

THE THIRD GENERAL MEETING OF NARBO

INTRODUCTION TO THE STUDY VISIT PROGRAM

(February 20, 2007)

BACKGROUND PAPER ON THE BENGAWAN SOLO RIVER BASIN

I. INTRODUCTION

1. Physical Condition and Boundaries

The Bengawan Solo River has been important to the welfare of the people, since ancient times. The river basin that is located in central and eastern part of Java, needs a comprehensive development and management plan to provide the valuable resource of water – increasingly necessary – for support to the present economic and social growth at Java, the most populous island in Indonesia. A map of the Bengawan Solo River Basin is shown at the front of this report.

The Bengawan Solo River system has a total catchment area of 20,125 km² and consists mainly of the Bengawan Solo River Basin with an area of 16,100 km², Grindulu River Basin 750 km² and Lamong River Basin 720 km². The remaining area, approximately 2,555 km² consists of the Northern Java River Basin that comprises peripheral rivers which directly flow into the Java Sea, like Kali Grasak, Kali Kemawing, Kali Klero and Kali Lohgung, and the Southern Java River Basin that flows into the Indonesian Ocean.

The Bengawan Solo River Basin has a precipitation potential of 2.100 mm/year, of which close to 1.040 mm or equivalent to 16.7 km³ surfaces as overland flow. The surface water in the river discharge fluctuates during the year. Groundwater potential is estimated to be 2.1 km³. From the available flow for the whole Bengawan Solo River System, 21% is available for bulk-consumption, 23% of the available flow for the Bengawan Solo river basin. Table 1 shows surface water potential and consumed use for the river system. **Figure 1.1** displays cumulative surface water potential in the Bengawan Solo basin.

Table 1 Surface water potential and consumed use through the Bengawan Solo River System

River Basin	Surface Water km ³	Consumed Use km ³	Ratio %
Bengawan Solo River Basin			
Upper Bengawan Solo	6.286	1.974	31
Lower Bengawan Solo	6.494	0.509	8
Madiun River	3.897	1.364	35
Northern Java River Basin	2.500	0.188	8
Lamong River Basin	0.754	0.120	16
Southern Java River Basin	0.921	0.132	14
Total (Bengawan Solo System)	20.833	4.287	21
Total (Bengawan Solo RB only)	16.677	3.847	23

Problems in the Bengawan Solo River System could be described as follows:

- a. During the rainy season, the Bengawan Solo River inundates its corridor which causes disaster to the

inhabitants. Flood-prone areas in the river system comprise the Lower Bengawan Solo, especially between Cepu and Tanjungkepala (Gresik), Madiun River between Ngawi and Ponorogo, Grindulu and Lorong River near Pacitan, and Upper Bengawan Solo near Sragen. The flood-prone area is estimated close to 8% of the total river system area. The most severe flood recorded by the Bengawan Solo River Basin Development Project was in 1966 with an inundated area of 142.000 ha, compared to the latest one of 1994 which inundated 40.000 ha. The following Table 2 provide an insight to the disaster scale of flood in the Bengawan Solo River Basin.

Table 2 Major flood damages in the Bengawan Solo River (OECF, 1991 & Jasa Tirta, 2008)

No	Item	Unit	1966	1968 ¹	2007 ²
1	Inundation area	Ha	142,000	120,000	119.800
2	Affected population	persons	880,000	670,000	898.000
	Died/missing		168	16	77
	Affected/displaced		> 370,000	> 140,000	> 221.240
3	Houses damage	Nos	182,000	152,000	93.273
	Broken		10,100	8,100	
	Inundated		171,900	143,900	240.000

