally excites the sample. The atoms emit light as they return to the ground state. The emission spectrum is analyzed to identify and quantify each target element. Unlike atomic absorption spectrophotometry, this method can analyze a number of elements at the same time. ICP Mass Spectrometry (ICP-MS) is designed to identify and quantify elements by introducing atoms that have been ionized by ICP into a Mass Spectrometer (MS). The use of an MS allows for hypersensitive analysis–at the ppt level.
Simplified Methods of Measurement	A wide variety of simple methods of water quality measurement have been developed for easier operation, much less labor requirement and lower cost, as well as greater convenience and accessibility to anyone. Many of these simplified methods take advantage of a color reaction. Some use test papers, an experiment pack or a set of colorimetric tubes. Others use a spectrophotometer. Even others can detect bacteria using test papers. At present, over 70 products for water quality analysis are on the market. Although their accuracy of measurement is improving, the fact remains that they are not established analytical methods; they only provide clues as to the extent of water pollution. For this reason, the data gained with the use of these kits should be handled with care.

Source: Compiled by Haruo IWAHORI from Wikipedia, the free encyclopedia (http://ja.wikipedia.org/wiki/) and *Suido Gijutsu Joho* [water works technical information] (http://www.asahi-net.or.jp/~kv6t-ymgc/12quality/raccoon_quality_examine.htm).

Table A5-3 Peripheral Technologies for Water Pollution Analysis

Name	Description/Features	Applicability to Developing Countries
Geographic Information Systems	A Geographic Information System (GIS) is designed to manage, process and display graphical information with geographical position data (spatial data) in an integrated manner. It allows for advanced analysis and prompt decision-making. With GIS, it is possible to accumulate water quality monitoring data in association with spatial data.	○ (http://www.gsi.go.jp/GIS/whatisgis.html)
Satellite Image Analysis	A component of remote sensing. Remote sensing generally refers to a method of observation in which the sensors and the targets are far from each other. Specifically, it represents a method of observing the state of the earth through sensors mounted on satellites (or aircraft). Remote sensing data is visual data of the earth. Such satellite observation data can be accumulated to create a database on an unprecedented scale for such purposes as data searching, data mining and data visualization.	○ (http://agora.ex.nii.ac.jp/˜kitaamoto/research/rs/)
Simulation	A numerical simulation is employed where an experiment with the “real thing” is impossible. In the context of water pollution analysis, tidal currents, lake flows, pollution dispersion, eutrophication, and many other characteristics can be simulated. Mesh division in the Finite Element Method (FEM) provides an effective means of conducting an accurate analysis that takes account of complex topographical conditions. Yet simulation-based prediction has its limitations. To improve the accuracy of such predictions, it is necessary to collect significant amounts of data.	○ (http://www1.odn.ne.jp/˜aef05570/simulation.html)

Sources: Compiled by Sanpei NAKANISHI from the websites shown above.

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http://www.adb.org/Documents/Reports/Water/adb_evolving.asp
"Project Profiles"
http://www.adb.org/Documents/Profiles
DFID http://www.dfid.gov.uk/
"Addressing the Water Crisis - healthier and more productive lives for poor people"
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Global Water Information Network
http:www.globwinet.org/
Global Water Partnership
http://www.gwpforum.org/servlet/PSP
GTZ http://www.gtz.de/en/index.htm
IDB "Policies - Inter- American Development Bank"
http://www.iadb.org/exr/pic/VII/sector_policies.cfm?language=English
Sida
"Growing urban needs"
http://www.sida.se/Sida/jsp/polopoly.jsp?d=168&a=5281
"Sustainable development in coastal areas"
http://www.sida.se/Sida/jsp/polopoly.jsp?d=168&a=5335
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UNDP
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UNEP
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Terms and Abbreviations

