Cooperation Fund for the Water Sector

Pilot Demonstration Activity

AS APPROVED BY THE ADB PDA ADVISORY PANEL ON 5 OCTOBER 2006

Activity Title: Development of a Water Quality Management System for the West Tarum Canal (WTC) of Citarum River Basin (CRB) in West Java Province	
Proposer (Name, Div/Dept): Korea Water Resources Corporation (K-water)	
Request Date: June 8, 2006	
Country (DMC): Indonesia	**Region:** Southeast Asia
Activity Proposed Start Date: October 2006	**Activity Proposed Duration:** 12 months
Cost Estimate: US$67,000	
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Short Description:

1. Background and Rationale: Citarum River Basin (CRB) is located in West Java Province and is a major source of water supply to Jakarta metropolitan city, the capital of Indonesia. There are nine (9) rivers traversing CRB with Citarum River as the biggest one and four smaller rivers on the west (Cibeet, Cikarang, Bekasi, Ciliwung) and another four on the east (Ciherang, Cikarang, Ciasem, Cipunegara), including two manmade canals, West Tarum Canal and East Tarum Canal. Three (3) large multi-purpose dams and reservoirs, Saguling, Cirata and Ir. H. Djuanda (Jatiluhur), have been built to regulate the flow of the Citarum River. Raw water supply for drinking water in Jakarta is sourced from the Djuanda reservoir and is transported mainly through the West Tarum Canal (WTC).

Rapid urbanization and industrialization of the metropolitan area including a considerable increase in pollution loads over the years have led to a deterioration of water quality in the CRB, frequently showing signs of below water quality standards. The Citarum River is mostly polluted by urban effluents in the upper part of the catchment areas, particularly in the Bandung area as well as Purwakarta urban area further downstream. Discharges from Bandung area have been responsible for the extreme eutrophic deterioration of the waters of the three reservoirs. The collapse of the natural purification capacity of these reservoirs could impose important threats for the future water supply in the region. Also, this deterioration has negative impacts on the operations of the hydropower stations and other productive uses of the lakes for fishing and recreation. Continued deterioration of the reservoirs is expected if no action is taken on improving water quality management of the whole CRB.

The Government of Indonesia recognizes that integrated water quality monitoring and planning is essential for sustainable water resources development and management of the basin. A pilot investment project for the sustainable management of CRB under NARBO is being proposed for ADB loan funding. The proposed PDA will pilot the establishment of a water quality monitoring and management system of the West Tarum Canal (WTC) as part of the overall plan of addressing the sustainable management of the

CRB and the first of its kind to be developed for the country. WTC carries about 70 percent of raw water supply from the Djuanda reservoir to the water treatment plants in Jakarta. While the WTC was originally designed as irrigation canal for rice production, it currently serves different types of industrial and municipal users whose demands are deemed to continue to increase, in the process, generating pollution in the canal and adversely affecting the raw water supply of drinking water to Jakarta.

2. Objectives: The aim is to pilot an approach that would address the issues of adequate database development through systematic monitoring of water quality and the development of a system to support better water quality management in the context of integrated water resources management (IWRM) of the CRB.

3. Scope and location of Work / Description of Activities:

The project will focus on the WTC area where the effects of the inflows from the tributaries on raw water quality are most apparent. Addressing the pollution in the rivers of Cibeet, Cikarang and Bekasi that flow through WTC towards the water treatment plants in Jakarta is estimated to reduce pollution loads by at least 11 percent of total load. Countermeasures need to be identified and put in place lest more expensive water treatment would be necessary to produce drinking water according to standard for the residents of the capital city of Jakarta.