- b. Drought during the dry season poses another problem for most of the river system area. As a matter of fact, from 545,000 ha of paddy fields in the Bengawan Solo River Basin, 163,000 ha are dependent on rain-fed water. During dry season, drought sweeps over 80% of the irrigated paddy fields in the basin.³ This condition shows that improper water management is recurring throughout the season in the basin. Even the OTCA master plan, 1974, reports surface water in the basin at an estimate of 16.7 billion cubic-meters/year, but it is important to notice here, that run-off fluctuation varies much from season to season, about 65% during the dry years and 160% during wet years. Surface water potentials in the basin; can be seen in Table 4.
- c. Land use in the Bengawan Solo River Basin is much characterized by dormant and active volcanoes, like Merapi, Merbabu and Lawu, in both its fertile uplands and alluvial lowlands, which are mainly found in the lower reaches. Agriculture is one most important land use throughout the basin, where 54.8% was used for paddy cultivation and dry land farming in 1998. Erosion as a result of improper land use practices is common in the basin, which results in sedimentation of the river and water infrastructures, especially the reservoirs. Change in land use is an important factor that affects the watershed; as well as the erosion and sedimentation process. This change can be seen in Table 5. More paddy fields were developed in 1998 than in 1974, either up-land farming or yards, but in a broader sense this does not represent assurance of good land conservation.

¹ Flood damage in upper Solo river basin occurred in 1968 is excluded

² Flood on December 26-27, 2007 extended into 2008. Inundation was present until early February 2008.

³ In the tropical monsoon of Asia, short and long spells of dry and wet seasons interchange during the year. Available rain water collected during the wet period has to be conserved, and managed for future use. This gave rise to the parallel development of advanced hydraulic civilizations in ancient Southeast Asia, including Indonesia. As in the past, today this limited resource is subjected to multiple and frequent conflicting demands.

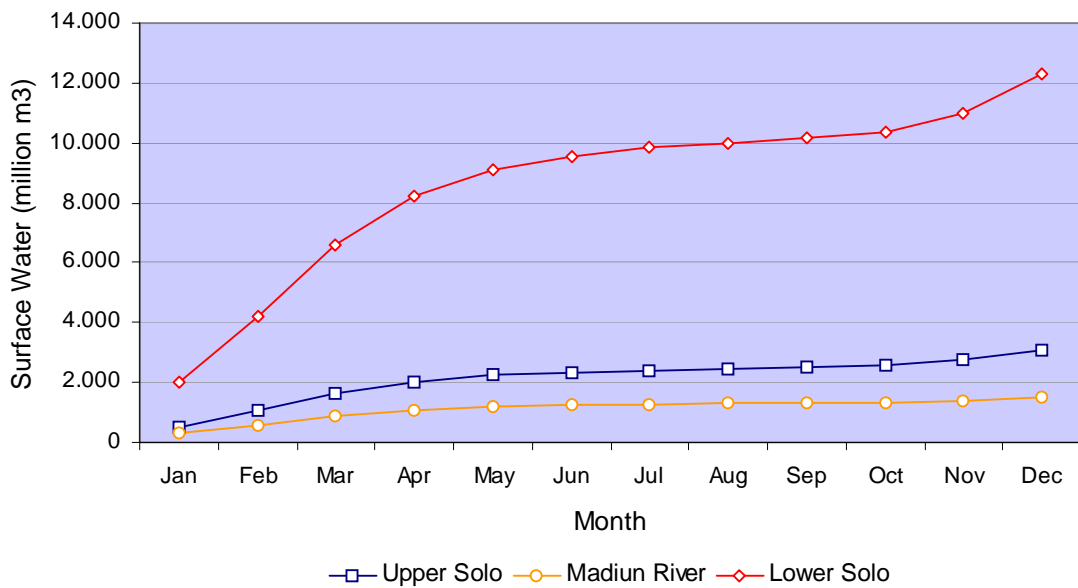


Figure 1 Cumulative surface water potential in the Bengawan Solo River Basin

2. Development of Bengawan Solo River Basin

Development of Bengawan Solo River Basin has been undertaken by an agency responsible for developing the entire basin, namely the Bengawan Solo River Basin Development Project (in Indonesian: *Proyek Bengawan Solo*, abbreviated as PBS) in 1969. The objective of the Project is an overall basin development comprising river improvements for flood control and drainage, watershed management and water resources development.