Terminology/Abbreviation	Definition/Description
Environmental Management	
5S	The acronym of *Seiri* [organization], *Seiton* [orderliness], *Seiso* [cleanliness], *Seiketsu* [organized cleanup] and *Shitsuke* [discipline]. This concept is at the base of the management philosophy of factories and other establishments in Japan. From this concept has sprung the self-management activities and energy-saving activities of Japan. Practicing these five concepts and making them take root in factories and other establishments has become more difficult in order of difficulty from *Seiri* and *Seiton* to *Shitsuke*.
Biochemical Oxygen Demand / Chemical Oxygen Demand (BOD / COD)	Biochemical oxygen demand and chemical oxygen demand. Both are indicators of the amount of organic matter in water. They are used as environmental standards related to the conservation of the living environment involving rivers, lakes and coastal waters. Generally speaking, BOD is used for rivers and COD for lakes and coastal waters. The higher the BOD/COD, the more organic matter contained in the water, in other words, the more polluted it is.
certified environmental measures	The term “certified environmental measurers” refers to those who are nationally qualified by the Minister of Economy, Trade and Industry to measure the concentrations of hazardous substances in the air, water (industrial effluent, rivers, etc.) and soil and the levels of vibration and noise in the environment. They are also qualified to verify data measured by others. Advanced expertise and skills are required.
closed water area	A water area where seawater tends to stay where it is. Tokyo Bay, Ise-Mikawa Bay, Osaka Bay, and the Inland Sea are all closed water areas. Such water areas are productive because large amounts of nutrients flow into them from rivers, etc. However, too much nutrient inflow causes pollution, including red tides.
end of pipe	Technologies for recovering and dissolving/treating air or water pollutants that have been generated in the production process at the last phase–just before being released into the environment through a smoke stack or drainage pipe.
eutrophication	A phenomenon in which matter containing nitrogen or phosphorus flows into a closed water area and promotes the growth of algae and other aquatic plants there, progressively causing a deterioration in water quality.
Guinea worm	Also called the medina worm or Dracunculus worm. The guinea worm is found in the West Coast Region of Africa, the Red Sea region, Central India, Iran and South America. The adult female measures 700-1,200 mm in length and 0.9-1.2 mm in width, compared to 12-40 mm in length and 0.4 mm in width for the adult male. Adult worms of both sexes live under the skin of a human, where they mate. Then the female moves to the end of a limb of the human body, where a blister develops and bursts when it touches water, releasing the larvae. The larvae are eaten by water fleas, an intermediate host. Humans become infected when they drink water containing the water fleas that have ingested the worm larvae or when they intake such water while swimming. The guinea worm larvae move and eat the tissues inside the human body, causing acute pain for the patient. The blisters thus developed may cause secondary infection. The number of people suffering from this serious disease is estimated at as many as 10 million. Major steps to prevent the disease include changing to well water or other water sources not contaminated with the guinea worm, and filtering water before drinking it.
internal return ratio	IRR is the rate of interest that equates the investment in a project with the present value of cash returns. It is a key factor in investment decisions. The higher the IRR, the higher the investment efficiency.
lagoon	A shallow pond designed to purify wastewater through sedimentation and biological processes. The lagoon process is subdivided into the multi-stage process, aeration process, and others. It has some advantages, including the capacity to cope with load fluctuations, and has low construction costs. However, the lagoon process requires a large site and generates odor and mosquito larva. Due to its low operating costs, the process is commonly used in developing countries.
Pollutant load	A type of load on the air and water–key elements of the environment. The environment originally has the capacity to purify polluted air or water. Environmental degradation will not occur as long as the pollutant load is below this capacity. If the load exceeds this capacity, then the environment will be irreversibly degraded.

