Supporting Report F

WATER QUALITY MONITORING AND POLLUTION CONTROL

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F1 Present Condition and Issues on Water Quality in the Jeneberang River

F1.1 Outline

Deterioration of river water quality in the Jeneberang River is a serious issue in the Study Area. Especially, aggravated river water quality and reduced discharges during the dry season affects adversely water supply operation of PDAM and agricultural activity in irrigational area: thus the implementation of countermeasures is strongly required.

Causes of river water pollution are; a) Inflow of chemicals used in village irrigation area in midstream/upstream area, b) Inflow of uncontrolled industrial effluent, c) Salinity intrusion from destroyed portion of the rubber dam (as at 2004), and d) Mudflow and sedimentation caused by large-scaled land collapse that occurred on Mt. Bawakaraeng slopes in March 2004.

F1.2 River Water Quality

(1) Present Condition

Of rivers in South Sulawesi Province, the Jeneberang River has better raw water quality. The extent of river water pollution due to human activity can be assessed by the biochemical index such as biochemical oxygen demand (BOD) and chemical oxygen demand (COD). Though the available data are limited, the BOD and COD values in the rivers can be summarized as follows.

Comparison of BOD and COD in Rivers in South Sulawesi

(Unit: mg/l)

River	Jeneberang River [1)]	Average of other 7 rivers [2)]	Urban Drainage Canal in Makassar City [3)]
BOD	2-6	6-20	20-50
COD	8-14	14-50	35-70
COD/BOD	2.3	2.3	1.6

Note: The above figure shows a range of observed data (see Figure F1.1)

Source: 1) Environment Impact Assessment of Bili-Bili Multipurpose Project (1997-2001), 2) Hydrology and monitoring section of Dinas PSDA (2003), and 3) Observation under JICA Study (2004)

Figure F1.1 shows a ratio of COD by BOD known as indicator of pollution level comparing with values of other seven (7) basins in south Sulawesi province. As shown in the Figure, pollution level is similar to or less than other seven (7) basins, except for heavily polluted urban drainage canals in Makassar City.

Figure F1.2 and Figure F1.3 show the seasonal variation and vertical profile of representative water quality parameters of the Jeneberang River, respectively. Though the extent is not severe,

BOD value does not meet the requirement of the standard of Class-I[1] water, which is classified as the water acceptable for a raw water source for drinking water supply. COD is also at a marginal level of meeting the Class-I standard.

Figure F1.4 shows the result of water quality monitoring conducted by the JICA Study Team from September 2004 to March 2005 and table below summarizes them by showing the average value of dry season and rainy season. These results indicate following characteristics:

- Average of observed values of turbidity, TDS and TSS in rainy season are much higher than the values in dry season. The turbidity is getting significantly increased after the on-set of rainy season. This tendency has become more evident after the land collapse at Mt. Bawakaraeng in March 2004.
- In rainy season, water quality indices (Electric conductivity, BOD, COD) are low level than those in dry season. It can be seen that water quality in drainage canal is better condition due to dilution by rainwater

Summary of the Result of WQM Conducted by the JICA Study Team

Parameter [Unit]	Season	Sabo Dam No. 4	Sand Pocket No. 2	Bili-Bili 0.5 m	Bili-Bili 15 m	Bili-Bili 30 m	Bili-Bili Outlet	Jene-lata	Maleng-keri	Drainage
Temperature	Dry	20.7	32.2	29.8	28.6	29.1	30.4	33.0	31.0	33.0
[°C]	Rainy	22.4	27.2	28.3	27.6	28.2	27.9	29.1	29.8	31.4
Turbidity	Dry	868	245	339	403	817	381	8	338	45
[NTU]	Rainy	8,322	3,657	434	595	665	929	21	588	52
pH	Dry	7.7	7.5	7.3	7.2	7.1	7.1	7.4	7.1	6.6
--	Rainy	7.2	7.1	7.2	7.1	7.0	7.0	7.2	7.0	6.8
Conductivity	Dry	0.178	0.156	0.087	0.103	0.084	0.146	0.118	0.179	1.154
[mS/cm]	Rainy	0.169	0.102	0.099	0.214	0.147	0.121	0.098	0.104	0.748
TDS	Dry	90.3	79.4	43.7	51.7	42.1	73.0	58.9	89.5	576.2
[mg/l]	Rainy	432	243	272	276	177	220	223	204	1,905
TSS	Dry	1,391	316.6	441.2	516.4	1,248	482.9	10.1	434.2	44.1
[mg/l]	Rainy	13,086	5,763	546	811	873	1,168	33	741	59
BOD	Dry	-	-	-	-	-	-	-	-	33.1
[mg/l]	Rainy									20.2
COD	Dry	-	-	-	-	-	-	-	-	55.2
[mg/l]	Rainy									37.6
Total Coliforms	Dry	-	-	-	-	-	-	-	-	28,000
[nos./100ml]	Rainy									12,600,000

Source: JICA Study Team (2004-2005)

Note: Dry: Average of observed data during September-November 2004, Rainy: Average of December 2004-march 2005

The river water has relatively high suspended solids and turbidity even during the dry season. This is supposed to be due mainly to deterioration of the upper watershed, especially the Bawakaraeng area, and partly due to sand mining activities in the river.

(2) Water Quality Condition in Upstream Reaches

[1] Raw Water Quality Standard of Government Regulation No.82/2001 (See Section F3 and Databook B)

[2] The beginning of rainy season

Figure F1.3 shows a profile of river water quality along the Jeneberang River covering from upstream reaches (US in the Figure) to downstream reaches (DS). It is noted that water quality does not meet Class I water standards even in the upstream reaches. River water with total nitrogen (T-N) content of 0.15-0.25 mg/l flows into the reservoir, which indicates increasing use of fertilizers in the upstream agriculture. Figure F1.5 shows the distribution of village irrigation areas in the upstream area of Bili-Bili dam as well as the distribution of irrigation area and industries in the lower reaches.

Table below shows the maximum values of some selected items of water quality observed in the upstream reaches in 2001. The Table indicates a general tendency that water quality indices become worse in the lower part than in the upstream part. Especially, the values of T-N, NO3-N, BOD and COD at US-5 (Mangempang River) are very high as compared with the other points. Figure F1.6 show the location of water quality observation points.

Considering further intensification of agricultural activity with increasing population, the water pollution is anticipated to aggravate in the future, although the indices are presently still within an acceptable range compared with the regional standard of South Sulawesi Province. Potential pollution sources are presumed to be upstream agriculture as well as domestic wastewater.

Water Quality Condition in Upstream Area (Maximum Value of Year 2001)

Parameters	US-1	US-2	US-3	US-4	US-5	Standard for Class-I	
						South Sulawesi	National
Total Nitrogen (T-N)	0.162	0.167	0.163	0.166	0.539	-	-
Nitrogen Ammonia (NH_3-N)	0.046	0.046	0.040	0.044	0.052	< 0.5	< 0.5
Nitrogen Nitrite (NO_2-N)	0.030	0.038	0.039	0.039	0.053	< 0.06	< 0.06
Nitrogen Nitrate (NO_3-N)	0.067	0.082	0.074	0.076	0.421	< 10	< 10
Total Phosphorus (T-P)	0.040	0.040	0.041	0.051	0.049	< 0.2	< 0.2
Dissolved Oxygen (DO)	6.94	6.80	7.02	7.03	5.11	> 6	> 6
Biochemical Oxygen Demand (BOD)	3.13	5.12	4.14	4.74	8.64	< 2	< 2
Chemical Oxygen Demand (COD)	9.22	13.29	10.22	10.63	19.93	< 10	< 10

Remarks: 1) See map of Figure F1.6 for the location of US-1 to US-5:
US-1: Upper Jeneberang US-2: Terong River
US-3: Jonggoa US-4: Sand Pocket Dam
US-5: Mangempang River
2) Underlined value indicates exceeding the standard value

Source: Environment Impact Assessment of Bili-Bili Multipurpose Project (2001)

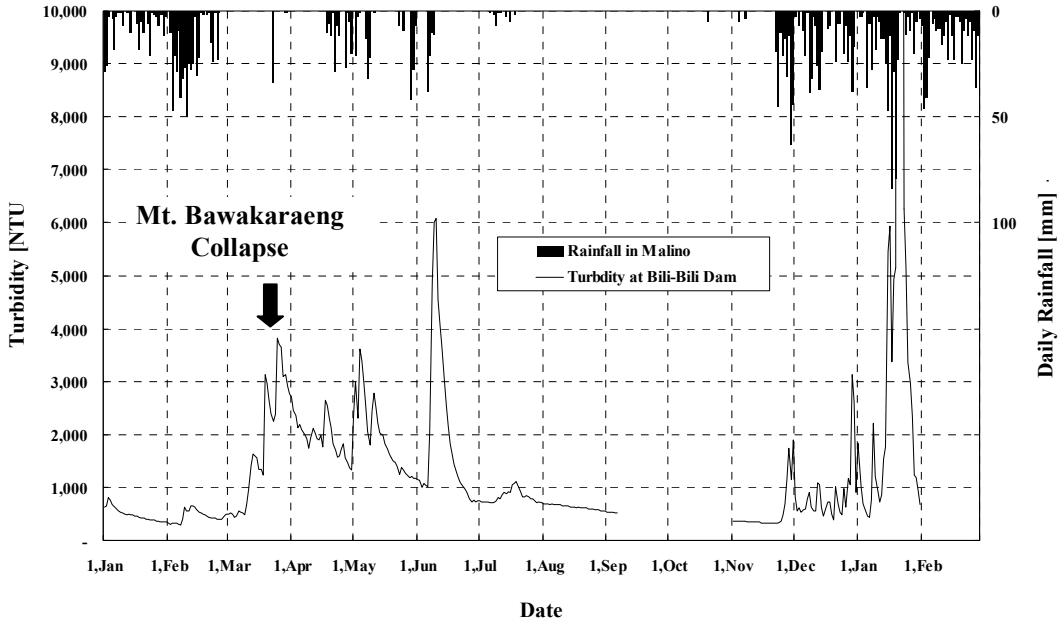
Moreover, Figure F1.3 indicates that the aggravation of water quality is more significant in the further downstream reaches (DS in the Figure) because of increased industrial/domestic effluent.

(3) Issues on Salinity Intrusion from Destroyed Portion at Rubber Dam

Saline water intrusion was obvious through damaged portion of the rubber dam in 2004. At Malengkeri water intake of PDAM Makassar located upstream of the rubber dam (Refer to Figure E9.1 and Figure E9.2), saline water intrusion often obliged PDAM to suspend the operation of water abstraction. JRBDP has already commenced the repair of rubber dam and foresees the completion within the dry season of 2005.

(4) Sediment Yield due to Land Collapse at Mt. Bawakaraeng

After the slope collapse at Mt. Bawakaraeng on 26th March 2004, the turbidity of river water has significantly increased and has become a serious factor especially from the viewpoint of municipal water supply. The figure below shows extraordinarily high turbidity just after the slope collapse in March and also in the succeeding April-June period following rainfall in the upper basin. The turbidity stabilized during the dry season from July to November, but again rose in the next rainy season (from December 2004). This indicates that debris mass in the Bawakaraeng caldera is still unstable, being subject to a high rate of erosion.



Period: Jan. 2004 – Aug. 2004
Source: Proyek Induk (Rainfall), PDAM Makassar (Turbidity)

Record of Turbidity after the Land Collapse

A report of PDAM indicates that water treatment cost for production of drinking water jumped after the land collapse up to approximately three to four times comparing with the previous period. For instance, Figure F1.7 shows the consumption of chemicals at five (5) WTPs of PDAM Makassar before and after the slope collapse. It is apparent that chemical consumption at WTPs taking water from the Jeneberang River (Ratulangi, Maccini Sombala and Somba Opu) increased at varying extent in April 2004. Especially, the increase was remarkable at Somba Opu WTP that takes the turbid water released from Bili-Bili dam, while the other WTPs take water at downstream reaches. It is said that acceptable raw water quality for treatment by PDAM is approximately 1,000 NTU[3]. Because of high turbidity, municipal water supply within PDAM Makassar service area was restricted to 40 % of the total supply area after the land collapse disaster.

[3] From interview at PDAM Makassar

F1.3 Uncontrolled Industrial Wastewater Discharged into the River

Currently, BAPEDALDA identifies 16 factories along the Jeneberang River basin as potential pollutant sources contributing to the deterioration of Jeneberang river water quality. Table F1.1 and Figure F1.5 show an inventory list and location of existing factories, respectively. As shown in Figure F1.5, most of the factories are densely located in the lower reach downstream of Somba Opu. Except for three (3) factories, most are discharging liquid waste directly into the river without pre-treatment. Bapedalda commenced monitoring of wastewater discharged from these factories in April 2004.

In 2003, Kabupaten Gowa conducted a monitoring survey of wastewater disposed from 22 industries located in the Kabupaten. The monitoring identified that most industries did not fulfill the requirements of the wastewater standard in various parameters such as BOD_5, COD, acidity (pH) and total suspended solids (TSS). (See-Table F1.2)

Even though there is no factory which owns wastewater treatment plant except for KIMA Industrial estate, it is seen that some of factories own simple treatment facility such as sedimentation tank or aeration tank in their factories in accordance with the regulation set forth for water pollution control in South Sulawesi. (See Section F3)

On the other hand, existing legislation stipulates; i) prohibition of wastewater disposal into water body without treatment, and ii) duty for installation of treatment facilities by individuals. Thus, enforcement of these legal provisions as well as relevant public awareness must be strengthened henceforward.

F1.4 Water Quality Condition in Urban Drainage Canal in Makassar City

Even though Makassar City is extensively urbanized as the capital of South Sulawesi Province having a population of more than one million, proper system of garbage collection has not been established as yet.

Presently, domestic wastewater discharges directly into the drainage canals and garbage is also disposed into the drainage canals. This reflects the inadequate practices of the general population. In the Jongaya-Panampu drainage canal, an extremely high biochemical pollution level (BOD 23-48 mg/l and COD 47-70 mg/l) was detected in September-November 2004. It is seen in the table below that the BOD and total coliforms greatly exceed the standards set forth for Class-IV[4] water, which is classified as the lowest class of water (water acceptable only for landscape, irrigation and other activity). At the Jongaya-Panampu Drainage Canal where the monitoring has conducted, numerous of garbage thrown by household and colony of insects were identified at the water surface with bad odor.

[4] The raw water standard of South Sulawesi Governor's Decree No.14/2003

Water Quality in Urban Drainage Canal in Makassar City (2004)

Parameters	17th, Sep. 20:00	24th, Sep. 16:00	8th, Oct. 16:30	22nd, Oct. 14:30	5th, Nov. 14:30	Standard for Class-IV	
						South Sulawesi(1	National(2
BOD	42.84	48.13	23.9	17.6	35.94	12	12
COD	68	69.84	47.26	35.5	57.33	100	100
Total Coliforms	37,000	24,000	24,000	11,000,000	10,000,000	10,000	10,000

Source: River Water Quality Monitoring subcontracted with Environmental Laboratory of University of Hasanuddin, under the JICA Study Team (2004)

Location: At a bridge in Jl. Sungai Sadang Baru

Note: (1 South Sulawesi Governor's Decree No.14/2003
(2 Government Regulation No.82/2001

In the Study Area, some of households have their own on-site facilities like a septic tank to treat domestic wastewater. Hotel, restaurant and shopping mall which are located in the urban area do not own any wastewater treatment plant. The uncontrolled disposal of garbage and influx of domestic wastewater are apparently causing the deterioration of waters in the drainage canals in the City.

Related with these issues, the Study of "Master Plan and Feasibility Study on Wastewater and Solid Waste Management for the City of Ujung Pandang" was conducted by JICA in 1994. The Study identified the need of the following measures:

- Improvement of living environment condition to be attained through active community participation;
- Treatment of wastewater using anaerobic filter system;
- Water quality improvement of the Jongaya-Panampu drainage canal;
- Protecting water quality of Losari Beach area; and
- Development of interceptor sewer system as the initial step of conventional sewage development in the central part of the objective area.