Project activities in the river basin are directed towards improving public welfare and accelerating economic development both nationally and regionally. Through a number of changes in the 1990s, Bengawan Solo River Basin Development Project was converted into PIPWSBS (*Proyek Induk Pengembangan Wilayah Sungai Bengawan Solo*) and made fully responsible for the implementation and operation of all water resources development projects within the Bengawan Solo river basin.

Recently, in 2007 the PIPWSBS was transformed into the River Basin Development Agency, in Indonesian, *Balai Besar Wilayah Sungai* (abbreviated as BBWS) Bengawan Solo through a decree from Ministry of Public Works. Most of the former responsibilities remain within this agency but additional tasks, such as conducting hydrological monitoring and surface water quality monitoring were added.

An overall development master plan for the Bengawan Solo River Basin was formulated under technical assistance from the Overseas Technical Cooperation Agency, Japan (OTCA) in 1974. The 1974 OTCA's master plan emphasizes water resources development for irrigation, flood control, and hydroelectric power generation. In line with this overall plan, various projects have been realized by PBS, as shown in Table 3.

Table 3 Various projects undertaken by the Bengawan Solo River Basin Development Project

No.	Name of Project	Stage	Period	Foreign Agency
1	Wonogiri Multipurpose Dam	F/S	1974-1975	JICA
		D/D	1976-1978	OECF
		C	1979-1982	OECF

No.	Name of Project	Stage	Period	Foreign Agency
2	Wonogiri Irrigation (including irrigation extensions)	F/S	1975-1976	JICA
		D/D	1977-1979	OEFC
		C	1980-1990	OEFC
3	Upper Solo River Improvement	F/S	1974-1975	JICA
		D/D	1983-1985	OEFC
		C	1987-1994	OEFC
4	Madiun River Urgent Flood Control	F/S	1980	JICA
		D/D	1983-1985	OEFC
		C	1987-1991	OEFC
5	Lower Solo River Improvement	F/S	1983-1986	CIDA
		D/D	1991-1993	OEFC
		C	1994-2001	JIBC

The river infrastructure has contributed much to the water system in the basin, for electricity, irrigation; municipal and industrial bulk water supply. As the total investment for water resources infrastructures in Bengawan Solo River Basin is recently about Rp 1.3 trillion, at year 2000 prices (excluding land compensation), Bengawan Solo River Basin Development Project currently encounters the problem of funding the cost of operation and maintenance, which is assumed to be 1% to 2% of water resources infrastructure investment.