The scope of the work includes the following activities:

(1) Design a monitoring network and formulate a plan/investment program – This will involve generating data sets for water quality modeling to cover flow rate and water quality data using available data for the past years, data collection on hydraulic parameters involving channel geometry either through a su rvey or monitoring points. It is desirable to select sampling points at the downstream of each tributary;

(2) Conduct monitoring to build up a Water Quality Data Base to set up an appropriate sample - The water quality parameters will include BOD, DO, Turbidity, TN, TP, etc. For BOD and DO, two weeks of sampling frequency is desirable, and for TN, TP, sampling frequency should be for a month. If additional data or sampling points are necessary, it is desirable to collect such data through instrumental measurements. This will also include identification and monitoring of suspected sources of pollution to allow for the establishment of a correlation between the source of pollution and its incidence downstream;

(3) Develop a water quality modeling system (WQMS) for WTC - Based on the data collected, hydraulic parameters based on channel geometry will be computed through the steady non-uniform flow modeling of Qual2E-Plus. This will include a matrix of options for the WQMS and a justification for the methodology selected, highlighting on the innovative aspects of the model structure or approach;

(4) Model calibration and application covering both the hydraulic model as well as the water quality model - Using the sampling data, water elevation and hydraulic characteristics will be compared with measured data. In adapting the water quality model to the target area, it is important to determine water quality parameters that allow to minimize the difference between simulated and measured water quality concentration; and

(5) Capacity building - Specific topics will be identified which need immediate attention. The activities and process in developing the water quality model will be discussed with field and laboratory staff of Jasa Tirta II Public Corporation (PJT II) as well as with its supervisory staff. For the calibrated model, the requirements for maintenance will be discussed with the management groups. In the process of the development and calibration of WQMS, stakeholder participation and interaction will be done to raise awareness.

4. Implementation Schedule, Institutional Management Arrangements, and Proponent Qualifications:

(1) Implementation Schedule - The project will be implemented over a period of 12 months as follows:

Key activities		*Duration*
Result 1: Water Quality Monitoring for WTC		
1	Design monitoring framework and planning	Months 1 to 2
2	Conduct monitoring to build up water quality data base	Months 2 to 11
3	Stakeholder consultation	Months 1 to 11
Result 2: Water Quality Model for WTC		
1	Development of a water quality modeling system for WTC	Months 2 to 5
2	Model calibration and application	Months 5 to 11
Result 3: Lab and Modeling Training		
1	Provide model training and application courses	Months 3 to 10
Report Preparation		Months 5 to 12

(2) Institutional Management Arrangement:

Project development and planning will be conducted by K-water and PJT II together**.** PJT II is the river basin organization for the CRB It is responsible for operating and maintaining water resources infrastructures in the CRB and Ir. H. Djuanda hydro-electric power plant and watershed management including conservation, development, and utilization of water and water resources in CRB. ***PJT II will play a key role in compiling hydrologic and hydraulic data, conducting water quality monitoring***. PJT II will also provide expertise, using its established links to work with local and national level stakeholders as identified in Section 7, assisting K-water for the overall development of the water quality management system.

Project finances will be managed by K-water with grants provided to Korea Institute of Water and Environment (KIWE), the research institute of K-water, to support staff, administration and other activities.

(3) Proponent Qualification:

K-water is the practical body on the Integrated Water Resources Management in Korea and has accumulated over 30-years of knowledge, technology and experiences. As a public corporation specialized in water services in the Republic of Korea, K-water has been dedicated to enhancing public living standards and social welfare by supplying water of good quality through comprehensive development, management, and protection of water resources and environment. K-water operates and manages 16 multipurpose dams and 27 water supply systems with 3,900 employees who are highly dedicated and specialized in various water-related fields.

5. Expected Results (outputs/outcomes/effects/impacts):

5.1 Outputs

- ✓ A comprehensive water quality monitoring network appropriate for the WTC area in the basin
- ✓ Water quality database (BOD, DO, Turbidity, TN, TP, etc.) based on the adequate monitoring activities, including identification of suspected sources of pollution
- ✓ A sound water quality modeling system for WTC, highlighting on the innovative aspects of the model structure
- ✓ Increased capacity of PJT II in water quality monitoring and modeling, and increased awareness of other stakeholders

5.2 Outcomes

The systems, procedures and the stakeholders' awareness to be gained in this project will be a fundamental outcome that is directly applicable for the CRB. Especially, this pilot project will prove the suitability of an approach that would address the issues of adequate database development through monitoring and the development of a system to support better water quality management in the context of integrated water resources management (IWRM) of the CRB.

5.3 Effects and Impacts

The importance of water quality management is to promote the awareness of IWRM in water quality management and to establish BMP for sustainable environmental and water resources management in the CRB. A well established BMP through the systematic water quality monitoring and modeling system will provide an appropriate strategy in establishing IWRM in the CRB as well as other river basins in Indonesia.