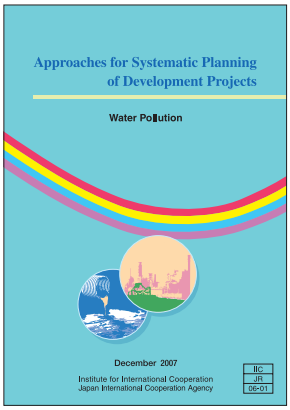
Terminology/Abbreviation	Definition/Description
Polluter Pays Principle	This is the principle that the generators of pollutants should pay to take the steps necessary for pollution control. This principle was first advocated by the Organization for Economic Co-operation and Development (OECD), an international grouping of advanced countries. The idea was to ensure fair trade by avoiding a situation in which some countries demand that businesses comply with stricter pollution controls than others. Now Polluter Pays Principle is one of the guiding principles of environmental protection in many countries. Some people even argue that this principle should be applied to global environmental conservation as well.
pollution control management system	This system requires factories of a certain scale or larger to designate a group of people who have expertise in industrial pollution control. The legal basis for this system is the Law Concerning the Improvement of Pollution Prevention Systems in Specific Factories (No. 107), which was established in June 1971.
surface water	The same as river water in a narrow sense. In a wider sense, it collectively refers to river water, lake water, glaciers, and deposited snow.
Development, Aid, etc.	
Agenda 21	A global action plan to implement the Rio de Janeiro Declaration adopted at the UN Conference on Environment and Development in 1992.
bilateral aid	ODA provided directly to developing countries. This has a number of advantages over multilateral aid. For example, (i) it can provide agile, flexible and accommodative aid. Moreover, (ii) under the bilateral arrangement, donor countries can directly impress recipient counties with their aid policies and performance, contributing to better relations with them.
Capacity Development (CD)	CD refers to the continuous process of developing the ability of individuals, organizations, institutions, and societies to individually or collectively perform functions, solve problems, and set and achieve objectives. It is the central concept for the initiative that was taken by the UNDP in the late 1990s to reexamine the traditional technical cooperation approaches.
consortium	An international group of banks and businesses that is formed to finance a large-scale development project or meet other huge demands for funds.
counterpart	Local technical experts and others who work with, and receive technical guidance from, JICA experts and Japan Overseas Cooperation Volunteers (JOCV) who are sent to developing countries.
donor	A country or organization that provides aid. This term corresponds to the term “recipient,” which refers to a developing country that receives aid.
empowerment	The process of individuals enlightening themselves, gaining the ability to make decisions on their own, and acquiring and exercising economic, social, legal, and political capabilities. The greater autonomy thus obtained may give rise to a collective initiative to overcome social inequalities.
Millennium Development Goals (MDGs)	The MDGs, which drew on the OECD/DAC New Development Strategy, were adopted at the United Nations General Assembly in September 2000. The MDGs to be achieved by 2015 include: (i) eradicate extreme poverty and hunger; (ii) achieve universal primary education; (iii) promote gender equality and empower women; (iv) reduce child mortality; (v) improve maternal health; (vi) combat HIV/AIDS, malaria and other diseases; (vii) ensure environmental sustainability; and (viii) develop a global partnership for development. The MDGs also call for commitments from participating countries to achieve them.
multilateral aid	ODA channeled through the World Bank and other multilateral institutions to be used for the development of the recipient countries. This makes it possible for donor countries to take advantage of the high-level expertise, extensive experience and global aid networks of these institutions. Multilateral aid also allows donor countries to maintain political neutrality. Hence, this type of ODA can provide relief to refugees and address global environmental issuesÑüactivities that are difficult to implement through bilateral aid. Multilateral aid can be effective even if adequate information on the target areas or aid modalities is unavailable.
ownership	Self-help efforts of developing countries. The DAC New Development Strategy includes ownership and partnership (with the donor countries) as its guiding principles.
Public - Private Partnership (PPP)	A general term to refer to the initiative to open public sector services to the private sector. In the water sector, the public and private sector have begun to work together to use water resources more effectively. PPP was discussed at the International Conference on Freshwater in December 2001, WSSD in 2002, and the WWF3 in 2003 in the context of sustainable development.
UN Millennium Summit	The summit meeting held in September 2000 concurrently with the UN Millennium General Assembly. In the light of the development goals agreed so far, the summit adopted the Millennium Development Goals.