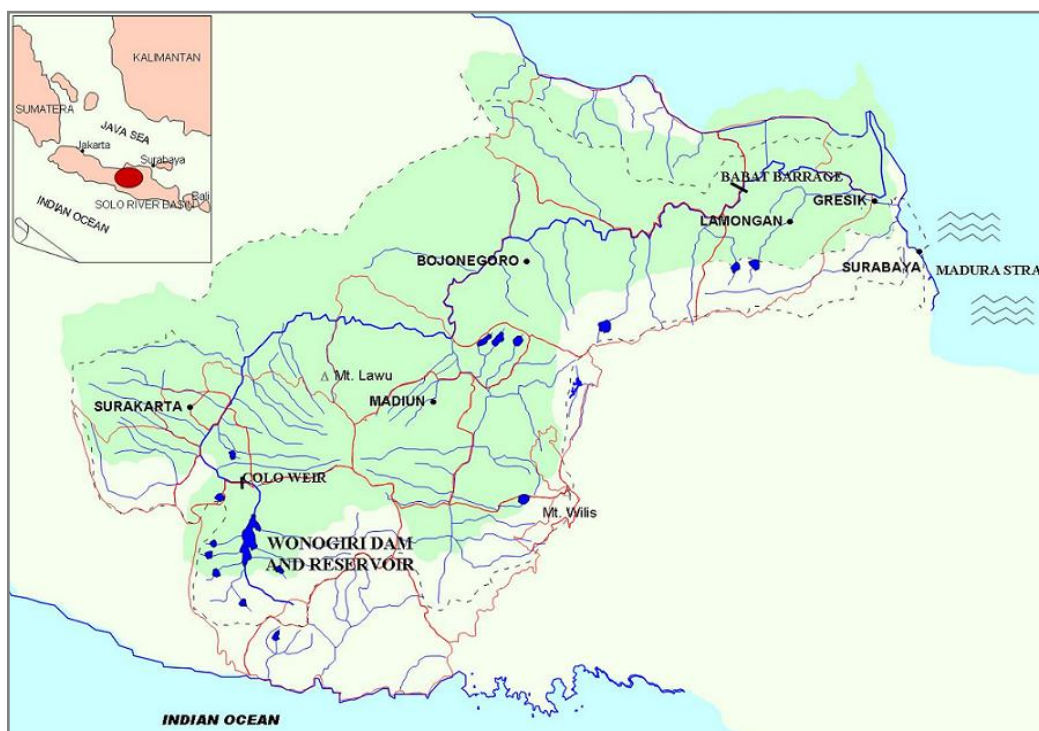


Figure 2 Bengawan Solo River Basin (C.A. of 16.100 km²) encompasses Central and East Java Province

As the biggest river basin in the densely populated island of Java, Bengawan Solo flows through Central and East Java Provinces, and passes 20 regencies and municipalities.⁴ Regencies and municipalities are administrative units within a province with a certain degree of freedom in conducting governance over the population within their boundaries. Decentralization process of the Government of Indonesia (GOI) relates on distributing authority and responsibility to both the provincial and regencies/municipalities level.

⁴ Regencies: Boyolali, Klaten, Wonogiri, Karanganyar, Sukoharjo, Grobogan, Sragen, Ponorogo, Magetan, Ngawi, Madiun, Blora, Tuban, Rembang, Bojonegoro, Lamongan and Gresik. Municipalities: Surakarta and Madiun.

Table 4 Surface water potential in the Bengawan Solo River System (CDMP, 2000)

River	Station	C.A. km ²	Years	Month (in m ³ /second)												Average
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lower B. Solo	Babat	14.247	'54-'99	749	922	876	632	339	165	112	55	53	83	248	488	393
Upper B. Solo	Jurug	3.220	'68-'94	186	225	230	142	79	32	20	17	24	37	67	111	97
Madiun R.	A. Yani	2.294	'63-'92	106	114	110	84	50	20	8	3	6	11	20	53	49
Grindulu R.	G. Sari	249	'80-'93	43	48	36	33	19	4,5	6,7	3,2	2,6	6,6	21	33	21
Sulang R.	Sulang	45	'88-'93	2,1	1,6	1,5	1,1	0,5	0,6	0,2	0,2	0,3	0,3	0,5	1,3	0,8
Lamong R.	Boboh	566	'88-'93	42	48	40	30	14	11	6,1	3,7	4	2,6	7,9	34	20

Note: Grey-scaled columns show the wet season discharge

Table 5 Change of land use in the Bengawan Solo River Basin

Sub Basin	Wet Paddy Cultivation		Upland Farming		Yards		Forests		Others	
	1974	1998	1974	1998	1974	1998	1974	1998	1974	1998
Upper Solo	183.800	161.200 ↓	137.500	133.900 ↓	123.700	133.900 ↑	32.800	53.500 ↑	36.200	42.500 ↑
Madiun River	147.900	145.700 ↓	44.300	63.800 ↑	85.900	72.900 ↓	119.900	123.000 ↑	9.400	15.800 ↑
Lower Solo	213.500	278.800 ↑	145.900	197.000 ↑	65.800	73.800 ↑	189.400	229.700 ↑	26.500	28.400 ↑
Pacitan Area	—	14.200	—	83.500	—	25.000	—	19.600	—	8.300
Total (Excluding Pacitan)	545.200	599.900	327.700	439.800	275.300	305.600	342.000	425.900	72.300	124.800