F2 Present Water Quality Monitoring Activities

F2.1 Water Quality Monitoring Activities by Public Institutions/Agencies

(1) BAPEDALDA[5] (South Sulawesi Province)

BAPEDALDA is basically a regulatory agency in the field of environmental conservation and management. As one of its function, BAPEDALDA shall take a leading role in the sector of water quality conservation and management. The role is defined as below in the South Sulawesi provincial regulation No.22/2001:

Summary of Role of BAPEDALDA

Activities
- To improve environmental awareness of society on environmental issues faced and problem solving efforts
- To improve cooperation with institution for environmental researches and assessment
- To improve the effort of observation of damage to water resource pollution and environment
- To develop an information system on environment monitoring and apply sanction to violation of environmental law and regulation in the control area

Source: Provincial Regulation of South Sulawesi No.22/2001

In respect of river water quality monitoring, BAPPEDALDA is acting as the coordinating agency for the multi-departmental PROKASIH program (Clean River Campaign) which was commenced in 1995. This program selects rivers which are of great importance in terms of water use, and attempts to mitigate the river water degradation by business activities through on-site inspections of factories in the river basin, strengthening administrative guidance on effluent control measures, implementing water quality monitoring and so forth. Under this program, the state of water pollution control in the selected factories is scored on a five-tiered system of gold, green, blue, red and black from best to worst. The results are then published together with company names.

For the Jeneberang River, BAPEDALDA is conducting monitoring at six (6) locations. The frequency of monitoring is however limited to once a year. The location of monitoring and observed data is shown in Figure F2.1.

In line with the legislation in the South Sulawesi Governor's Decree No.14/2003, BAPEDALDA also monitors the activity and effluent status of industrial factories along the Jeneberang River, presently totaling 16 sites. The monitoring activity was essentially started in 2004.

[5] Badan Pengendali Dampak Lingkungan Daerah (Regional Agency for Environmental Impact Assessment)

Existing Activities of BAPEDALDA Related with WQM

- Industrial Effluent Monitoring	
(Governor's Decree of South Sulawesi Province No.14/2003, Government Regulation of South Sulawesi Province No.7/2003)	
Location	: At outlet of 16 industrial factories along the Jeneberang River
Period	: Every 3 months
Analysis	: Sampling and analysis is conducted by each industrial factory itself.
Reporting	: A report should be prepared by factories and submitted to BAPEDALDA
- River Water Quality Monitoring (PROKASIH)	
Location	: At 6 points along the Jeneberang River
Period	: Once a year
Monitoring Parameter	: pH, TSS, BOD, COD
Analysis	: At a laboratory of Balai Industrial Ujung Pandang

Source: Verbal information from Bapedalda

(2) Dinas PSDA

Dinas PSDA South Sulawesi incorporates the Hydrology and Water Quality Monitoring Section. This institution does not regularly conduct water quality monitoring in the Jeneberang River.

A series of monitoring was conducted during five (5) years (1999-2003) under the central finance of APBN and DAK in seven (7) rivers in South Sulawesi. In the monitoring, 19 physical, chemical and microbiological parameters and river discharge are monitored for every 22 locations as shown in table below. Detailed location and collected data by the Study Team are compiled in Volume IV-2 Data Book.

a) Location of Water Quality Monitoring by Dinas PSDA (1999-2003)

1-a) Funding by APBN (to 2003)

	River	Location
1	Upper Dingau	Intake PG Takalar
2	Upper Pappa	Bt. Cinde Bridge
3	Lower Dingau	Ds. Patene
4	Lower Pappa	Pappa River Bridge
5	Upper Maros	Lekopancing Bridge
6	Bantimurung	Batubassi Dam
7	Lower Maros	Lama maros bridge
8	Upper Walanae	Intake publik gula Camming
9	Lower Walanae	Camming market
10	Upper Luppereng	Upper public gula Arasoe
11	Lower Luppereng	Luppereng Bridge
12	Upper Lompoe	Lompoe Bridge
13	Lower Lompoe	Ds. Lawalane
14	Upper Karaja	Malino Bridge
15	Lower Karaja	Karaja Bridge

1-b) Funding by DAK (since 2003)

No.	River	Location
16	Upper Tallo	Sawagi Bridge
17	Lower Tallo	Nipa-Nipa Bridge
18	Cenranae	Tampangeng Bridge
19	Walanae	Cabenge Bridge
20	Batu-Batu	Batu-Batu Bridge
21	Bilokka	Bilokka Bridge
22	Tanrutedong	Tanrutedong Bridge

2) Parameters

	Parameter	Unit
A	**Physical**	
1	Electric Conductivity	umhos/cm
2	Turbidity	NTU
3	Temperature	℃
4	Total Dissolved Solids	mg/L
5	Total Suspended Solids	mg/L
6	Organic Matter	mg/L
7	Salinity	ppt
B	**Chemical**	
1	Ammoniac (NH_3-N)	mg/L
2	Biochemical Oxygen Demand (BOD)	mg/L
3	Chemical Oxygen Demand (COD)	mg/L
4	Nitrate Nitrogen (NO_3-N)	mg/L
5	Nitrite Nitrogen (NO_2-N)	mg/L
6	Dissolved Oxygen (DO)	mg/L
7	pH	
8	Orthophosphate (PO_4^-)	mg/L
9	Sulfate (SO_4^-)	mg/L
C	**Microbiological**	
1	Fecal Coliform	per 100 ml
2	Total Coliform	per 100 ml
D	**Discharge**	m^3/sec

Source: Hydrology and Water Quality Monitoring Section of Sub Dinas Bina Teknik, Dinas PSDA (January 2004)

(3) Other Institutions (JRBDP, Balai PSDA and Cipta Karya Makassar)

JRBDP carried out a series of water quality monitoring on the Jeneberang River during 1994 to 2001 under an environmental monitoring program for the Bili-Bili dam project. In 2004, JRBDP conducted a water quality survey in connection with the Mt. Bawakaraeng land collapse. Their activity is not, however, on a continuous basis.

Balai PSDA is assigned to carry out water quality monitoring as one of its duties of river basin management. However, the organization is still on a mobilization stage and has not yet commenced the monitoring activity.

Based on present knowledge, Cipta Karya of Makassar City is not carrying out water quality monitoring for city drainage canals, apart from ad-hoc observation conducted irregularly. Some water quality of drainage canals is available from a previous study[6].

F2.2 Water Quality Monitoring Activities by PDAM and PLN

(1) PDAM Makassar

PDAM Makassar undertakes periodic monitoring of raw water quality at every water treatment plant (WTP) that takes water from the Jeneberang River and the Lekopancing (Maros) River. A total of 32 parameters (6 for physical, 24 for chemical and 2 for biological) are fully tested in their own laboratory basically once a month. Somba Opu WTP is monitoring fundamental parameters (temperature, pH, turbidity, color and residual chlorine, etc.) daily and at lesser occasions in other WTPs. Detailed analysis of the observed data in comparison with the standards for drinking water is conducted once a month in the laboratory of PDAM.

Water Quality Monitoring at Five (5) PDAM Makassar Intakes

	Name of WTP	Raw Water Source	Parameter	Period
I	Ratulangi	Jeneberang River	Monthly, for 32	Apr. 2000-Now
II	Panaikang	Lekopancing River	Parameters for Physical,	
III	Antang	Lekopancing River	Chemical and Biological	
IV	Maccini Sombala	Jeneberang River	Testing	
V	Somba Opu	Jeneberang River		Apr. 2001-Now

(2) PLN

Since January 2004, PLN is conducting water quality sampling on a monthly basis to assess the potential impact of water quality on the mechanical equipment of hydropower plant. In the monitoring, 23 parameters (6 for physical, 15 for chemical and 2 for biological) are tested at the laboratory of UNHAS-PPLH. According to the data collected up to August 2004, no notable contents hazardous to the equipment have been detected except for relatively high values of dissolved iron (Fe).

[6] Master Plan and Feasibility Study on Wastewater and Solid Waste Management for the City of Ujung Pandang" in 1994

F2.3 Equipment and Facilities for Water Quality Analysis

(1) Supply of Equipments by RMCD Project

In 1994, set of environmental monitoring equipments were supplied by RMCD (Regional Monitoring Capacity Development) Project under financial assistance from OECF (JBIC). This Project aimed at: i) establishing national environmental monitoring network in cooperating with local environmental laboratory; and, ii) capacity development of environmental management for local government. As one component of above, water quality analysis equipment was supplied to 39 water quality testing laboratories in 14 provinces which are owned by Ministry of Health, Ministry of Industry and/or Ministry of Public Works as shown in the table below.

a) Laboratories Reinforced under RMCD Project in 1994 (Component 1)

No.	Province	City	Laboratories		
1	West Java	Bandung	BBS	PU	BLK
2	Central Java	Semarang	BPPI	PU	BLK
3	East Java	Surabaya	BPPI	PU	BTKL
4	North Sematera	Medan	BPPI	PU	BLK
5	South Sematera	Barenbang	BPPI	PU	BLK
6	Lampung	Tanjung Karang	BPPI	PU	BLK
7	Liau	Bakanbaru	-	PU	BLK
8	Ache	Banda ache	BPPI	PU	BLK
9	West Kalimantan	Bonti anak	BPPI	PU	BLK
10	East Kalimantan	Samarinda	BPPI	PU	BLK
11	South Kalimantan	Banjyaru Mashin	BPPI	PU	BLK
12	Bali	Denpasar	-	PU	BLK
13	Yogjakarta	Yogjakarta	-	PU	BTKL
14	**South Sulawesi**	**Ujung Pandang (Makassar)**	**BPPI**	**PU**	**BLK**

Source: The post-evaluation Study on Implementation on Environmental Management in Indonesia, by JBIC, 2003

Note: BPPI: Laboratory of Balai Industry, PU: Laboratory of Ministry of Public Works, BLK: Laboratory of Balai Health

b) Major Equipment Supplied

No.	Equipments
1	Atomic spectral photometer
2	Gas Chromatograph
3	Total Oxidized Carbon meter
4	Spectrophotometer
5	Wastewater treatment facility
6	Biochemical Oxidant Demand (BOD) meter

Source: The post-evaluation Study on Implementation on Environmental Management in Indonesia, by JBIC, 2003

For South Sulawesi region, the Project supplied 3 sets of equipments for i) Laboratory of Ministry of Public Works (Dinas PU), ii) Laboratory of Balai Industrial, and iii) Laboratory of Balai Health.

i) Laboratory of Ministry of Public Works (PU)

This laboratory completely stopped their operation in 2003 and all equipments were transferred to Bapedalda. This decision was made by the Ministry of Environment at that time with an aim of concentrating water quality analysis activity onto Bapedalda.

In September 2004 the Study Team has visited the ex-laboratory building and confirmed that the building for water quality analysis is completely out of order without electricity and no equipments are kept there.

ii) Laboratory of Balai Industry

Similar to PU Laboratory, all of water quality testing equipment supplied by RMCD project was transferred to Bapedalda by February 2004. After that, they conduct water quality analysis on demand by other public institutions using their own equipment. This agency does not undertake regular monitoring and analysis of river water quality.

iii) Laboratory of Balai Health

Different from other two (2) institutions, the laboratory owns the equipments which the laboratory of Bapedalda could not accommodate in their building site. Thus, the institution conducts water quality analysis of samples at other public institution's request and opens the laboratory for academic training to students.

(2) Laboratory of BAPEDALDA (South Sulawesi Province)

BAPEDALDA owns an environmental laboratory which commenced operations since March 2004 and has 3 staffs as water sampling staff and water quality analyst (total 7 staffs including staff for air quality monitoring). New high-performance equipment is accumulated here from laboratories aforementioned.

However, most of equipments are kept not used. The officer of the laboratory explains that this is due to financial limitation to purchase chemicals needed for chemical analysis and so on.

(3) Environmental Laboratory of University of Hasanuddin (UNHAS-PPLH)

University of Hasanuddin owns two (2) laboratories (laboratory of Environment and laboratory of Physical chemistry) for water quality analysis. They own sufficient equipment for testing and experiences on environmental studies such as EIA Study of Bili-Bili dam project (1994-2001). The institution conducts environmental-related studies such as recommendation of pollution effluent charging system.

(4) Available Water Quality Testing Laboratory

At present, there are four (4) laboratories in operation in Makassar. These are listed as below:

Profiles of Existing Water Quality Testing Laboratory in Makassar City

Laboratory	Operating Agency	Activities
Balai Industry	Provincial Industrial Service	➢ Conducts water quality analysis on demand of other public institutions and private enterprises, but undertakes no regular monitoring and analysis of raw water quality by themselves
Balai Health	Provincial Health Service	➢ Owns testing equipment provided under JBIC loan project ➢ Conducts water quality analysis on demand of other public institutions, but undertakes no regular monitoring and analysis of raw water quality
Bapedalda	Bapedalda	➢ Owns testing equipment provided under JBIC loan project ➢ Laboratory started operations in April 2004 ➢ Conducting river water and effluent quality monitoring
UNHAS	UNHAS	➢ Owns sufficient equipment for testing ➢ Conducts water quality analysis on demand of other organizations, including project studies

Source: Interview held by the Study Team (September 2004)

All of these laboratories have a capability to conduct ordinary items of water quality testing. The Study assumes that new Public Corporation can use these laboratories on an outsourcing contract basis and hence will not need to have its own laboratory for a certain period. Nevertheless, there will be an option to have an own laboratory in the future depending on the increase of work volume.

F2.4 Water Quality Monitoring conducted by the Study Team in 2004

In relation with the occurrence of land collapse aforementioned, water quality monitoring was conducted by this Study during a period from September 2004 until March 2005. The work was approved by JICA in August 2004 and conducted as a subcontract work with CES-UNHAS (The Center of Environmental Science of University of Hasanuddin)

The monitoring work aimed at observation of mudflow together with a few parameters of river water quality of the Jeneberang River. The monitoring was undertaken at seven (7) locations once two (2) weeks.

Specifications such as monitored parameters, location and frequency are as described in the table below. (See Figure F2.2 for sampling location)

Analyzed Water Quality Parameters

a) Common Items (for all 7 locations)

Items		Unit
Temperature		^{o}C
Turbidity		NTU
pH		-
Conductivity		mS/cm
Total Dissolved Solids	(TDS)	mg/L
Total Suspended Solids	(TSS)	mg/L

b) Additional Examination for Jongaya-Panampu Drainage Canal (for 1 location)

Items		Unit
Biochemical Oxygen Demand	(BOD)	mg/L
Chemical Oxygen Demand	(COD)	mg/L
Total Coliforms	(T-C)	nos./100ml

Sampling Location

No.	Sampling Site	Sample Point	Number of Sampling
1	Sabo Dam No.4	Under the Dahara bridge	1
2	Sand Pocket No.2	At overflow weir	1
3	Bili-Bili Reservoir	Depth of 1) 30 cm 2) 15 m 3) 30 m at center of Bili-Bili Reservoir	3
4	Bili-Bili Dam	Near outlet of Bili-Bili Dam (near the intake facility of PDAM)	1
5	Jenelata River, at water level gauge site	Near the water level gauge site	1
6	Malengkeri PDAM intake	Near the intake facility of PDAM	1
7	Jongaya-Panampu Drainage Canal	Near the flushing gate	1

Totally 14 times of monitoring was conducted by the end of March 2005 and the results are reported periodically after laboratorial analysis by CES-UNHAS. Outline of the observed data was described in Section F1 above, and the detailed data contained in Volume IV-2 Data Book.

F2.5 Issues in Present Water Quality Monitoring Activities

As aforementioned, a critical issue on water quality management in the Study Area is the absence of institution or agency which is in charge of periodic water quality monitoring, reporting or giving technical recommendation to the concerned administrative agency, e.g. BAPEDALDA, Dinas PSDA, Dinas Kabupaten, etc.