6. Measurable Performance Indicators:

- ✓ A comprehensive water quality monitoring network for the WTC area in the basin
  - Well designed monitoring framework
  - Monitoring planning
  - Regular and adequate monitoring activities
  - Applicable and doable in the local context
- ✓ Water quality database (BOD, DO, Turbidity, TN, TP, sources of pollution, etc.) development
  - Well designed database framework
  - QA/QC procedures of water quality data
  - Adequate water quality constituents to be included in the database
- ✓ A sound water quality modeling system for WTC
  - Compilation of relevant hydrologic and hydraulic data of the target area
  - Modeling system design
  - Model setup
  - Model calibration and verification
  - Sensitivity analysis
  - Innovative aspects of the model structure
- ✓ Increased capacity of PJT II in water quality monitoring and modeling and increased awareness of other stakeholders
  - Training program development for Staff of PJT II
  - Participation of Staff of PJT II in field activity
  - Participation of Staff of PJT II in modeling
  - Number of stakeholder meetings
  - Profile of stakeholder participnts
- ✓ Report
  - Progress report
  - Final report

7. Stakeholders Participation:

- ✓ **Landholding communities around WTC.** This activity builds on strong relationships with landholding communities, who are the principal owners and users of the catchment's resources. The water quality management plan will assist landholding groups to develop and implement community management plans that set out practical activities to protect water quality.
- ✓ **NARBO.** Over the past decade, PJT II and K-water have built up strong relationships with some of the world's foremost scientists and scientific institutions through NARBO with an interest in IWRM. Their input will be sought in developing the water quality monitoring network and modeling system for WTC.
- ✓ **Research Institute for Water Resources Development (Ministry of Public Works) and Environmental Bureau** (Ministry of Environment): A good anti-pollution Clean River Program has been initiated by Environmental Impact Control Agency/BAPEDAL (under Ministry of Environment). The technical aspects of this program have been designed and organized by the Center of Water Environmental Unit of the Research Institute for Water Resources Development under the Ministry of Public Works. PJT II will work closely with both Ministries.

- ✓ **Concerned Local Governments, government agencies, NGOs and Universities:** PJT II and K-water will organize regular meetings with these stakeholders and will demonstrate the impact of proposed technologies. Brochures will be developed for wide scale dissemination of the project activities.

8. Scope for Replication/Use in Other DMCs:

The outputs and lessons learned from this PDA will be applied to other areas covering the CRB and further calibrated as necessary. Priority will be given to the river downstream of the Djuanda reservoir as well as on the upper area of the Saguling reservoir. Saguling reservoir is located in the uppermost of the three reservoirs and therefore the quality of its raw water is important. Since the Bandung city contributes much of the pollution of the Saguiling reservoir it would be necessary to evaluate the effect of the pollutants released from Bandung city. With the adaptation of the water quality model developed for WTC to the other major streams of CRB, this PDA will help in developing a water quality model that is consistent, integrated and according to the conditions of the CRB, and therefore facilitate the design of the investment project proposed for ADB funding.

9. Cost Estimate:

Input/Expenditure Category	PDA Grant (in US$)	K-water Contribution (in US$)	PJT II Counterpart (US$)	Total
1. Civil Works: Field surveys - Water quality monitoring - Hydrologic and hydraulic data acquisition	**22,000** *15,000* *7,000*	0	0	**22,000**
2. Trainings and Workshops: Capacity building of PJT-II staff and management, stakeholder workshops/ consultations	15,000	0	0	
3. Specialist Services: Consultant services for water quality modeling, monitoring, and training	0	**40,000**	**21,000**	**61,000**
4. Project Management:	**20,000**	**10,000**	**2,000**	**32,000**
PDA: Internal travel and accommodation	*20,000*			
- K-Water: Air fares ($800/pax x 10 persons) - Miscellaneous expenses		*8,000* *2,000*		
PJT II: Local per diems			*2,000*	
5. Other inputs: - Laptop computer - Miscellaneous sundries	**10,000**			**10,000**
Total	**67,000**	**50,000**	**23,000**	**140,000**