Source: 1) Data from 1974 was taken from the OTCA Master Plan, where data for Pacitan area is not available
 2) Data from 1998 was taken from CDMP Study (2000)

II. INSTITUTIONAL ARRANGEMENTS

1. Basic Principles of Water Management in Indonesia

The Government of Indonesia has enacted Laws No. 7 on Water Resources with an aim of promotion of Integrated Water Resources Management at basin level. Out of 3 river basins had been managed by Corporate Type River Basin Organization i.e. Jasa Tirta I and Jasa Tirta II Public Corporation, in the year of 2007, under the new laws and regulation, the Central Government establishes 30 (thirty) Public Utility Type River Basin Organizations under the jurisdiction of the central government. In collaboration with provincial government, Government of Indonesia has established also 50 (fifty) Public Utility Type River Basin Organizations under jurisdiction of the provincial government. In the new laws and regulations illustrate the RBOs position as an organization in charge of water resources management at river basins level. It means the River Basin Organization are required to take consultation and their participations in increasing capacity and applying better water resources management and technology in its river basin.

The basic principle of water management under the context of Water Law No. 7/2004 is involving the effort to plan, implement and monitor as well as evaluate the subsequent implementation on water conservation, utilization, and mitigation of water resources disastrous potentials. While the water resource planning refers to in this context (which is just at the beginning stage in Indonesia) is the comprehensive plan, making use of integrated approach for subsequent implementation of water resources management under the principle of “one river, one plan, and one integrated system of management”.

2. River Basin Organization in Indonesia

Basically River Basin Organizations in Indonesia can be divided into 2 (two) types i.e. corporate type (Jasa Tirta I and II Public Corporation) and river basin development agency (BBWS). Financial source of the corporate type RBO and river basin development agency is mainly coming from water users and National Budget respectively.

Corporate Type

Jasa Tirta I and II Public Corporation (PJT I and PJT II) were established as a pilot of a new concept of corporatization in water resources management, i.e.: a river basin that is managed by a neutral and professional institution who applies in balanced between healthy corporation principles and accountable public service norms on water resources, based on the principle of “One River, One Plan, One Integrated Management” supported by public, private and stakeholders participation.

Main task of Jasa Tirta I and II Public Corporation is to conduct operation and maintenance of water resources infrastructures in Brantas, Bengawan Solo and Citarum River basin. Scope of works of Jasa Tirta I and II Public Corporation are:

- a. Preparation of water allocation and drought allocation plan for Provincial Water Resources Management Committee (*Panitia Tata Pengaturan Air* abbreviated as PTPA) approval and bulk water allocation based on the agreed plan and user licenses;
- b. Planning and operating the flood control and the flood forecasting and warning system;
- c. Undertaking watershed management in cooperation with related agencies;
- d. Provision of technical recommendation for water licensing; and
- e. Undertaking water quality monitoring, provision of technical recommendations for wastewater discharge and

participation in the «clean river program».

Concerning operation and maintenance of water resources infrastructures, tasks of PJT I include development and implementation programs concerning:

- a. General maintenance and some less expensive rehabilitation of infrastructure;
- b. Sediment removal in reservoir and river channel;
- c. Monitoring and controlling sand mining activities in rivers;
- d. Preparation land use plans (especially in the green belt area of the reservoirs and river corridors); and
- e. Providing technical recommendation for licensing of river corridor utilization and its monitoring.

Many aspects of IWRM and water governance system were developed and implemented in the Brantas, Bengawan Solo and Citarum River Basins. River infrastructures in the basins are in better condition, basin productivity and public awareness as well as user's contributions for financing O&M activities increase significantly. The key success factor to have supports from stakeholders is stakeholder satisfaction. Brantas River Basin under PJT I is the first river basin in Indonesia and in Asia as well who applies Quality Management System of ISO 9001 for design, operation and maintenance of water resources and infrastructure since 1997 as commitment of PJT I to achieve stakeholders' satisfaction through continuous improvement of the system and responsive actions on stakeholders' complaints. Since 2001, PJT I is also involved in managing water resources infrastructure in the Bengawan Solo, although full-fledged management system as in the Brantas River Basin is not yet implemented until 2007.