For instance, the Clean River Campaign (PROKASIH) is undertaken under the leadership of BAPEDALDA since 1995. However, the frequency of monitoring is only once a year for every six (6) locations and it is still insufficient and difficult to figure out the present condition of the Jeneberang River all the time. Similarly to this, most of these activities are tend to be undertaken just for singly or occasionally, and very few continuous monitoring has been conducted.

There is also the absence of controlling system for industrial liquid waste management. In accordance with provincial regulation of South Sulawesi (No.7/2003) and National Regulation on wastewater management (No.82/2001), water quality monitoring for industrial liquid waste is

undertaken by each industry at the frequency of once three (3) months. As of 2004, 16 industries submit effluent quality data (tested by laboratory in Makassar City) to Bapedalda. Notwithstanding, no substantial actions for controlling wastewater (e.g. charging of pollution fee, warning for excessive pollution, etc.) have been taken yet, though the requirement of the actions is stipulated in the provincial regulation.

Summary of Existing Activity Related to Water Quality Management by Public Agencies/Individuals

Program	Agency/Institution	Outline of Activity
PROKASIH (Clean River Program)	BAPEDALDA	- River Water Quality Monitoring at 6 locations on Jeneberang River - Industrial Effluent Water Quality Monitoring for 16 factories - Conducts inventory survey for pollutant sources (Industrial factories)
Water Quality Monitoring	Dinas PSDA	- Water quality monitoring in 7 rivers in South Sulawesi
Water Quality Monitoring for municipal water supply	PDAM	- Water Quality Monitoring at inlet of 5 WTPs - 32 parameters including physical, chemical and biological are analyzed once a month
Laboratory Analysis	UNHAS	- Conducts water quality sampling and analysis under subcontract from various public institutions
EIA for the construction of Bili-Bili hydroelectric power plant	PLN	- Water quality monitoring at Bili-Bili hydro-electric power plant site

F3 Legal Framework of Water Quality Monitoring and Water Pollution Control

Existing legal structure related to water quality management and pollution control in Indonesia and South Sulawesi Province are summarized in Table F3.1.

F3.1 State Law on Environmental Management

In 1997, the State Law No.23/1997 concerning the Environment Management was enacted as primary legislation which stipulates the framework of general environment, which covers; i) Strengthening environmental regulations on business operations, ii) Strengthened penalties, iii) Enhanced regulations for environmental disputes, and iv) Introduction of the right of the general public on environmental information.

F3.2 National Regulation on Water Quality Management and Pollution Control

(1) Raw Water Quality

Consequently, the governing regulation on water quality aspect, which forms the basis of water quality management and water pollution control measures, is the Government Regulation concerning Water Quality Management and Water Pollution Control (Government Regulation No.82/2001, hereafter, "the National Regulation"), which stipulates water quality environmental standards for land water.

The standards classify water into four (4) classifications according to water use. These are: Class-I (water acceptable for raw water for drinking water), Class-II (water acceptable for recreational activity), Class-III (water acceptable for fisheries) and Class-IV (water acceptable for agriculture and livestock farming). Necessary parameters relative to respective water use are then selected from 46 parameters classified into i) physical parameters, ii) chemical parameters (organic substances, inorganic substances), iii) microbes, and iv) radioactive substances, and the maximum value for each parameter is indicated.

Raw Water Quality Standard by Water Use

Grade	Purpose
Class-I	Water usable for raw water for drinking water supply
Class-II	Water usable for recreational activity and other uses mentioned for Class-III and Class-IV
Class-III	Water usable for fisheries and other uses mentioned for Class-IV
Class-IV	Water usable for agriculture and livestock farming

Source: Government Regulation No.82/2001 concerning "Water Quality Management and Pollution Control"

Table F3.2 indicates the standard values set forth for respective classes of water. These standard values were also legislated at regional level by the Provincial Regulation No.7/2003 of South Sulawesi Province. These standards values are used as guideline indices in assessing the quality of surface water used for various purposes.

(2) Wastewater Quality

The Decree of the State Minister of Environment concerning Quality Standards of Liquid Waste for Industry Activity (No.51/1995) prescribes the standards for expanded number of specified 21 industrial sectors. Traditional major industries in Indonesia were selected as specified sectors, which include soda, metal processing, tanning, textile, palm oil, pulp and paper, soft drinks, and paint as below.

Specified Sectors and Standard Parameters for Wastewater Control by MNLKH No.51/1995

Type of Industry			
1	Caustic Soda	12	Mono Sodium Glutamate (Msg)
2	Metal Coating	13	Plywood
3	Leather Tanning	14	Milk and Food produced from milk
4	Palm Oil	15	Soft Drink
5	Pulp and Paper	16	Soap, Detergent and Vegetable Oil
6	Rubber	17	Beer
7	Sugar	18	Dry Battery
8	Tapioca	19	Paint
9	Textile	20	Pharmaceutical
10	Fertilizer	21	Pesticide
11	Ethanol		

Parameters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Discharge	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○
BOD			○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○	○	○
COD	○		○	○	○	○	○	○	○	○		○	○	○		○	○	○		○	○
TSS	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
pH	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Cd																			○		
Hg	○																	○	○		
Pb	○																	○	○		
Cu	○	○																	○		○
Zn	○	○																○	○		
CN		○						○													○
Total metal		○																			
Nickel		○																○			
Total Cr		○	○						○									○			
Cr^{6+}		○																	○		
Sulfide as H_2S			○				○														
Oil and Grease			○	○					○	○					○	○		○	○		
Total NH_3-N			○	○		○				○								○			
Total Phenol									○				○						○	○	○
Phosphate PO_4																○					
MBAS																○					
Titanium																			○		
T-N																				○	
Total Active material																					○

Source: Minister's Decree of Ministry of State's Environment No.51/1995

F3.3 Legislation of South Sulawesi Province concerning Water Quality and Wastewater Quality

In 2003, South Sulawesi Province has published new Decree and Regulation concerning Water Quality Management and Pollution Control (Governor's Decree No.14/2003 and Provincial Regulation No.7/2003, respectively) replacing the former version (Governor's Decree No.465/1995). This new legislation (hereafter, "the Provincial Regulation") basically follow the essences of latest national legislation (aforementioned (1) and (2)), and proposes regional water quality standards and 26 wastewater standards for each kind of industry including hospital,

domestic waste, and one general standard for other activities (Table F3.3). These standards can be used as guideline indices to control the effluents from industries.

Main Points of Government Regulation No.7/2003 and Governors' Decree No.14/2003

Themes	Main Contents
Water Quality Management	Responsible Agency - BAPEDALDA and/or Corporation - Report the result of Water Quality Monitoring
Pollution Control	Responsible Agency - BAPEDALDA and/or Dinas PSDA Effluent License - No Polluters cannot discharge wastewater into water without government license - To obtain effluent license, Polluters is obliged to fulfill these conditions; ➢ To prepare wastewater tanks, drainage canal or pipe following Dinas or Corporation's technical guidance ➢ To submit monitoring report once in 3 months to Bapedalda ➢ To bear the expenses for wastewater monitoring, and ➢ To pay wastewater disposal fee Collection of Revenues - Regional Government can collect wastewater treatment fee if water treatment plant is installed

In the regulation, authority of taking wastewater disposal fee from factories is entitled to the Governor together with that of issuing wastewater disposal license. It is noted that, presently, the role of water pollution monitoring is not assigned as the task of the Corporation. Thus, in this respect, the revision of relevant provincial regulations will be needed for execution of water pollution control by the Corporation.

In addition to the above regulations, river water quality management work will require another guidelines standard that describes the target quality of river water specific to each stretch of the river. This standard has not been prepared for the Jeneberang River. BAPEDALDA should prepare the guideline and legislate it as a Governor's Decree, based on which the new Public Corporation can undertake river water quality management in a proper way.

F4 Proposed Water Quality Management in the Jeneberang River Basin

F4.1 Proposed Role of the Public Corporation

In case of East Java, the provincial government delegates several authorities including monitory function of wastewater management to PJT I by Minister's Decree of Kimpraswil No. 342/1990 and periodical monitoring is undertaken by the corporation even though the regulatory role is not yet in active. In the Jeneberang basin, as far as the stipulation of existing provincial regulation indicates, the Corporation does not possess the function for wastewater management. Thus, establishment or revision of similar regulation to the above Kimpraswil Decree is recommended in South Sulawesi as well.

As one of the elements for proper water resources management and as required in the relevant regulations, the new public corporation shall participate in water quality monitoring and pollution control activities in a cooperative manner with the concerned agencies, including BAPEDALDA. As for the case being conducted by PJT I and PJT II, the role and responsibility of the Public Corporation will be as follows:

Activities which should be Undertaken by the Corporation

Activity	Target of activity
1. Water Quality Management	1) Conduct river water quality monitoring through sampling and testing at 8 proposed locations 2) Release river maintenance discharge as required for maintaining the river water quality 3) Report the results of monitoring and recommend corrective measures to BAPEDALDA through Dinas PSDA 4) Assist BAPEDALDA in formulating and conducting an integrated water quality monitoring activity in the basin
2. Wastewater Pollution Control	1) Periodically monitor effluent quality at pollutant sources in addition to factories' own 3-monthly reporting currently in practice 2) Identify pollutant sources as a part of river patrol survey 3) Analyze the collected data and propose the necessary corrective measures as required 4) Report the results of data analysis and recommend corrective measures to Bapedalda through Dinas PSDA 5) Submit technical recommendation regarding the issue of effluent discharge permits on demand of Bapedalda 6) Assist Bapedalda in formulating and conducting an integrated water pollution control activity in the basin 7) Collect effluent discharge fee as service cost for the above activities, through regional tax office (collection of fee together with effluent discharge tax)
3. Data Management	1) Keep in custody all collected data in a data base system established in the Corporation 2) Exchange data among all other agencies to share the information 3) Coordinate with Bapedalda in establishing a provincial data management system 4) Disseminate the relevant information to public through Corporation's annual report, public information leaflet or web-site

Figure F4.1 schematically describes demarcation of roles and responsibilities among concerned agencies/institutions.

F4.2 River Water Quality Monitoring Plan

(1) Monitoring Plan

Main objectives of river water quality monitoring are placed on identifying any potential problems before they arise. The monitoring will focus mainly on the following six (6) aspects:

(a) Adequacy of water quality for use as source of drinking water supply
(b) Hazardous industrial effluent inflow into the river in the lower reaches
(c) Effect of use of fertilizers for upstream agriculture
(d) Eutrophication of Bili-Bili reservoir water, particularly potential pollution due to fish-cage aquaculture
(e) Excessive sediment runoff from Mt. Bawakaraeng area
(f) Excessive aggravation of water quality in drainage canals in Makassar City

Eight (8) locations have been selected for periodical monitoring (See Figure F4.2). Of the 8 locations, observation of No.8 shall eventually be taken over to the Cipta Karya of Makassar City in the future, since Cipta Karya will be the agency responsible for the O&M of city canals.

Proposed Sampling Location in the Jeneberang River

No.	Location	Sampling Point	Number of Samples
1	Sabo Dam No.4	Under the Dahaha bridge	1
2	Sand Pocket No.2	At overflow weir	1
3	Bili-Bili Reservoir	At 1) surface 2) middle and 3) bottom depths at center of Bili-Bili Reservoir	3
4	Bili-Bili Dam Site	Near outlet of Bili-Bili Dam (near the intake facility of PDAM)	1
5	Kampili	Near the irrigation gate	1
6	Malengkeri	Near the intake facility of PDAM	1
7	Long Storage (Maccini Sombala)	Near the intake facility of PDAM	1
8	Jongaya-Panampu Drainage Canal	Near the flushing gate	1

In view of the objectives of the monitoring, the monitoring shall be conducted once a month for each location and the testing parameters shall cover the following.

Proposed Water Quality Monitoring Parameters for Each Location

Parameter	A. Upstream of Reservoir	B. Downstream of Reservoir	C. Downstream
Turbidity, Temperature, pH, Electric Conductivity, TSS, and TDS	○	○	○
BOD, COD, PO_4^-, T-N, NH_3-N, NO_3-N, and NO_2-N	○	○	○
Pb, Fe, Ca, Cr^{6+}, Cd, Hg, Mn, As, and CN		○	○
Cl^-, Na, and Mg			○
Fecal Coliforms, Total Coliforms (T-C)	○	○	○

(2) Technical Recommendation for Water Quality Management

The monitoring agency should submit collected data to environmental administrative agency (BAPEDALDA) with technical guidance on implementation of river water quality.

Apart from water quality deterioration due to domestic and industrial pollutants, an attention is also given to water contamination due to agriculture in the future. According to existing regulations, no water quality standard has been determined considering healthy growth of agricultural crops so far. For example, in Japan's case, the Ministry of Agriculture and Fishery determines a more strict values for agricultural than general standards, especially for rice-paddy and the standard is utilized as a reasonable guideline even though it does not have any law enforcement. From Figure F1.2 and Figure F1.3, it is seen that concentration of Total Nitrogen (T-N) is still in an affordable range (0.10-0.16 mg/liter) in 2001 (see Table shown in Section F1.2 (2)) even if comparing with Japanese special standard (1.0 mg/liter, see Table below). However, an increasing trend of concentration is detected.

Similarly, impacts for fish culture in Bili-Bili reservoir and lower reaches should be taken into consideration. The National Standard (No.82/2001) determines a special standard for fishery that a concentration of Ammoniac Nitrogen (NH_3-N) should be less than 0.02 mg/l for the normal growth, where the observed data range from 0.059 mg/liter to 0.072 mg/liter representing the maximum value in 2001 (see Table shown in Section F1.2 (2)).

Water Quality Standard for Agriculture (Rice Paddy)

Items	Unit	Standard
pH		6.0-7.5
COD	mg/l	6
BOD	mg/l	-
SS	mg/l	100
DO	mg/l	5
T-N	mg/l	1
NH_4-N	mg/l	-
Electric Conductivity	mS/cm	0.3
Cl^-	mg/l	-
Evaporation Residual	mg/l	-
Arsenic	mg/l	0.05
Zinc	mg/l	0.5
Copper	mg/l	0.02
ABS	mg/l	-

Source: Technical Conference for Agriculture and fishery (1971)

T-N [mg/l]	Effect for production
1	None
1-3	Growing thick
3-5	Growing thick or decrease
5-10	Decreasing
10-	Too decreasing

Source: Experimental Field of Agriculture, Tokyo (1967)

(3) Financial Source

Water quality monitoring is a service essential for public health and environmental conservation, but no revenue income is expected for the Corporation. Thus, the expenditure incurred by the Corporation for water quality monitoring shall be borne by the Government under a concept of public service obligation (PSO). (For the detail, refer Main Report Chapter 12)

Existing regulations (Government Regulation No.6/1981) stipulates that polluters shall pay a fee to the river management body to compensate for having caused contamination of water. Based on this concept, the Corporation can collect a fee from polluters. However, there is no regulation

specifically applicable to the Jeneberang River basin. MPW or regional government shall legislate a new decree similar to Kimpraswil Decree No.342/KPTS/M/2002 issued for PJT I (authorization of PJT I to collect fees including effluent discharge fee). The fee rate shall also be agreed between stakeholders.

F4.3 Plan for Water Pollution Monitoring

Although the authority for examination of pollutant sources and taking wastewater samples is stipulated as a role of the Corporation, the authority for controlling pollution activity or giving sanction to illegal polluters is not obliged to the Corporation. Therefore, revision of existing legislation or establishment of supplemental legislation is necessary to commence water quality management by pollution control by the Corporation as aforementioned.

(1) Monitoring Plan

In line with the water pollution control policy as stipulated in the National Regulation, the agency/institution concerned (proposed to be new Corporation in regard to Jeneberang basin) shall conduct effluent monitoring. Samples of industrial effluent shall be taken at the outlet of industrial factory which are located in the Jeneberang River basin as listed in the Table F1.1. The monitoring should be conducted once 3 months and covers all required parameters for industrial wastewater as determined by the regulation.