Terminology/Abbreviation	Definition/Description
World Summit on Sustainable Development (WSSD)	Also known as the Johannesburg Summit. This summit was held in Johannesburg, South Africa, in August 2002, 10 years after the Earth Summit (in Rio de Janeiro), which was the first international conference to discuss "the environment and development" in a holistic manner.
JICA Terminology	
Feasibility Study (F/S)	Feasibility study seeks to determine the feasibility, relevancy, and investment impact of a particular project. It is usually aimed at demonstrating objectively that the project is feasible from the social, technical, economic and financial aspects. Feasibility study plays a central part in JICA's development studies.
JICA Partnership Program	One of the ODA programs of JICA to support motivated NGOs, universities, local governments and public corporations of Japan in their projects to help local communities in developing countries. To qualify for JPP support, such activities need to meet 3 key criteria: (i) whether they will offer technical cooperation at the grassroots level; (ii) whether they will focus on sectors or communities that need immediate attention, such as those that should be given priority in reconstruction assistance; (iii) whether they will motivate Japanese citizens at large to deepen their understanding of, and even participate in, international cooperation activities.
JOCV (Japan Overseas Cooperation Volunteers)	A volunteer system established in 1965 for participants between 20 and 39 years of age. A total of some 23,000 JOCVs have been assigned to 76 developing countries.
Master Plan (M/S)	A study to draw up a comprehensive development plan at the national or regional level, or a long-term development plan in a particular sector.
Project Type Technical Cooperation	A form of technical cooperation involving expert dispatch, trainee acceptance and equipment provision that is planned, implemented, and evaluated within a 3-5 year cooperation period. In FY2002, this scheme was combined with some other types of assistance to form a new scheme known as a "Technical Cooperation Project."
Technical Cooperation Project	A JICA aid scheme that seeks to achieve a measure of success within a specific time frame. For this purpose, a logical relationship between the development interventions and the outcomes is identified. Based on this relationship, the optimal mix of expert dispatch, trainee acceptance and equipment provision is pursued.
Third Country Training	Training that JICA organizes in a comparatively advanced developing country in which the people of that country who have received training through Japan's technical cooperation then train people from other developing countries.
Bilateral and Multilateral Donors	
ADB	Asian Development Bank
CIDA	Canadian International Development Agency
DAC (Development Assistance Committee)	The Development Assistance Committee (DAC) coordinates the assistance policy of the OECD* (Organization for Economic Cooperation and Development) in relation to developing countries. It is one of the three major committees of the OECD, along with the Trade Committee and the Economic Policy Committee. The current membership is 23 countries.
DFID	Department for International Development
GTZ	Gesellschaft für Technische Zusammenarbeit German Agency for Technical Cooperation
IDB	Inter-American Development Bank
JBIC	Japan Bank fir International Cooperation JBIC was established in 1999 through the merger of the Export-Import Bank of Japan and the Overseas Economic Cooperation Fund.
JICA	Japan International Cooperation Agency
OECD	Organization for Economic Cooperation and Development OECD was launched in 1961 with the reorganization of the Organization for European Economic Co-operation (OEEC), which was established in 1948 to support the reconstruction of Europe. Its objectives include economic growth, assistance to developing countries, and the expansion of multidirectional free trade. Membership is 30 countries as of 2005.
Sida	Swedish International Development Agency
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

Terminology/Abbreviation	Definition/Description
UNICEF	United Nations Children's Fund
USAID	The United States Agency for International Development
WHO	World Health Organization
World Bank	The name World Bank (WB) generally refers to two organizations, the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). The World Bank Group includes these two organizations and the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA), and the International Center for Settlement of Investment Disputes (ICSID).
World Water Council (WWC)s	The World Water Council (WWC) is a non-profit, non-governmental organization launched in 1996 as an international water policy think tank. In 1977, the UN Water Conference, the first of its kind, was held in Mar del Plata. This conference designated the 1980s as the United Nations Decade of Water and Sanitation. In 1992, the Dublin Conference and the Rio Environmental Summit were held. After these meetings, no global initiative was taken for the water sector. This fact led to the establishment of WWC. WWC was established to disseminate information and make policy recommendations on the imminent water crisis, under an integrated framework that transcends national borders, political divisions, and different levels of development. Two multilateral donors (WB, ICID) and the IWRA (International Water Resources Association) greatly contributed to the establishment of WWC. WWC is based in Marseilles, France (Canada failed to lure the WWC headquarters). WWC regional centers are located in Montreal, Cairo and New Delhi. 1/4 of the general budget is covered by annual membership fees (100 dollars) from 160 members. The remaining 3/4 of the budget is financed by the city of Marseilles.