Besides applying Quality Management System of ISO 9001, Jasa Tirta I Public Corporation also having Certification of SNI-19-17025-2000 (ISO/IEC 17025) for its Water Quality Laboratory. Based on the assessment result carried out by National Accreditation Committee (this committee has been acknowledged by Asia Pacific Laboratory Accreditation Cooperation (APLAC) and International Laboratory Accreditation Cooperation (ILAC) for test laboratory accreditation system) on May 17-19, 2004, the Water Quality Laboratories of Jasa Tirta I Public Corporation have fulfilled the conditions as test laboratory and have the rights to obtain its Certification of SNI 19-17025-2000.

The consideration of Jasa Tirta I Public Corporation to implement quality system of SNI 19-17025-2000 is to anticipate the stakeholders' requests and management necessity toward augmentation of the service and to create water quality analysis and monitoring system that fulfilled the International standards that finally would yield precise water quality data, efficient, effective and consistent monitoring system in order to improve the best performance of the corporation.

River Basin Development Agency Type

River basin development agency (abbreviated in Indonesian as BBWS) is a public utility type RBO were established that have an overall function in managing water resources management in river basin basis. In 2007, the Central Government establishes 30 (thirty) river basin development agency under the jurisdiction of the Central Government. Some of them have been appointed as pilots of basin water resources planning and basin water resources management program.

BBWS is responsible for implementing the management of water resources covering the planning, construction, operation and maintenance in the areas of water resources conservation, water resources development, water resources efficiency and control of water damaging power in the river basin. According to decree of the Ministry of Public Works No. 12/PRT/M/2006, BBWS should perform the following functions when a PJT is not present:

- a. Preparation of water resources management scheme and plan in the river basin
- b. Preparation of plan and implementation of management of protected water source area in the river basin
- c. Water resources management covering water resources conservation, development, water resources efficiency and control of water damaging power in the river basin
- d. Preparation of technical recommendation and provision of permit for the preparation, allocation, use and exploitation of water resources in the river basin
- e. Operation and maintenance of water resources facilities in the river basin
- f. Management of hydrological monitoring system
- g. Preparation of water resources data and information
- h. Facilitation for the activity of coordination team for water resources management in the river basin
- i. Community empowerment in water resources management

III. ASSESSMENT OF THE CURRENT IWRM IN BENGAWAN SOLO RIVER BASIN

In order to provide understanding of the current IWRM practice in the Bengawan Solo River Basin, an initial assessment using the generic IWRM road map developed by Asian Development Bank (ADB) was conducted.⁵ Result of the initial assessment can be viewed as the following Table 6. Score of this road map is ordered as follows: 0 for condition whereupon no clear or present status for IWRM element is founded in the basin; 2 for IWRM on its way; and 4 is given when IWRM is getting results.

End score is founded as 58 out of 100. Thus it could be concluded that the current status of IWRM in the Bengawan Solo River Basin is on going, with respective results but still in need of further improvement and managerial development.

Table 6 Assessment of the current IWRM practice in Bengawan Solo River Basin

IWRM Element	IWRM Current Status	Score
River basin organization	PJT I was established under the Government Decree No. 93 of 1999, with clear mandate and organizational-set-up; and improves its performance through capacity building programs, like implementing quality assurance based management and good-corporate governance. BBWS Bengawan Solo was established as transformation of the former PIPWS Bengawan Solo by decree of the Ministry of Public Works in 2007. Responsibilities of the BBWS comprises infrastructure development, major repair and rehabilitation of water resources infrastructure.	4
Stakeholder participation	In both the Brantas and Bengawan Solo River Basin, regular and meaningful stakeholder participation is present. Stakeholder participation is envisaged under the framework of surface water allocation and user rights, most notable through the PTPA and PPTPA committees. However, this participation is limited, and in accordance to the Law No. 7 of 2004, further participation is possible.	4
River basin planning	A river basin plan or strategy exists as basis for basin investments. The basin plan was developed stage-wisely. Initial plan was drawn in 1974, but the plan gets updated in 2001 and 2005, with participation and ownership of basin stakeholders. Even though a basin plan exist, investment remains mostly in the pocket of	2