(2) Technical Recommendation for Wastewater Management

In accordance with the provincial regulation, the agency/institution shall prepare technical recommendation to BAPEDALDA. The recommendation shall include the items as listed below:

- Identification of existing pollutant sources around the Jeneberang River and updating in corporation with other institutions.
- Method of taking corrective measures for clearing national & provincial wastewater quality standard.
- Fulfillment of other conditions required for issuing license as stipulated in the regulation:
  - i) Installation of wastewater tank and drainage canal or pipe;
  - ii) Periodical wastewater quality examination and reporting of the results to BAPEDALDA; and,
  - iii) Payment of wastewater fee; and so on.

F4.4 Data Management

(1) Compilation of Data, Reporting and giving technical recommendation to environmental administrative agency (BAPEDALDA)

All agencies concerned with water quality monitoring (both rivers and groundwater) shall keep the observed data in custody and report them to Bapedalda every quarterly. It is preferable that

all agencies would use same data recording format. For attaining this, Bapedalda shall take an initiative. The Corporation will give technical recommendation in this aspect as well.

(2) Publication of Information on Present Water Quality Condition

New regulation requires the publicity of environmental data to the general people; accordingly the agencies concerned with environmental observation are obliged to release necessary information to the Public. In accordance with this stipulation, existing PJT I disseminates water quality data and industrial pollution condition on their website with comparison with concerned environmental standards determined by the central/provincial government. New Corporation in the Jeneberang basin shall also exercise the similar effort.

F4.5 Need of Further Studies by BAPEDALDA South Sulawesi Collaborating with Relevant Institutions

(1) Assessment of Target River Water Quality

As mentioned before, there is no standard indicating the target river water quality that should be maintained in each river stretch. Determination of target water quality requires conducting a wide range of environmental assessments; such as estimates of natural decontamination capacity (self-purification capacity) of rivers and potential pollutant quantities in the future. Bapedalda shall take a leading role for the study and legislate it by a Provincial Regulation.

(2) Optimum Waste Disposal Fee for the Pollution Control

As aforementioned in Section F3, well sophisticated legal system on environmental management exists in Indonesia comparable to law system in other environmentally-developed countries. However, the problem is that any regulation or pollution control activities including pollution fee, penalty for non-licensed polluters and other sanctions have not been actually undertaken by responsible agency so far.

Of several methods to regulate pollution by human activity as shown in Table F4.1, giving an "economic incentive" for polluters is practically effective to control pollution activity in Indonesia. Namely, some benefits should be given through a repayment or exemption of pollution charges depending on their effort for waste reduction. This concept seems to be ideal because it is realistically quite difficult to monitor disposing activities continuously. Table F4.2 shows examples of pollution charging system already in practice in OECD Countries.

F4.6 Service Schedule and Cost Estimate

Provision of these services is a burden to the Corporation during the initial phase of operation since no direct revenue is expected for the above services. It is proposed that the Corporation would commence these services only after the Corporation has established a firm revenue-collecting system; say, commencing the services from the 3rd year after the operation.

Table F4.3 shows the estimated annual cost for the services by the Corporation in the field of water quality and pollution control management.

F5 Capacity Development Plan for the Water Quality Monitoring Section

Capacity Development Plan (CDP) is required for the Corporation in the following aspects. It is reasonable that initial activity with On the Job Training (OJT) of the Corporation would be conducted during first 2 years under technical instruction and lecture of PJT I's chemical expert.

In OJT program, PJT I's guidelines and manuals for a) river water quality monitoring and b) pollution control shall be employed. It is also recommended to prepare new guidelines and manuals for the Jeneberang River based on existing one.

Existing Guidelines and Manuals of PJT-I

	Description
QP/PJT/42	Water Quality Monitoring Procedure
QP/PJT/57	Licensing water pollution activity
QI/PJT/31	Guideline for Water Sampling

To collect continuous water quality data as possible, it is desirable that the Corporation shall undertake water quality monitoring as a subcontract based work by another institution listed in Section F2.3 until commencement of their own work in FY 2009.

Capacity Development Plan for Water Quality Management Activity

	Description	Method
1.	Water Quality Monitoring (a) - Technical Guidance for Raw Water Sampling: - Technical Guidance for Water Quality Analysis	Lectures by PJT-I & OJT through a field experiment, Cooperation with research Institution or laboratory
2.	Wastewater Monitoring (b) - Inventory survey of Pollutant source - Interpretation of result and providing technical guidance to BAPEDALDA	Lectures by PJT-I & OJT
3.	Broadcasting of Collected Environmental Dataset (includes others) - Establishment and revision of database - Broadcast information through the web	Lectures by PJT-I & OJT

Detailed CDP is further described in a CDP Profile Sheet contained in Supporting Report N.

Tables

Table F1.1 Profile of Industrial Activity around the Jeneberang River

No	Name of Company	Location	Kinds of Product	Effluent	Effluent Water Quality Standard (Parameters) *)	Result of PLH Monitoring							Treatment Activity
						1	2	3	4	5	6	7	
1	UD. Kian Jaya	Gowa	Soft Drink Industry	Channel	TSS, BOD and COD	O	-	-	×	-	-	-	Nothing
2	UD. Mangasa Jaya	Gowa, Downstream	Food Processing Industry	River	BOD and COD	O	-	-	×	-	-	-	Nothing
3	UD. Tulung agung	Gowa, Downstream	Sea Grass Processing Industry	River	pH, TSS, BOD and COD	O	-	-	×	-	-	-	by Waste treatment Installation
4	UD. Adinata	Gowa	Food Processing Industry	Waste Disposal	pH, TSS, BOD and COD	O	-	-	×	-	-	-	Nothing
5	UD. Cahaya Terbit	Gowa	Coconut Oil Industry	IPAL	-	O	×	O	O	×	-	×	Sedimentation, neutralizing with caporite
6	UD. Malino	Gowa, upstream	Markisa Juice	Small river	TSS, BOD and COD	O	×	×	×	O	×	×	Nothing
7	PT. Nitto tea	Gowa, upstream	Black Tea and Green Tea	Public canal	BOD and COD	O	×	×	×	O	×	×	Nothing
8	CV. DHT.	Gowa, Downstream	Soft Drink Industry	Directly to Jeneberang River	pH, TSS, BOD and COD	O	-	-	×	-	-	-	Nothing
9	PT. GMTDC	Gowa/Makassar	Real Estate	Directly to the sea									Nothing
10	PT. Katelindo	Gowa, upstream	Tapioca Flour Industry	IPAL	BOD and COD	O	×	O	×	O	O	×	Nothing
11	PT. Uma Pelita S.	Gowa/Takalar	Tapioca Flour Processing	IPAL, 6 tanks@100 m^2	pH and COD	O	×	O	×	O	×	×	Aeration system, Filtering and Sedimentation
12	CV. Cahaya Indra	Gowa/Takalar	Ice Bar Factory	Public canal	TSS, BOD and COD	O	×	×	×	O	×	O	Nothing
13	PT. Celebes hotel	Malino, Gowa	Hotel Industry	Directly to the public canal	BOD and COD	O	×	×	×	O	×	×	Nothing
14	PT. Giwang Citra	Takalar	Sea Grass Processing Industry	-	-	-	-	-	-	-	-	-	
15	PT. Usaha Timur	Gowa	Soft Drink Industry and Printing Company	Directly to public canal	TSS, BOD and COD	O	×	O	-	O	×	×	Nothing
16	UD. Sumber Pangan	Gowa	Noodle Industry	Directly flow to urban drainage	TSS, BOD and COD	O	-	-	×	-	-	-	Nothing

Source: BAPEDALDA 2002/2003

Remarks:

1. Have document of AMDAL (Environmental Impact Assessment),
2. Report business activity routinely
3. Have implemented mostly the requirements of AMDAL Document.
4. Effluent water quality standard not more than maximum limit.
5. Not important to make revision for Document of Environmental Preservation Plan, Environmental Management Plan
6. To make an effort for recycling the residue of production.
7. To participate environmental conservation activity through yearly environmental day celebration.

PLH: Environmental Assessment Study

IPAL: Effluent Water Treatment Plant

*): Effluent water quality standard as attachment of the table of evaluation of industrial activity monitoring

Table F1.2 Recapitulation of Wastewater Analysis in Gowa Regency

Parameter			TSS (mg/l)	pH -	DO* (mg/l)	BOD_5 (mg/l)	COD (mg/l)
Sampling Location	a	UD. Kian Jaya	20	10	0	281	480.88
	b	DHT	20	7.2	0.8	200	487
	c	Kiosk Satelit	376	6.8	0	1050	1314
	d	Kiosk Sentosa	521	6.8	0.4	1400	1566.4
	e	Kiosk Delta	314	6.9	0	1450	1533.12
	f	Mangasa Jaya	150	7.12	0	1350	1650
	g	PT. Adinata	60	4.86	0	100	173
	h	Cahaya Terbit	7	8.03	9.4	40	66
	i	CV. Tulung Agung	21	6.991	0	60	99
	j	CV. Cahaya Indra Mulia	30	6.837	1.8	120	138
	k	Sumber Pangan	280	7.5	0	600	1620
	l	PT. Usti Makassar Jaya	78	6	4.2	480	682
	m	UD. Cipta Persada Makmur	74	13	7.8	105	218
	n	PT. Surya Nusantara Perkasa	118	6	0	250	430
	o	PT. Tiga Permai Tarsis	22	14	3.8	60	114
	p	PT. Katelindo Tulus Sejahtera	155	6	0	400	864
	q	Limbung Fuel Station	35	6.5	0	119	145
	r	PT. Uma Pelita Abadi	111	7	0	1300	1811
	s	PT. Nitto Malino Tea	100	6..5	0.9	1010	1650
	t	Pinang Mas Hotel	0	6	9.6	570	862
	u	Celebes Hotel	31	6.5	0	49	68
	v	Pesanggerahan Malino	18	6	6.6	700	920
Water Quality Standard		A-Class	200	6.0 – 9.0	-	50	100
		B-Class	400	6.0 – 9.0	-	150	300

Source: Bapedalda of Kabupaten Gowa

Table F3.1 Existing Legislation related with Water Quality Management

Title of Document	Kind of Document	Main Contents
National Law		
State Law No.23/1997 on Environmental Management	State Law	- Stipulates general framework: ➢ Strengthening of environmental regulations on business operations ➢ Strengthened penalties ➢ Enhanced regulations for environmental disputes ➢ Introduction of the right of the public on environmental information
Government Regulation No.82/2001 on Water Quality Management and Pollution Control *)	Government Regulation	- Revision of raw water quality standard and determines standards for 46 parameters for 4 kind of water use - Delegation of authority on water quality management to regional government
Minister's Decree No.51/1995 on Industrial Effluent Standard for 21 industrial activities	Minister's Decree of Ministry of State's Environment	- Determines effluent liquid standard for 21 industrial activities - Guideline for evaluating and calculating the amount of wastewater
Ministerial Regulation No.416/1990 on Clean Water	Ministerial Regulation of Ministry of Health	- Determines standards for; i) drinking water, ii) clean water, iii) water for swimming pool, and iv) water for public bath
Regional Regulation		
South Sulawesi Provincial Regulation No.7/2003 on Water Quality Management and Pollution Control	Provincial Regulation	- Provincial standard for water quality and wastewater regarding national standard and guidelines - Delegation of authority for water quality monitoring and pollution monitoring - Demarcation for water quality management among relevant agencies/institutions - Procedure and criteria for issuing effluent license
SS Governor's Decree No.14/2003 on Water quality and Wastewater, air condition management	Provincial Decree	- Determine wastewater quality standard for 26 industries, domestic, hotel, hospital and general industrial activity
(Draft Regulation)		
- Water Pollution Control in South Sulawesi Prov.	Provincial Level	- To determine detailed procedure for wastewater monitoring and pollution control, such as reporting and giving technical guidance to factory

Source: Field Survey by the JICA Study Team (2004)

Note: *) As of Nov. 2004, GR is under the revision by MPW (former Kimpraswil)

Table F3.2 National Water Quality Standard for Water Quality Management (Government Regulation No.82/2001)

Parameter		Unit	Class				Remarks
			I	II	III	IV	
A. PHYSICAL							
Temperature		^oC	± 3	± 3	± 3	± 5	from the natural condition
Total Dissolved Solids	(TDS)	mg/l	1,000	1,000	1,000	2,000	
Total Suspended Solids	(TSS)	mg/l	50	50	400	400	
B. INORGANIC CHEMICAL							
pH			6-9	6-9	6-9	5-9	
Biochemical Oxygen Demand	(BOD)	mg/l	2	3	6	12	
Chemical Oxygen Demand	(COD)	mg/l	10	25	50	100	
Dissolved Oxygen	(DO)	mg/l	6	4	3	0	Minimum Value
Total Phosphate	(T-P)	mg/l	0.2	0.2	1	5	
Nitrate Nitrogen	(NO_3-N)	mg/l	10	10	20	20	
Ammoniac Nitrogen	(NH_3-N)	mg/l	0.5	(-)	(-)	(-)	≤ 0.02 mg/l (**)
Arsenic	(As)	mg/l	0.05	1	1	1	
Cobalt	(Co)	mg/l	0.2	0.2	0.2	0.2	
Barium	(Ba)	mg/l	1	(-)	(-)	(-)	
Boron	(B)	mg/l	1	1	1	1	
Selenium	(Se)	mg/l	0.01	0.05	0.05	0.05	
Cadmium	(Cd)	mg/l	0.01	0.01	0.01	0.01	
Hexavalent Chromium (VI)	(Cr^{6+})	mg/l	0.05	0.05	0.05	1	
Copper	(Cu)	mg/l	0.02	0.02	0.02	0.2	≤ 1 mg/l (*)
Iron	(Fe)	mg/l	0.3	(-)	(-)	(-)	≤ 5 mg/l (*)
Lead	(Pb)	mg/l	0.03	0.03	0.03	1	≤ 0.1 mg/l (*)
Manganese	(Mn)	mg/l	0.1	(-)	(-)	(-)	
Mercury	(Hg)	mg/l	0.001	0.002	0.002	0.005	
Zinc	(Zn)	mg/l	0.05	0.05	0.05	2	≤ 5 mg/l (*)
Chloride	(Cl)	mg/l	600	(-)	(-)	(-)	
Cyanide	(CN)	mg/l	0.02	(-)	(-)	(-)	
Fluoride	(F)	mg/l	0.5	1.5	1.5	(-)	
Nitrite Nitrogen	(NO_2-N)	mg/l	0.06	0.06	0.06	(-)	≤ 1 mg/l (*)
C. PHYSICS							
Sulfate	(SO_4)	mg/l	400	(-)	(-)	(-)	
Free Chloride	(Cl_2)	mg/l	0.03	0.03	0.03	(-)	not required for the ABAM
Hydrogen Sulfide	(H_2S)	mg/l	0.002	0.002	0.002	(-)	≤ 0.1 mg/l (*)
D. MICROBIOLOGY							
Fecal coliform		/100ml	100	1,000	2,000	2,000	≤ 2,000 total/100ml (*)
Total coliform		/100ml	1,000	5,000	10,000	10,000	≤ 10,000 total/100ml (*)
E. RADIOACTIVITY							
Gross-A		Bq/l	0.1	0.1	0.1	0.1	
Gross-B		Bq/l	1	1	1	1	
F. ORGANIC CHEMISTRY							
Oil and Fat		µg/l	1,000	1,000	1,000	(-)	
Detergent as MBAS[(1]		µg/l	200	200	200	(-)	
BHC		µg/l	210	210	210	(-)	
Aldrin, dieldrin		µg/l	17	(-)	(-)	(-)	
Chlordane		µg/l	3	(-)	(-)	(-)	
DDT		µg/l	2	2	2	2	
G. PHYSICS							
Heptachlor and heptachlor epoxide		µg/l	18	(-)	(-)	(-)	
Lindane		µg/l	56	(-)	(-)	(-)	
Methoxychlor		µg/l	35	(-)	(-)	(-)	
Endrin		µg/l	1	4	4	(-)	
Toxaphone		µg/l	5	(-)	(-)	(-)	