Source: International Development Journal Co., Ltd., ed. (2004).

Approaches for Systematic Planning of Development Projects: Water Pollution



(December 2007)

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What are *Approaches for Systematic Planning of Development Projects*?

A series of reports have been prepared on *Approaches for Systematic Planning of Development Projects* as part of efforts to strengthen both the country-specific approaches and area-specific approaches of JICA. The purpose of these reports is to provide a general picture of each development issue and a basic understanding of effective approaches to addressing each one, so as to better tackle key issues in a given developing country. For this purpose, the reports systematically analyze each development issue. They are put to good use in developing aid projects and formulating cooperation programs. The reports also provide valuable perspectives on development issues for more general purposes. Appendices to the reports focus on JICA's track record in the relevant sectors, international aid trends, and considerations for project formation and implementation. This makes the reports even more practical. Designed to be "at your fingertips," the reports provide a brief summary of the issues as seen from the perspective of development assistance.

What is the *Development Objectives Chart*?

Each report on *Approaches for Systematic Planning of Development Projects* contains a chart that presents a comprehensive set of development objectives and targets to address the development issue in a tree form (Development Objectives Chart). The idea is to provide, in an easy-to-understand manner, an overall picture of the issue in the context of developing countries and possible approaches to address it. This is a major feature of this report. The table in the upper half on the reverse side shows an excerpt from the Development Objectives Chart for water pollution. The Chart is organized into a hierarchical structure, comprising goals in water pollution control (*Development Objectives*), *Mid-term Objectives* to achieve the Development Objectives, and *Sub-targets of the Mid-term Objectives* to achieve the Mid-term Objectives. The Chart also provides selected means and methods for achieving the Sub-targets of the Mid-term Objectives. In short, the Development Objectives Chart offers an avenue to an understanding of the objectives and targets of development assistance in water pollution control, as well as the specific activities needed to achieve them.

The Development Objectives Chart is organized from a certain perspective that has been formed in the process of this study. The relationships among the items in the Chart are presented in a linear manner for the sake of simplicity. In reality, however, water pollution problems, including their causes, are entwined, with a wide spectrum of factors involved. Keep in mind that when considering development interventions using the Chart, it may be necessary to explore an optimal portfolio of means and methods for achieving the objectives and targets.

Series of Reports on *Approaches for Systematic Planning of Development Projects*

Basic Education (2002), Higher Education (2004), Anti-HIV/AIDS Measures (2002), Reproductive Health (2005), Water Resources (2005), Information and Communication Technology (2004), Promotion of Small and Medium Enterprises (2002), Trade and Investment Promotion (2004), Rural Development (2002), Agricultural and Rural Development (2005), Poverty Reduction (2004), Urban and Regional Development (2006), Transportation (2007)

* The figures in parentheses indicate the year of issuance of the related report.
* These reports are available in PDF format from the JICA website: http://www.jica.go.jp/
* The report on Air Pollution is planned to be published, and also be downloaded from our website.

Development Objectives Chart for Water Pollution (an excerpt)