⁵

Road map can be viewed at: <http://www.adb.org/water/wfp/basin-roadmap.asp>.

IWRM Element	IWRM Current Status	Score
	government, due to the circumstances where the existing water service fee covers only the O&M costs.	
Public awareness	Public awareness programs for IWRM has just been introduced; and are minimal in scope	2
Water allocation	Water allocation among uses and geographical areas is implemented in the basin but limited. This is subject for improvement, including for participatory and negotiated approaches.	2
Water rights	Water user rights or entitlements administration are implemented well, based on the Law on Water Resources. Abstraction permits acts as main regulating instrument of the right. Even farmers and customary water users of local communities and farmers and farmer organizations constitutes the biggest user group, they are not subject to water service fee, thus making irrigation efficiency low in certain areas within the basin.	4
Wastewater permits	Legally a system of wastewater discharge permits and effluent charges exists, but implementation within the basin is still difficult.	0
IWRM financing	Government budget for IWRM is institutionalized at some levels of governance. IWRM financing is spend either at the reGENCY or municipality level, or provincial, but most of it at the national level, sourcing from the national budget.	4
Economic instruments	A system of raw water pricing and/or other economic instruments is enforced in the basin. The system provide share in IWRM costs, stimulate water demand management and to a certain extend conservation. Obstacle of the system is that the tariff remain low and is a political product of the related government institution, water users vis a vis the RBO. Revenue from water service fee covers only the basic O&M, thus making most of the water service to the farmers and public services subject to public service obligation fund from the government.	4
Regulations	Legal and regulatory framework to implement the principles of IWRM and its financing is not satisfactorily enforced	2
Infrastructure for multiple benefits	Several water resources infrastructures exist; and with scope to improve management	4
Private sector contribution	Private sector participation in IWRM is partly introduced but limited due to low return value of investments.	2
Water education	IWRM is occasionally introduced in school programs	2
Watershed management	Minimal investment to protect and rehabilitate upper watersheds; with little collaboration with local communities and civil society organizations	2
Environmental flows	A policy and implementation framework for introducing environmental flows is considered, but it's existence is weakly enforced due to the limited capability in controlling most of the flow downstream.	2
Disaster management	Separate and minimal investments in combined structural and nonstructural interventions to reduce vulnerability against floods, droughts, chemical spills and other disasters.	2
Flood forecasting	Flood forecasting and warning systems exist but does not work and need urgent improvement due lack of maintenance and operation costs.	2
Flood damage rehabilitation	Government provides limited budget allocation for the rehabilitation of infrastructure after floods. But complete assessment is under going in order to improve.	2
Water quality monitoring	Basin-wide water quality monitoring; and adequate application of standards.	4
Water quality improvement	A few structural or nonstructural interventions that reduce point and non-point water pollution, but with no direct result in improvement.	2
Wetland conservation	Limited or no investment to conserve and improve wetlands.	0
Fisheries	Limited measures to protect and improve fisheries	2
Groundwater management	Groundwater management is either just starting or is weakly enforced. Groundwater is in the jurisdiction of Ministry of Energy, Minerals and Mining. Evaluation and enforcement is weak.	2

IWRM Element	IWRM Current Status	Score
Water conservation	A policy and implementation framework to promote efficiency of water use, conservation, and recycling is weakly enforced	2
Decision support information	No river basin information systems to support IWRM	0
Total Score		58

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