(*) criterion for a conventional drinking water processor (**) for Fishery

Source: Attachment of Government Regulation Number 82 Year 2001 dated on 14 December 2001 concerning Water Quality Management and Water Pollution Control

Note: mg: milligram, µg: microgram, ml: milliliter, l: liter, Bq: Becquerel,

Note: [(1] MBAS: Methyl Blue Activators Substances

Table F3.3 Effluent Standards of Specified Sectors (South Sulawesi Governor's Decree No.14/2003)

1. Caustic Soda Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (kg/ton)
1	Total Suspended Solids (TSS)	25	75.0
2	Residual Chlorine (Cl^2)	0.5	1.5
3	Copper (Cu)	1.0	3.0
4	Lead (Pb)	0.6	1.8
5	Zinc (Zn)	1.0	3.0
6	Total Chromium (Cr)	0.5	1.5
7	Nickel (Ni)	1.2	3.6
8	Mercury (Hg)	0.004	0.012
9	Alkalic Mercury	Not detected	-
10	pH	6.0 - 9.0	
11	Waste maximum discharge	3.0 m^2 per ton of chloride Product or 3.4 per ton of Cl^2	

Remarks:
1. The maximum limit for each parameter on the table above is notified in milligram parameter per liter of wastewater
2. The maximum pollution load for each parameter on the table above is notified in gram per ton of caustic soda

2. Metal Coating Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (kg/ton)
1	Total Suspended Solids (TSS)	20	0.40
2	Cyanide (CN)	0.2	0.004
3	Total Chromium (Cr)	0.5	0.010
4	Chromium hexavalent (Cr^{6+})	0.1	0.002
5	Copper (Cu)	0.5	0.010
6	Zinc (Zn)	1.0	0.020
7	Nickel (Ni)	1.0	0.020
8	Cadmium (Cd)	0.05	0.001
9	Lead (Pb)	0.1	0.002
10	pH	6.0 - 9.0	
11	Waste maximum discharge	20 L per m^2 of metal coating product	

Remarks:
1. The maximum limit for each parameter on the table above is notified in milligram parameter per liter of wastewater
2. The maximum pollution load for each parameter on the table above is notified in gram parameter per m^2 of metal coating

3. Leather Tanning Industry

No	Parameter	Chrome use in processing		Leaves use in processing	
		Maximum limit (mg/l)	Maximum pollution load (kg/ton)	Maximum limit (mg/l)	Maximum pollution load (kg/ton)
1	Biochemical Oxygen Demand (BOD_5)	50	2.0	70	2.8
2	Chemical Oxygen Demand (COD)	100	4.0	150	6.0
3	Total Suspended Solids (TSS)	60.0	2.40	50	2.0
4	Total Chromium (Cr)	0.5	0.024	0.10	0.004
5	Oil and Grease	5.0	0.20	5.0	0.20
6	Total Nitrogen (T-N)	10.0	0.40	15	0.60
7	Total Ammonia (as a NH_3-N)	0.5	0.02	0.50	0.02
8	Sulfide (as H_2S)	0.7	0.028	0.50	0.02
9	pH	6.0 - 9.0		6.0 - 9.0	
10	Waste maximum discharge	40 m^2/ton of raw material		40 m^2/ton of raw material	

Remarks:
1. The maximum limit for each parameter on the table above is notified in milligram parameter per liter of wastewater
2. The maximum pollution load for each parameter on the table above is notified in kg parameter per ton raw material
3. Total Nitrogen is a sum of N organic + Total Ammonia + NO_3 + NO_2

4. Palm Oil Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution Load (kg/ton)
1	Biochemical Oxygen Demand (BOD_5)	80.0	0.20
2	Chemical Oxygen Demand (COD)	160	0.40
3	Total Suspended Solid (TSS)	200.0	0.50
4	Oil and Grease	25	0.003
5	Total Nitrogen (T-N)	50	0.125
6	pH	6.0 - 9.0	
7	Waste maximum discharge	2.5 m^2/ton Palm oil production	

Remarks:
1. The maximum limit for each parameter on the table above is notified in milligram parameter per liter of wastewater
2. The maximum pollution load for each parameter on the table above is notified in kg parameter per ton palm oil product
3. Total Nitrogen is a sum of N organic + Total Ammoniac + NO_3 + NO_2

5. Pulp & Paper Industry

Processing	Waste maximum discharge	Parameters: Biochemical Oxygen Demand (BOD)		Chemical Oxygen Demand (COD)		Total Suspended Solids (TSS)	
		Maximum limit	Maximum pollution load	Maximum limit	Maximum pollution load	Maximum limit	Maximum pollution load
	m^3/ton product	mg/ton	kg/ton	mg/ton	kg/ton	mg/ton	kg/ton
A. Pulp							
Washed /cleaned up Craft	85	100	8.5	350	29.8	100	8.5
Suspended pulp	95	100	9.5	300	28.5	100	9.5
Unwashed /cleaned up craft	50	75	3.8	200	10.0	60	3.0
Mechanic and Ground wood	60	50	3.0	12	7.2	75	4.5
Semi-chemical	70	100	7.0	200	14.0	100	7.0
Caustic pulp	80	100	8.0	300	24.0	100	8.0
De-inkpulp (reused paper)	60	100	6.0	300	18	100	6.0
B. Paper							
Smooth	50	100	5.0	200	10.0	100	5.0
Raft	40	90	3.6	175	7.0	80	3.2
Sparet	175	60	10.5	100	17.5	45	7.8
Washed/cleaned up paper	35	75	2.6	160	5.6	80	2.8
pH				6.0 - 9.0			

6. Rubber Industry

No	Parameter	Concentrated Latex: Maximum limit (mg/l)	Concentrated Latex: Maximum pollution load (kg/ton)	Rubber in dried form: Maximum limit (mg/l)	Rubber in dried form: Maximum pollution load (kg/ton)
1	Biochemical Oxygen Demand (BOD_5)	100	4.0	60	2.4
2	Chemical Oxygen Demand (COD)	160	6.4	150	6.0
3	Total Suspended Solids (TSS)	100	4.0	100	4.0
4	Total ammonia (NH_3-N)	15	0.6	5	0.2
5	Total Nitrogen (T-N)	25.0	1.0	10	0.4
6	pH	6.0 - 9.0		6.0 - 9.0	
7	Waste maximum discharge	40 m^3 per ton of rubber product		40 m^3 per ton of rubber product	

Remarks:
1. The maximum limit for each parameter on the table above is notified in milligram parameter per liter of wastewater
2. The maximum pollution load for each parameter on the table above is notified in kg parameter per ton of the dried rubber product or concentrated latex product

7. Sugar Industry

No	Parameter	Maximum limit (mg/l)	Maximum Pollution load (kg/ton)
1	Biochemical Oxygen Demand (BOD_5)	60	0.3
2	Chemical Oxygen Demand (COD)	100	0.5
3	Total Suspended Solids (TSS)	50	0.25
4	Oil and Grease	5	0.025
5	Sulfide (H_2S)	0.5	0.0025
6	pH	6.0 - 9.0	
7	Waste maximum discharge	5.0 m^3 per ton of Sugar product	

Remarks:
1. The maximum limit for each parameter on the table above is notified in milligram parameter per liter of wastewater
2. The maximum pollution load for each parameter on the table above is notified in kg parameter per ton sugar product
3. Waste maximum discharge is excluded injection water and refrigerating water

8. Tapioca Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution charge (kg/ton)
1	Biochemical Oxygen Demand (BOD_5)	120	3.6
2	Chemical Oxygen Demand (COD)	200	6.0
3	Total Suspended Solids (TSS)	100	3.0
4	Cyanide (CN)	0.3	0.009
5	pH	6.0 - 9.0	
6	Waste maximum discharge	30 m^3 per ton of tapioca product	

Remarks:
1. The maximum limit for each parameter on the table above is notified in milligram parameter per liter of wastewater
2. The maximum pollution load for each parameter on the table above is notified in kg parameter per ton of tapioca product

9. Textile Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (kg/ton)							
			Integrated Textile	Cotton Washing and weaving	Sizing & desizing	Clearing & Scouring	Bleaching	Mercerization	Dyeing	Printing
1	Biochemical Oxygen Demand (BOD_5)	60	6.0	0.42	0.6	1.44	1.08	0.9	1.2	0.36
2	Chemical Oxygen Demand (COD)	150	15	1.05	1.5	3.6	2.7	2.25	3.0	0.9
3	Total Suspended Solids (TSS)	50.0	5.0	0.35	0.5	1.2	0.9	0.75	1.0	0.3
4	Total phenol	0.5	0.05	0.004	0.005	0.012	0.009	0.008	0.01	0.003
5	Total Chromium (Cr)	1.0	0.1	-	-	-	-	-	0.02	0.006
6	Total ammonia (N-NH_3)	8	0.8	0.056	0.08	0.192	0.144	0.12	0.16	0.048
7	Sulfide (H_2S)	0.3	0.03	0.002	0.003	0.007	0.005	0.05	0.006	0.002
8	Oil and Grease	3	0.3	0.021	0.03	0.07	0.054	0.045	0.06	0.018
9	pH					6.0 - 9.0				
10	Waste maximum discharge (m^3 per ton of textile product)		100	7	10	24	18	15	20	6

Remarks:
1. The maximum limit for each parameter on the table above is notified in milligram parameter per liter of wastewater
2. The maximum pollution load for each parameter on the table above is notified in kg parameter per ton of textile product

10. Fertilizer Industry

No	Parameter	Urea fertilizer maximum pollution load (mg/l)	Nitrogen fertilizer maximum pollution load (kg/ton)	Ammonia Maximum pollution load (kg/ton)
1	Chemical Oxygen Demand (COD)	3.0	3.0	0.3
2	Total Suspended Solids (TSS)	1.5	3.0	0.15
3	Oil and Grease	0	0.3	0.03
4	Nitrogen Ammoniac (NH^3-N)	0.75	1.5	0.30
5	TKN…….. ?	1.5	2.25	-
6	pH		6.0 - 9.0	
7	Waste maximum discharge		15 m^3 per ton product	

Remarks:
1. Measurement of waste discharge to be done at a tail waste ditch
2. Pollution load (kg/ton product) = Concentration of each parameter x waste discharge
3. Pollution load of ammoniac Industry is being valiable also for Urea Fertilizer and other Nitrogen Fertilizer Industries producing over product of ammoniac

11. Ethanol Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (kg/ton)
1	Biochemical Oxygen Demand (BOD_5)	100	1.5
2	Chemical Oxygen Demand (COD)	200	3.0
3	Total Suspended Solids (TSS)	100	1.5
4	Sulfide (H_2S)	0.5	0.008
5	pH	6.0 - 9.0	
6	Waste maximum discharge	15 m^3 per ton of Ethanol Product	

Remarks:
1. The maximum limit for each parameter in the table above is notified on mg parameter per liter wastewater
2. The maximum pollution load for each parameter in the table above is notified on Kg parameter per ton of Ethanol product

12. Mono Sodium Glutamate (MSG) Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (kg/ton)
1	Biochemical Oxygen Demand (BOD_5)	80	9.6
2	Chemical Oxygen Demand (COD)	150	18.0
3	Total Suspended Solids (TSS)	100	12.0
4	pH	6.0 - 9.0	
5	Waste maximum discharge	120 m^3 per ton of MSG Product	

Remarks:
1. The maximum limit for each parameter in the table above is notified on mg parameter per liter wastewater
2. The maximum pollution load for each parameter in the table above is notified in Kg parameter per ton of MSG product

13. Plywood Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (gram/m^3 product)
1	Biochemical Oxygen Demand (BOD_5)	75	22.5
2	Chemical Oxygen Demand (COD)	125	37.5
3	Total Suspended Solids (TSS)	50	15.0
4	Phenol	0	0.1
5	Total ammonia (NH_3-N)	4	1.2
6	pH	6.0 - 9.0	
7	Waste maximum discharge	0.30 m^3 per $m^3$of Plywood Product	

Remarks:1.The maximum limit for each parameter in the table above is notified in mg parameter per liter wastewater
2. The maximum pollution load for each parameter in the table above is notified in gram per m^3 of plywood product
3. 1000 m^2 of the product = 3.6 of the product within 3.6 cm thickness

14. Milk Industry and Food Produced from Milk Industry

No	Parameter	Maximum limit (mg/l)	Waste maximum discharge Milk base factory (kg/ton)	Integrated Milk Industry (kg/ton)
1	Biochemical Oxygen Demand (BOD_5)	0.08	0.06	0.06
2	Chemical Oxygen Demand (COD)	0.20	0.15	0.15
3	Total Suspended Solids (TSS)	0.10	0.075	0.075
4	pH		6.0 - 9.0	
5	Maximum Waste Discharge		2.0 l/kg of total solids	1.5 l/kg of milk product

Remarks:
1. Base Milk Industry produces Sweeten Condensed Milk, Cream, Liquid Milk and/or Powder Milk
2. Integrated Milk Industry Produces Products made of Milk such as Cheese, Margarine and /or Ice cream
3. Maximum content for each Parameter in the table above is to be noted in mg parameter per liter Liquid Waste

15. Soft Drink Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (g/m^3) Bottle washing with Syrup making	Bottle washing without Syrup making	Syrup making without Bottle washing	Without Bottle washing/ Syrup making
1	Biochemical Oxygen Demand (BOD_5)	50	175	140	85	60
2	Chemical Oxygen Demand (COD)	30	105	84	51	36
3	Total suspended Solids (TSS)	6	21	17	10.2	7.2
4	pH			6.0 - 9.0		
5	Waste maximum discharge			3.5 mg per liter of soft drink		

Remarks:
1. The maximum limit for each parameter in the table above is noted on mg parameter per liter wastewater
2. The maximum pollution load for each parameter in the table above is noted on mg parameter per m^3 of soft drink produced

16. Soap Industry, Detergent and Vegetable Oil Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (kg/m^3) Soap	Vegetable oil	Detergent
1	Biochemical Oxygen Demand (BOD_5)	75	0.60	1.88	0.075
2	Chemical Oxygen Demand (COD)	160	1.28	4.50	0.18
3	Total suspended Solids (TSS)	60	0.48	1.50	0.06
4	Oil and Grease	15	0.12	0.375	0.015
5	Phosphate (PO_4^-)	1	0.016	0.05	0.002
6	MBAS	3	0.024	0.075	0.003
7	pH		6.0 - 9.0		
8	Waste maximum discharge		8 m^3 per ton of Soap	25 m^3 per ton of vegetable oil	1 m^3 per ton of detergent

Remarks:
1. The maximum limit for each parameter in the table above is noted on mg parameter per liter wastewater
2. The maximum pollution load for each parameter in the table above is noted on mg parameter per Kg parameter per ton of Soap, Vegetable oil and detergent product

17. Beer Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (g/ton)
1	Biochemical Oxygen Demand (BOD_5)	40	24.0
2	Chemical Oxygen Demand (COD)	100	60.0
3	Total suspended Solids (TSS)	40	24.0
4	pH	6.0 - 9.0	
5	Waste maximum discharge	6 hectoliter per hectoliter of Beer	

Remarks:
1. The maximum limit for each parameter in the table above is noted on mg parameter per liter wastewater
2. The maximum pollution load for each parameter in the Table above is noted on parameter per hectoliter Beer product