Development Objectives	Mid-term Objectives	Sub-targets of the Mid-term Objectives
1. Developing the Capacities of Government, Industry, Civil Society and Academia for Water Conservation and Pollution Control as part of their own Functions	1-1 Improving the Legal and Regulatory Framework	Formulating water management policy; developing an effective legal and regulatory framework; strengthening integrated water management; developing systems for the appropriate enforcement of regulations
	1-2 Improving the Institutional and Human Resources Framework	Raising the awareness of policymakers; clearly defining duties within organizations; improving coordination with other organizations; developing the capacity of the government officials in charge (excluding water quality analysis and monitoring techniques)
	1-3 Improving the Financial Framework	Appropriate financial planning; studying cost recovery options
	1-4 Improving Scientific Knowledge of the Water Environment	Building a framework for and improving the accuracy of water quality monitoring; promoting the accumulation and utilization of water quality data and the disclosure of related information
	1-5 Developing the Environmental Management Capacity of Industry	Building and strengthening corporate environmental management systems; encouraging private participation in environmental management and promoting environmental conservation industries
	1-6 Developing the Water Pollution Control Capacity of Civil Society	Raising public awareness about water environment conservation; developing the environmental management capacity of community-based organizations; strengthening water conservation and pollution control measures that accommodate local and cultural characteristics
	1-7 Developing the Water Pollution Control Capacity of Academia	Strengthening research capacities; providing information to and seeking more engagement with government, industry and civil society
2. Developing the Capacity for Water Conservation and Pollution Control according to the Types of Bodies of Water	2-1 Developing the Capacity for Water Conservation and Pollution Control of Rivers	Designating uses and setting the levels of water quality conservation for rivers; considering options that accommodate the characteristics of river basins and existing water pollution; considering options that accommodate the stage of development of the recipient countries and regions
	2-2 Developing the Capacity for Water Conservation and Pollution Control of Groundwater	Designating uses and setting the levels of water quality conservation for groundwater; considering options that accommodate the characteristics of groundwater basins and water pollution found there; considering options that accommodate the stage of development of the recipient countries and regions
	2-3 Developing the Capacity for Water Conservation and Pollution Control of Lakes	Designating uses and setting the levels of water quality conservation for lakes; assessing the hydrological characteristics of lakes; considering options that accommodate the characteristics of lake basins and existing water pollution found there; considering options that accommodate the stage of development of the recipient countries and regions
	2-4 Developing the Capacity for Water Conservation and Pollution Control of Enclosed Coastal Seas	Designating uses and setting the levels of water quality conservation for enclosed coastal seas; assessing the hydrographic characteristics of enclosed coastal seas; considering options that accommodate the characteristics of basins and existing water pollution; considering options that accommodate the stage of development of the recipient countries and regions

Source: The main report.

Development Objectives Chart (Water Pollution)

To consider approaches to water pollution control, this report has established two development objectives: (i) strengthen the capacity of stakeholders for water conservation and pollution control; and (ii) improve the capacity for water conservation and pollution control according to the type of public bodies of water.

The idea behind Development Objective 1 is that in order to improve the capacity of a society as a whole to undertake water quality management, it is essential to evaluate the roles of and interrelationships between different stakeholders in that society and develop their capacities accordingly. The idea behind Development Objective 2 is that each public body of water has its own characteristics and requires approaches that are tailored to these for effective problem-solving.

The intention here is to take a more holistic approach to water pollution by analyzing and addressing two different aspects of this development issue. To assess the relevancy and identify the components of a project for improving the water quality of a given body of water, the following steps will be taken: (i) examine specific options for the type of that water body under Development Objective 2 and select the appropriate options; and (ii) study how to support the capacity development or assistance required to put the options into practice based on the menu under Development Objective 1. Chapter 2 of this report discusses effective approaches to water pollution using the chart items that have been set based on this concept.

Towards More Effective Development Assistance in Water Pollution Control

The report has identified four guiding principles of JICA's cooperation in water pollution reduction: (i) target-setting and phasing-in of JICA's cooperation in line with the stage of development and priority needs of the recipient countries; (ii) building the capacities of the key actors to develop the pollution control capacity of the society as a whole; (iii) consideration of the optimal portfolio of development interventions based on capacity assessment; and (iv) strengthening water environment administration and water quality management capacity based on environmental science and technology. Based on these principles, the report has identified the following priorities to make JICA's assistance more effective and efficient for the future:

- Support for strengthening the capacity for formulating water sector policy and environmental management programs
- Organization and institution building and capacity development assistance for water environment management
- Upgrading the levels of environmental science and technology in the area of the water environment
- Timely implementation of priority measures for water pollution control
- Partnership with other donors for synergies
- Use of the program approach, which involves a range of aid modalities

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