18. Dry Battery Industry

No	Parameter	Alkaline-Manganese		Carbon-Zinc	
		Maximum limit (mg/l)	Maximum pollution load (mg/kg product)	Maximum limit (mg/l)	Maximum pollution load (mg/kg product)
1	Biochemical Oxygen Demand (BOD_5)	-	-	15	3.75
2	Total suspended Solids (TSS)	8	12	10	2.5
3	Total Ammonia (NH_3-N)	-	-	1	0.25
4	Oil and Grease	2	3.0	4	1.0
5	Zinc (Zn)	0	0.3	0.3	0.075
6	Mercury (Hg)	0.005	0.015	0.01	0.0025
7	Alkali Mercury	Not detected	-	-	-
8	Manganese (Mn)	0.3	0.45	0.3	0.075
9	Chromium (Cr)	0.06	0.09	-	-
10	Nickel (Ni)	0.4	0.6	-	-
11	pH	6.0 - 9.0		6.0 - 9.0	
12	Waste maximum discharge	1.5 per kg battery		0.25 per kg battery	

Remarks:

1. The maximum limit for each parameter in the table above is noted on mg parameter per liter wastewater
2. The maximum pollution load for each parameter in the table above is noted on milligram parameter per kg Battery product

19. Paint Industry

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (g/m^3)
1	Biochemical Oxygen Demand (BOD_5)	80	40
2	Total suspended Solids (TSS)	50	25
3	Mercury (Hg)	0.005	0.0025
4	Alkali mercury	Not Detected	-
5	Zinc (Zn)	1	0.50
6	Lead (Pb)	0.30	0.15
7	Copper (Cu)	0.8	0.40
8	Chromium hexavalent (Cr^{6+})	0.20	0.10
9	Titanium (Ti)	0.40	0.20
10	Cadmium (Cd)	0.08	0.04
11	Phenol	0.20	0.10
12	Oil and Grease	10	5
13	pH	6.0 – 9.0	
14	Waste maximum discharge	0.5 l per liter product of water base of color paint	

Remarks:

1. Solvent – based of Color Paint should be zero in discharge; all waste water produced should be stored and re-processed and prohibited to through away in general aquatic area
2. The maximum limit for each parameter in the table above is notified on mg parameter per liter wastewater
3. The maximum pollution load for each parameter in the table above is noted on milligram parameter per m^3 product of color paint

20. Pharmaceutical Industry

No	Parameter	Maximum limit	
		Production process of formula material (mg/l)	Formula/Packing (mg/l)
1	Biochemical Oxygen Demand (BOD)	100	75
2	Chemical Oxygen Demand (COD)	160	120
3	Total Suspended Solids (TSS)	100	75
4	Total Nitrogen (T-N)	30	-
5	Phenol	1.0	-
6	pH	6.0 - 9.0	

Remarks:The maximum limit for each parameter in the table above is notified on mg parameter per liter wastewater.

21. Pesticide Industry

No	Parameter	Technical pesticide production		Formula/packing
		Maximum limit (mg/l)	Maximum pollution load (mg/kg product)	Maximum limit (mg/l)
1	Biochemical Oxygen Demand (BOD)	30	0.60	15
2	Chemical Oxygen Demand (COD)	100	2.00	50
3	Total Suspended Solids (TSS)	25	0.50	15
4	Phenol	2	0.04	1.5
5	Benzene	0	0.002	0
6	Toluene	0.1	0.002	0
7	Total Cyanide (T-CN)	0.8	0.016	0
8	Copper (Cu)	1.0	0.02	0
9	Total Ammonia (N-NH_3)	1.0	0.02	0
10	Total active material	1.0	0.02	0.05
11	pH	6.0 – 9.0		6.0 – 9.0
12	Waste maximum discharge	20 m^3 per ton of product		-

Remarks:

1. The maximum limit for each parameter in the table above is notified on mg parameter per liter of wastewater
2. The maximum pollution load for each parameter in the table above is notified on kg parameter per ton of pesticide product

22. Hotel Industry

No	Parameter	Maximum limit (mg/l)
1	Biochemical Oxygen Demand (BOD)	30
2	Chemical Oxygen Demand (COD)	50
3	Total Suspended Solids (TSS)	50
4	pH	6.0 – 9.0

23. Hospital Industry

No	Parameter	Maximum limit (mg/l)
A	**Physical**	
	Temperature	30 ^oC
B	**Chemical**	
	pH	6.0 – 9.0
	Biochemical Oxygen Demand (BOD)	30 mg/l
	Chemical Oxygen Demand (COD)	70 mg/l
	Total Suspended Solids (TSS)	30 mg/l
	Total NH^3	0.1 mg/l
	PO_4^-	2 mg/l
	Microbiological	
	Coliforms (MPN)	10,000 colony/100ml
C	**Radioactive**	
	$_{32}P$	7 x 10^2 Bq/L
	$_{35}S$	2 x 10^3 Bq/L
	$_{45}Ca$	3 x 10^2 Bq/L
	$_{51}Cr$	7 x 10^4 Bq/L
	$_{67}Ga$	1 x 10^3 Bq/L
	$_{85}Sr$	4 x 10^3 Bq/L
	$_{99}Mo$	7 x 10^3 Bq/L
	$_{113}Sn$	3 x 10^3 Bq/L
	$_{129}I$	1 x 10^4 Bq/L
	$_{131}I$	7 x 10^4 Bq/L
	$_{192}Ir$	1 x 10^4 Bq/L
	$_{201}Ti$	1 x 10^5 Bq/L

24. Domestic Activity

No	Parameter	Unit	Maximum limit		
			A	B	C
1	pH	-	6 - 9	6 - 9	6 - 9
2	Biochemical Oxygen Demand (BOD)	mg/l	25	40	75
3	Chemical Oxygen Demand (COD)	mg/l	80	100	125
4	Total Suspended Solids (TSS)	mg/l	20	35	50
5	Oil and Grease	mg/l	5	8	10
6	Total coliforms	nos/100 ml	2,500	5,000	-

Remarks:

Category A:
- Real estate area within > 200 ha in area
- Restaurant within > 2,300 m^2 in area
- Office, trade centre and apartment within > 50,000 m^2 in area

Category B:
- Real Estate Area within 16 - 200 ha in area
- Office, trade centre and apartment within 10,000 - 50,000 m^2 in area

Category C:
- Restaurant within 500 – 1,400 m^2 in area
- Office, trade centre and apartment within 5,000 – 10,000 m^2 in area

25. Oil - Petroleum Exploration

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (g/m^3)
1	Biochemical Oxygen Demand (BOD)	80	80
2	Chemical Oxygen Demand (COD)	160	160
3	Oil and Grease	20	20
4	Sulfide (H_2S)	0.5	0.5
5	Total ammonia (N-NH_3)	5.0	5
6	Total phenol	0.5	0.5
7	Temperature	45 ^oC	
8	pH	6.0 – 9.0	
9	Waste maximum discharge	1,000 m^3 per m^3 Oil raw material	

26. Industrial Area *)

No	Parameter	Maximum limit (mg/l)	Maximum pollution load (kg/day)
1	Biological Oxygen Demand (BOD)	50	4.3
2	Chemical Oxygen Demand (COD)	100	8.6
3	Total Suspended Solids (TSS)	200	17.2
4	Iron (Fe)	5.0	0.43
5	Chromium hexavalent (Cr^{6+})	0.3	0.0258
6	Zinc (Zn)	6.0	0.516
7	Copper (Cu)	2.0	0.172
8	Nitrogen Nitrate (NO_3-N)	15.0	1.29
9	Nitrogen Nitrite (NO_2-N)	2.0	0.172
10	Nitrogen Ammoniac (NH^3-N)	3.0	0.258
11	Sulfide (H_2S)	0.03	0.00258
12	Cyanide (CN^-)	0.3	0.0258
13	Oil and Grease	7.0	0.602
14	pH	6.0 – 9.0	

Remarks:

Maximum waste water Discharge: 1 liter per second per hectare for the utilized land Area

*) After under processing at the Installation of Waste Water Treatment Unit

27. General Standard of Liquid Waste

No	Parameter	Unit	Standard Class	
			Class-I	Class-II
A	**Physical**			
1	Temperature	^oC	37	40
2	Total Dissolved Solids (TDS)	mg/L	2,000	3,000
3	Total suspended Solids (TSS)	mg/L	200	400
B	**Chemical**			
1	pH	-	6.0 - 9.0	
2	Iron (Fe)	mg/L	5	10
3	Manganese (Mn)	mg/L	2	4
4	Barium (Ba)	mg/L	1.5	3
5	Copper (Cu)	mg/L	1.5	3
6	Zinc (Zn)	mg/L	4	8
7	Chromium hexavalent (Cr^{6+})	mg/L	0.1	0.5
8	Total Chromium (Cr)	mg/L	0.5	1
9	Cadmium (Cd)	mg/L	0.05	0.1
10	Mercury (Hg)	mg/L	0.002	0.005
11	Lead (Pb)	mg/L	0.1	0.8
12	Stannium (Sn)	mg/L	1.5	3
13	Arsenic (As)	mg/L	0.1	0.5
14	Selenium (Se)	mg/L	0.05	0.5
15	Nickel (Ni)	mg/L	0.2	0.5
16	Cobalt (Co)	mg/L	0.3	0.6
17	Cyanide (CN^-)	mg/L	0.05	0.5
18	Sulfide (H_2S)	mg/L	0.05	0.1
19	Fluoride (F)	mg/L	1.5	2
20	Total Chloride (Cl_2)	mg/L	1	2
21	Total Ammonia (NH_3-N)	mg/L	1	5
22	Nitrate (NO_3-N)	mg/L	15	30
23	Nitrite (NO_2-N)	mg/L	1	3
24	Biochemical Oxygen Demand (BOD)	mg/L	50	150
25	Chemical Oxygen Demand (COD)	mg/L	100	300
26	MBAS	mg/L	5	10
27	Phenol	mg/L	0.5	1.0
28	Vegetable oil	mg/L	5	10
29	Mineral oil	mg/L	10	40
30	Radioactivity**)	mg/L	-	-

Remarks:

To fulfill the Quality Standard, therefore, the Parameter Content should be prohibited that not to be able to obtain the Standard by mixing with water being taken directly from Water Sources. The Quality value of the parameters of the such waste liquid is stated with the permitted Maximum quality standard. Number of the Parameters measured being determined in accordance with the such kind of Liquid waste.

**) The content of Radioactivity that is being followed the prevailing Law.

Table F4.1 Method for Pollution Control

Method	Contents
Fee & Charge	Pollution surcharge is a fee imposed to pollutant source depending on an amount of waste deposit into environment, which is composed with: - **Effluent fee**, related to the amount of waste deposit - **Product charge**, imposed to products which may cause pollutant source through its processing - **User charge**, imposed to user of natural resources
Subsidy	Payment or exemption of charge as an economical grant for effort/plan for reducing pollutant
Depositing System	Potential polluters are imposed an advance payment for coming environmental pollution damages and can be paid back when polluters conduct any effective countermeasures for their pollution activity.

Source: "Interim Report on the Workshop of Finance and Taxation System for Water Treatment", Japan Wastewater Research Institute

Table F4.2 Existing Effluent Charge System in OECD Countries in 2000

Country	Abstract of Charge System	Usage of the Charge	Amount of collected Charge (million USD)
Australia	Depends on amount of wastewater	Cost for Environmental Administration	Unknown
Belgium	Occasionally imposes pollutant charges	Cost for Wastewater Treatment	261.4 (1998)
Canada	Impose to industrial effluent	Provincial Tax	Unknown
Czech	Impose for pollutants		13.5 (2000)
Denmark	Impose for effluent water	General Budget	Unknown
France	Depends on polluters and pollutants	Cost for Water Pollution Control	1342.4 (1999)
German	Depends on polluters	Cost for Water Pollution Control	409.2 (1998)
Rep. Korea	Imposes for 15 kind of pollutant	Cost for environmental administration	7.1 (2000)
Mexico	Depends on area, effluent discharge and pollutants	General Budget	6.6 (2001)
Netherlands	Depends on BOD, COD, heavy metal, unit per population. For large scaled activity, depends on measured quality and quantity of wastewater	Cost for Water Pollution Control	31.2 (2001)
Poland	Depends on area, polluters and pollutants	Environmental Funds	Unknown
Slovakia	Wastewater Effluent Charges	Cost for Water Pollution Control	4.3 (2000)
Spain	Depends on pollution index and charging system	Cost for Water Management including construction of wastewater treatment plant	29.2 (2001)
U. Kingdom	Depends on effluent discharge and poison	Cost for environmental administration	Unknown

Source: Environmental Performance Reviews - WATER Performance and Challenges in OECD Countries, OECD (2003)

Table F4.3 Water Quality Monitoring and Pollution Control
Estimated Operation Cost (1/2)

Description	Unit	Q'ty	Unit Price	Amount (Rp.)	Remarks
1 Direct Personnel Cost (Responsibel Section: O&M & Environ. Section of Technical Bureau)					
Head of Technical Bureau (1)	M/M	3	5,474,959	16,424,877	25% of annual M/M
Head of O&M and Environment Sec. (1)	M/M	8	4,385,779	35,086,230	70% direct work
Water Quality Analyst (1)	M/M	12	2,017,413	24,208,956	100% direct work
Sampling Staff cum analysis assist. (2)	M/M	24	1,026,145	24,627,482	100% direct work
Computer operator	M/M	6	1,039,657	6,237,943	
Drivers	M/M	12	1,026,145	12,313,741	
Miscellaneous (20%)				23,779,846	
Sub-total				142,679,074	
2 Labour Cost					
Labor for sampling work	M/D	120	16,800	2,016,000	
Miscellaneous (20%)				403,200	
Sub-total				2,419,200	
3 Materials and Supplies					
Water Samplers	No.	10	10,000	100,000	Purchase 1 ea.
Portable water samplers kit	No.	1	3,000,000	3,000,000	every year
Consumables for sampling	month	12	100,000	1,200,000	
Miscellaneous (20%)				860,000	
Sub-total				2,060,000	
4 Equipment					
Vehicles (fuel, consumables, repair)	car/day	365	100,000	36,500,000	
Computer consumables	No./mo.	12	100,000	1,200,000	
Miscellaneous (20%)				7,540,000	
Sub-total				45,240,000	
5 Duty Trip and Field Allowance					
(1) Duty Trip					
Duty trip to Jakarta					
- Travel Cost	No.	5	1,500,000	7,500,000	
- Perdiem and lodging	day	10	550,000	5,500,000	
Duty trip to Malang					
- Travel Cost	No.	5	1,200,000	6,000,000	
- Perdiem and lodging	day	15	400,000	6,000,000	
Sub-total				25,000,000	
(2) Field Allowance					
Field allowance for staff	M/D	120	30,000	3,600,000	Sampling +
Field allowance for drivers	M/D	60	10,000	600,000	Inspection
Lodging allowance	M/D		200,000	0	
Miscellaneous (20%)				840,000	
Sub-total				5,040,000	
6 Other Direct Costs					
Report printing cost	LS			5,000,000	
Leaflets for public relation	LS			5,000,000	
Miscellaneous (20%)				2,000,000	
Sub-total				12,000,000	
7 Sub-Total of 1 to 6				234,438,274	
8 Contract Work					
8.1 River Water Quality Minitoring					
B-1) Physical Paremeters (at every locations)					
Turbidity	No.	120	5,000	600,000	10 samples x
Temperature	No.	120	5,000	600,000	12 times/year
pH	No.	120	5,000	600,000	
Electric Conductivity	No.	120	5,000	600,000	
Total Suspendid Solids (TSS)	No.	120	15,000	1,800,000	
Total Dissolved Solids (TDS)	No.	120	15,000	1,800,000	
B-2) Chemical Parameters					
Biochemical Oxygen Demand (BOD)		96	25,000	2,400,000	8 samples x
Chemical Oxygen Demand (COD)		96	25,000	2,400,000	12 times/year
Orthophosphate (PO_4^-)		96	20,000	1,920,000	
Total Nitrogen (T-N)		96	40,000	3,840,000	

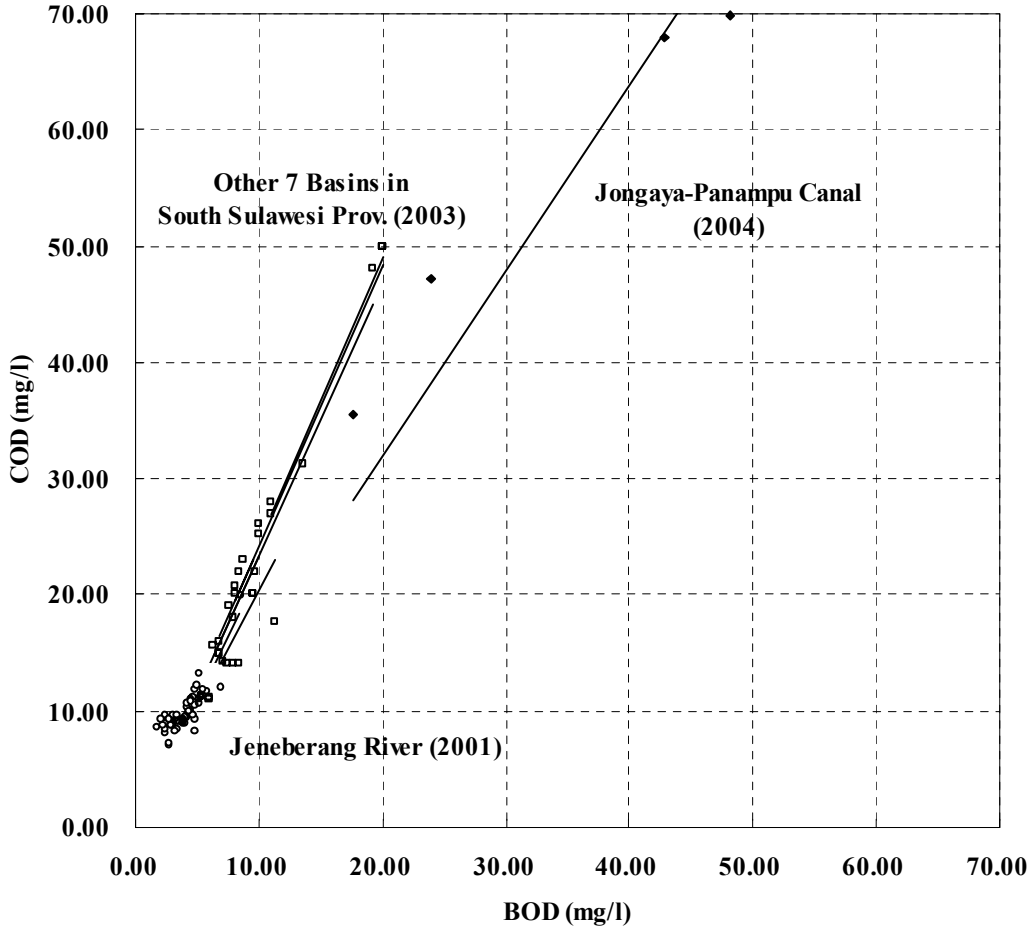
Table F4.3 Water Quality Monitoring and Pollution Control
Estimated Operation Cost (2/2)

Description	Unit	Q'ty	Unit Price	Amount (Rp.)	Remarks
Nitrogen Ammoniac (NH_3-N)		96	40,000	3,840,000	
Nitrogen Nitrate (NO_3-N)		96	20,000	1,920,000	
Nitrogen Nitrite (NO_2-N)		96	20,000	1,920,000	
Lead (Pb)		72	35,000	2,520,000	6 samples x
Iron (Fe)		72	35,000	2,520,000	12 times/year
Calcium (Ca)		72	35,000	2,520,000	
Crom hexavalent (Cr^{6+})		72	35,000	2,520,000	
Cadmium (Cd)		72	35,000	2,520,000	
Mercury (Hg)		72	75,000	5,400,000	
Manganese (Mn)		72	35,000	2,520,000	
Arsenic (As)		72	75,000	5,400,000	
Cyanide (CN)		72	40,000	2,880,000	
Chloride (Cl^-)		36	15,000	540,000	3 samples x
Natrium (Na)		36	35,000	1,260,000	12 times/year
Magnesium (Mg)		36	35,000	1,260,000	
B-3) Biological Parameters					
Fecal Coliforms		72	80,000	5,760,000	6 samples x
Total Coliforms (T-C)		72	75,000	5,400,000	12 times/year
Sub-total				67,260,000	
8.2 Effluent Discharge Minitoring					
B-1) Physical Parameters					
Temperature		60	5,000	300,000	15 factories x
pH		60	5,000	300,000	4 times/year
Total Suspendid Solids (TSS)		60	15,000	900,000	
Total Dissolved Solids (TDS)		60	15,000	900,000	
B-2) Chemical Parameters					
Biochemical Oxygen Demand (BOD)		60	25,000	1,500,000	
Chemical Oxygen Demand (COD)		60	25,000	1,500,000	
Manganese (Mn)		60	35,000	2,100,000	
Barium (Ba)		60	35,000	2,100,000	
Nitrogen Ammoniac (NH_3-N)		60	40,000	2,400,000	
Nitrogen Nitrate (NO_3-N)		60	20,000	1,200,000	
Nitrogen Nitrite (NO_2-N)		60	20,000	1,200,000	
Lead (Pb)		60	35,000	2,100,000	
Iron (Fe)		60	35,000	2,100,000	
Cupper (Cu)		60	35,000	2,100,000	
Crom hexavalent (Cr^{6+})		60	35,000	2,100,000	
Cadmium (Cd)		60	35,000	2,100,000	
Mercury (Hg)		60	75,000	4,500,000	
Zinc (Zn)		60	35,000	2,100,000	
Arsenic (As)		60	75,000	4,500,000	
Cyanide (CN)		60	40,000	2,400,000	
Crom (Cr)		60	35,000	2,100,000	
Stannium (Sn)		60	35,000	2,100,000	
Selenium (Se)		60	75,000	4,500,000	
Nickel (Ni)		60	35,000	2,100,000	
Cobalt (Co)		60	35,000	2,100,000	
Sulfate (H2S)		60	40,000	2,400,000	
Fluoride (F)		60	40,000	2,400,000	
Residual Chlorine (Cl2)		60	15,000	900,000	
methylene Blue (MBAS)		60	40,000	2,400,000	
Phenol		60	40,000	2,400,000	
Oil		60	40,000	2,400,000	
Sub-total				64,200,000	
Total				**365,898,274**	
River water quality monitoring				184,479,137	
Water pollution control				181,419,137	

Note: 1. The above estimate is made for annual work volume to be accomplished according to job schedule prescribed in the mid-term operation plan (toward 2011). The work volume will be expanded to this work volume level year by year
2. Note: It is roughly assumed that 50% of the above cost is allocated to river water quality monitoring and 50% to water pollution control.
3. Cost for respective years is roughly estimated on the basis of work volume anticipated in each year: asuumed as 20% for 2007 (only preparatory work), 50% for 2008 (only river water quality monitoring), and 100 % for 2009 onward (full scale operation).

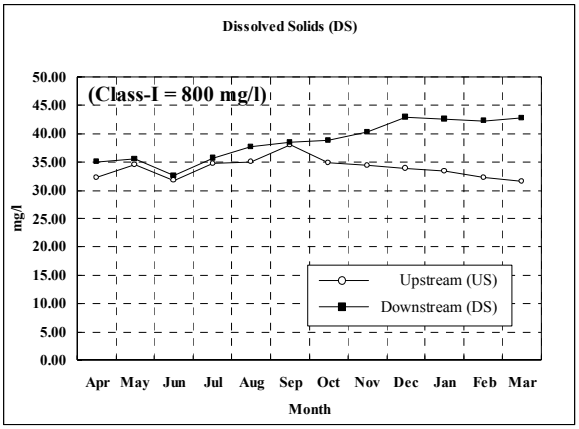
Figures

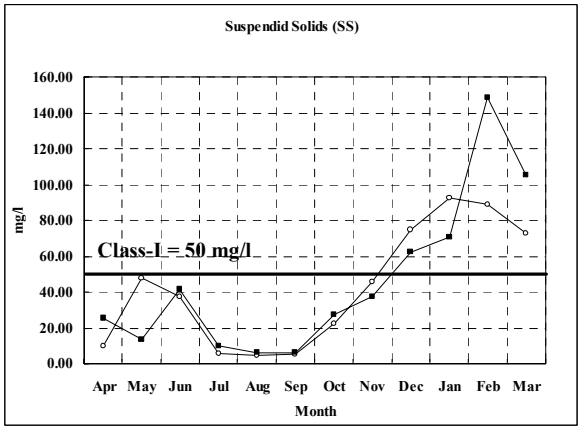
Figure F1.1 River Water Quality of the Jeneberang River - Comparison of BOD and COD

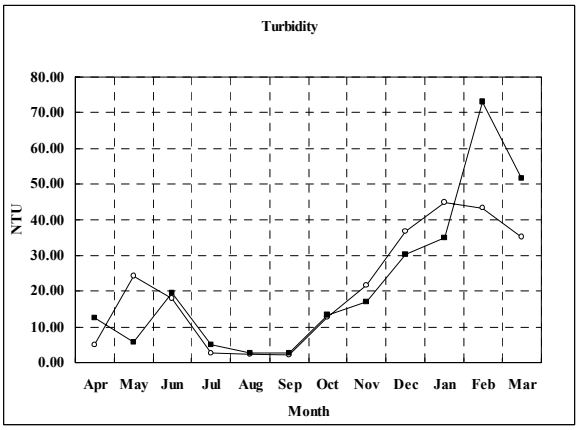


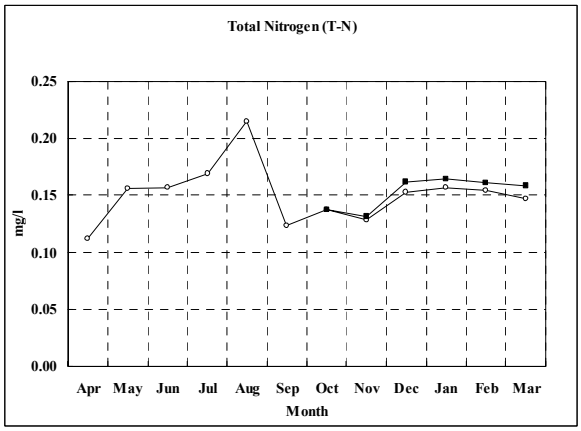
Source:
1) Jeneberang River (2001): Environmental Impact Assessment of Bili-Bili Multipurpose Dam Project in 2001
2) Data of other 7 basins (2003): Water Quality Survey by Hydrology and Water Quality Monitoring Section of Dinas PSDA
3) Jongaya-Panampu Drainage Canal (2004): Water Quality Monitoring by the JICA Study Team in Sep.-Dec. 2004

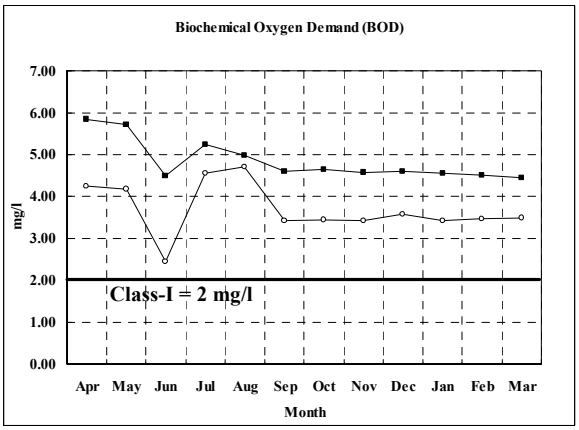
Figure F1.2 River Water Quality of the Jeneberang River - Seasonal Variation

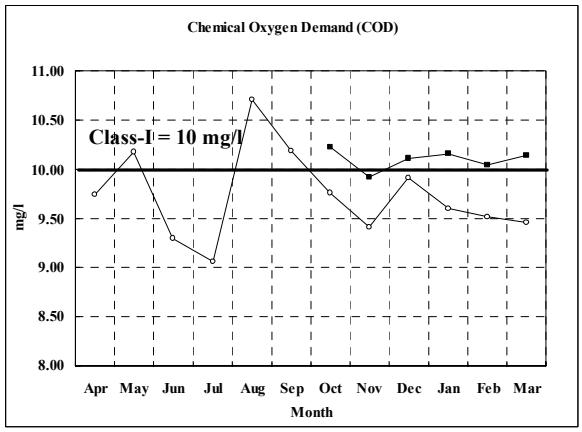


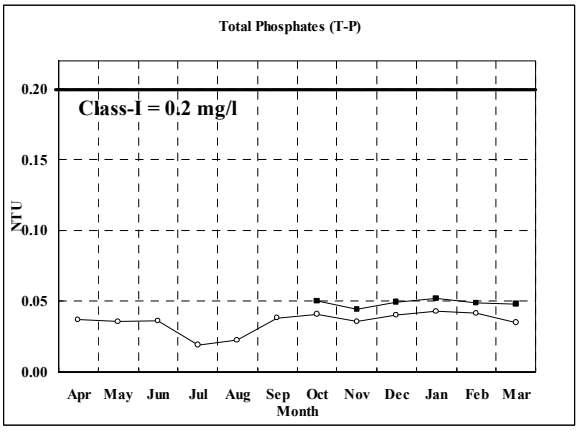


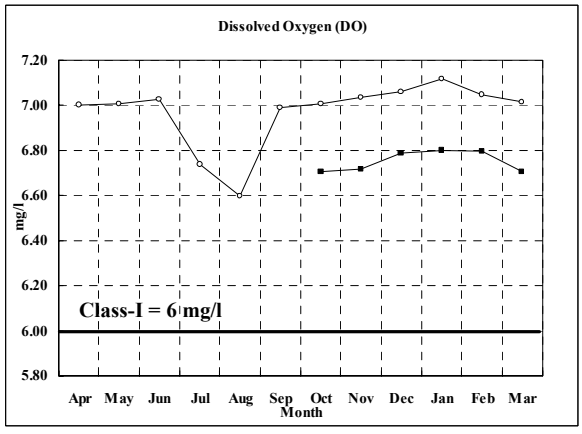








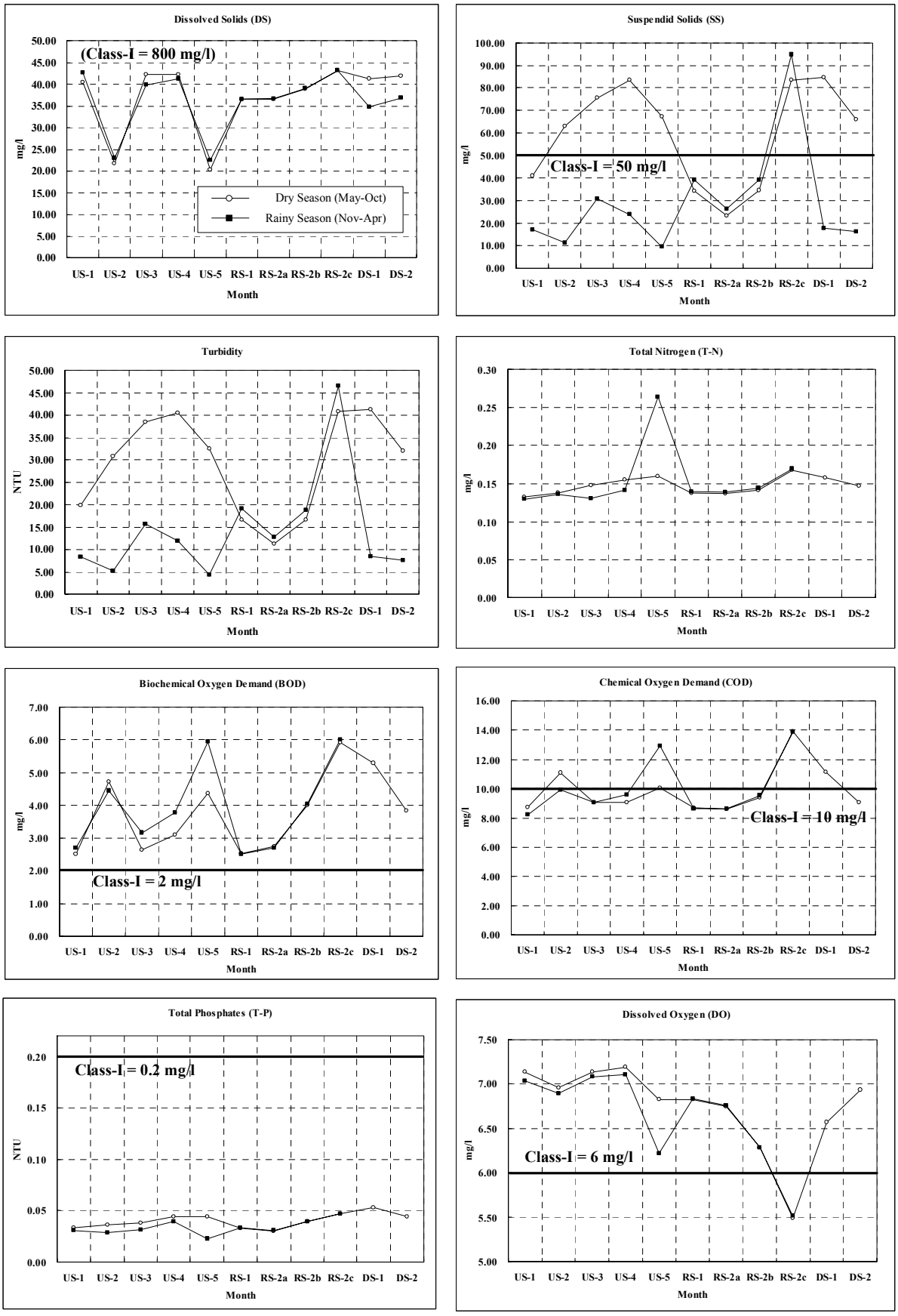




Note: Class-I - Provincial water quality standard for drinking raw water determined by South Sulawesi Governor's Decree No.14/2003

Source: Environmental Impact Assessment of Bili-Bili Multipurpose Dam Project

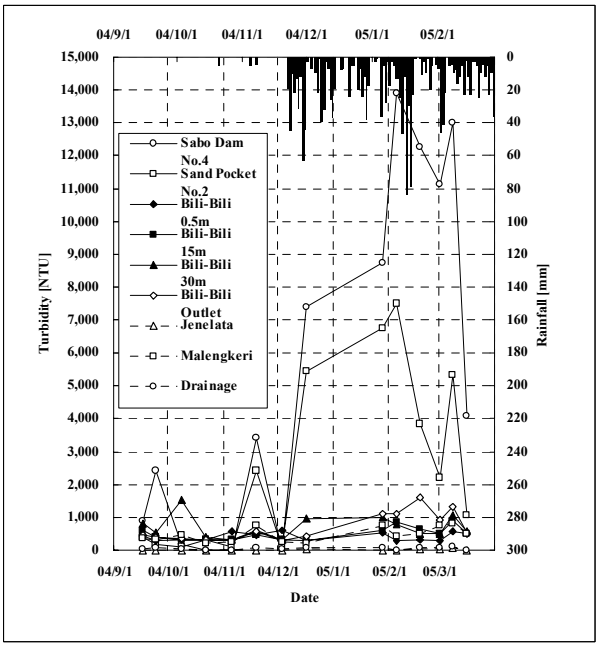
Figure F1.3 River Water Quality of the Jeneberang River - Vertical Profile



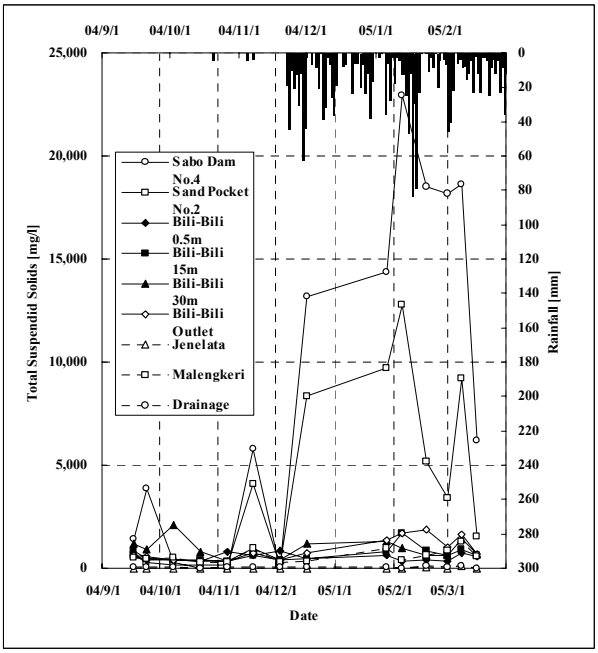
Note: Class-I - Provincial water quality standard for drinking raw water determined by South Sulawesi Governor's Decree No.14/2003

Source: Environmental Impact Assessment of Bili-Bili Multipurpose Dam Project

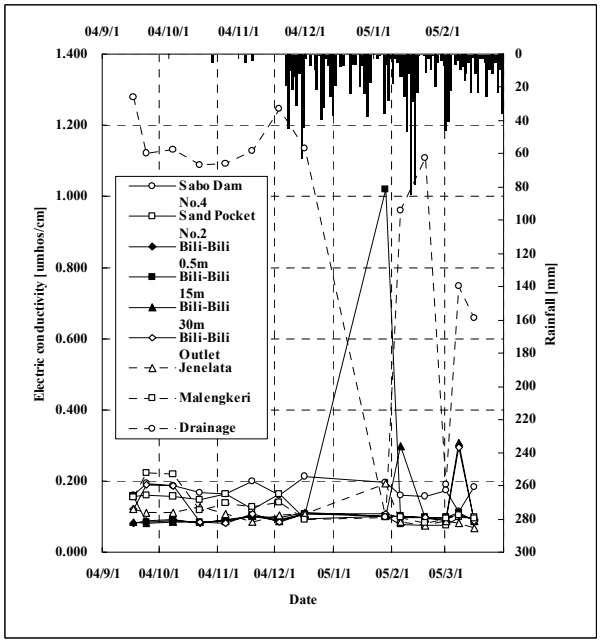
Figure F1.4 Water Quality Monitoring by This Study (2004-2005)



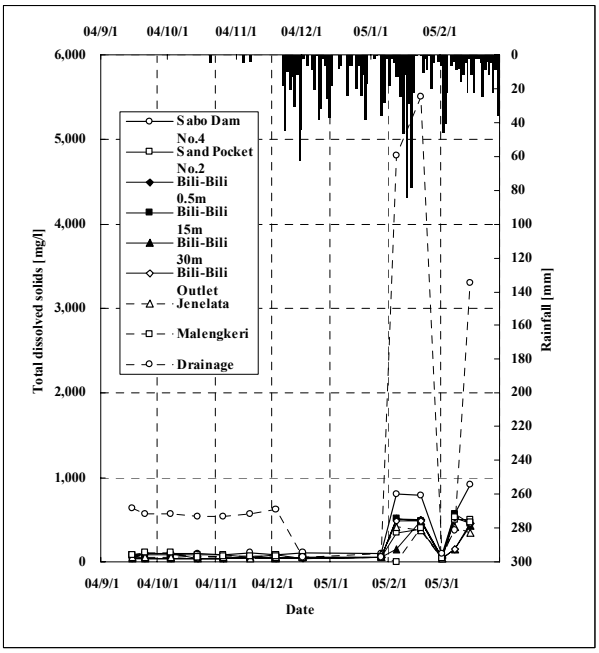
a) Turbidity



b) Total Suspended Solids



c) Electric Conductivity



d) Total Dissolved Solids

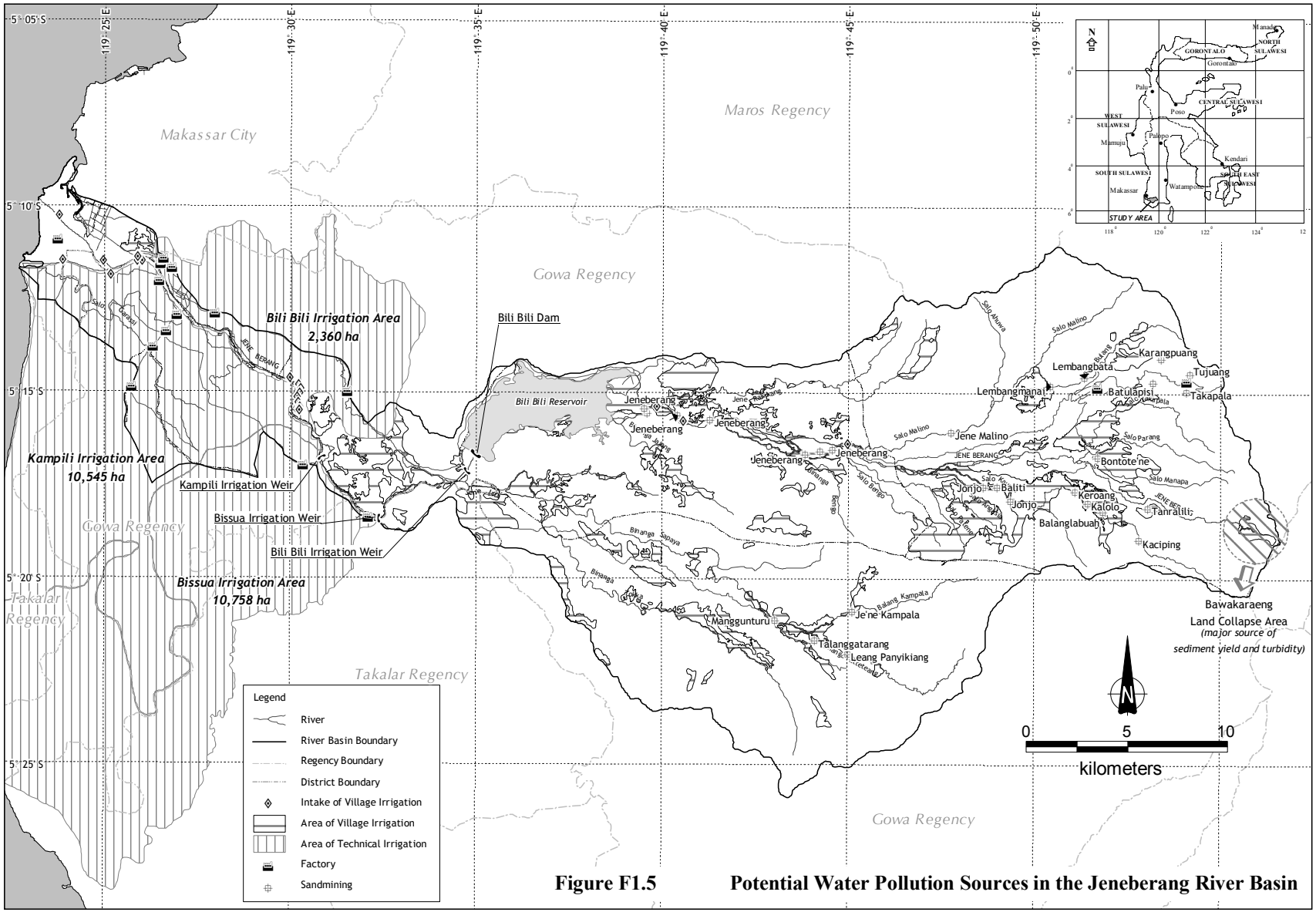


Figure F1.5 Potential Water Pollution Sources in the Jeneberang River Basin

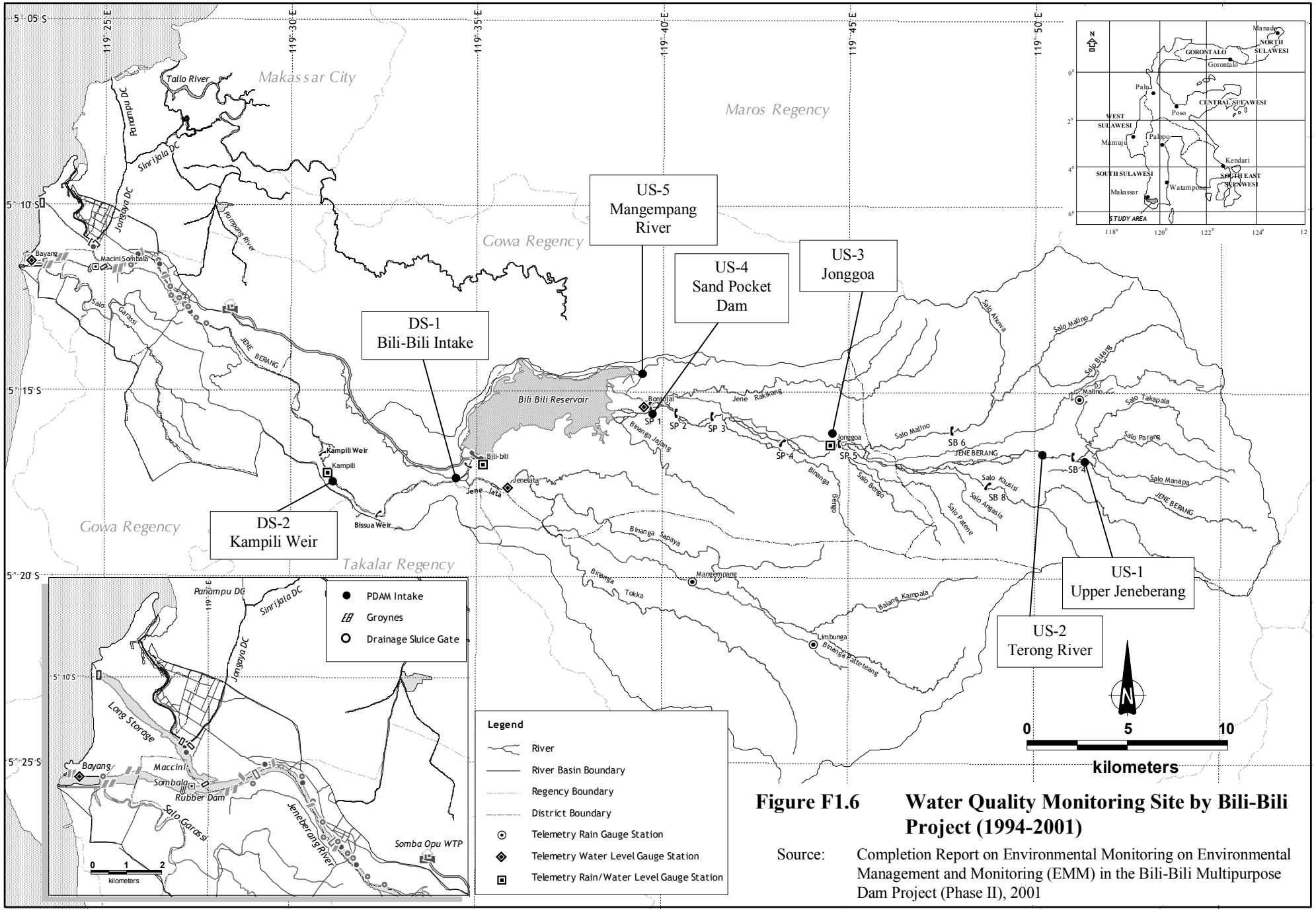


Figure F1.6 Water Quality Monitoring Site by Bili-Bili Project (1994-2001)

Source: Completion Report on Environmental Monitoring on Environmental Management and Monitoring (EMM) in the Bili-Bili Multipurpose Dam Project (Phase II), 2001

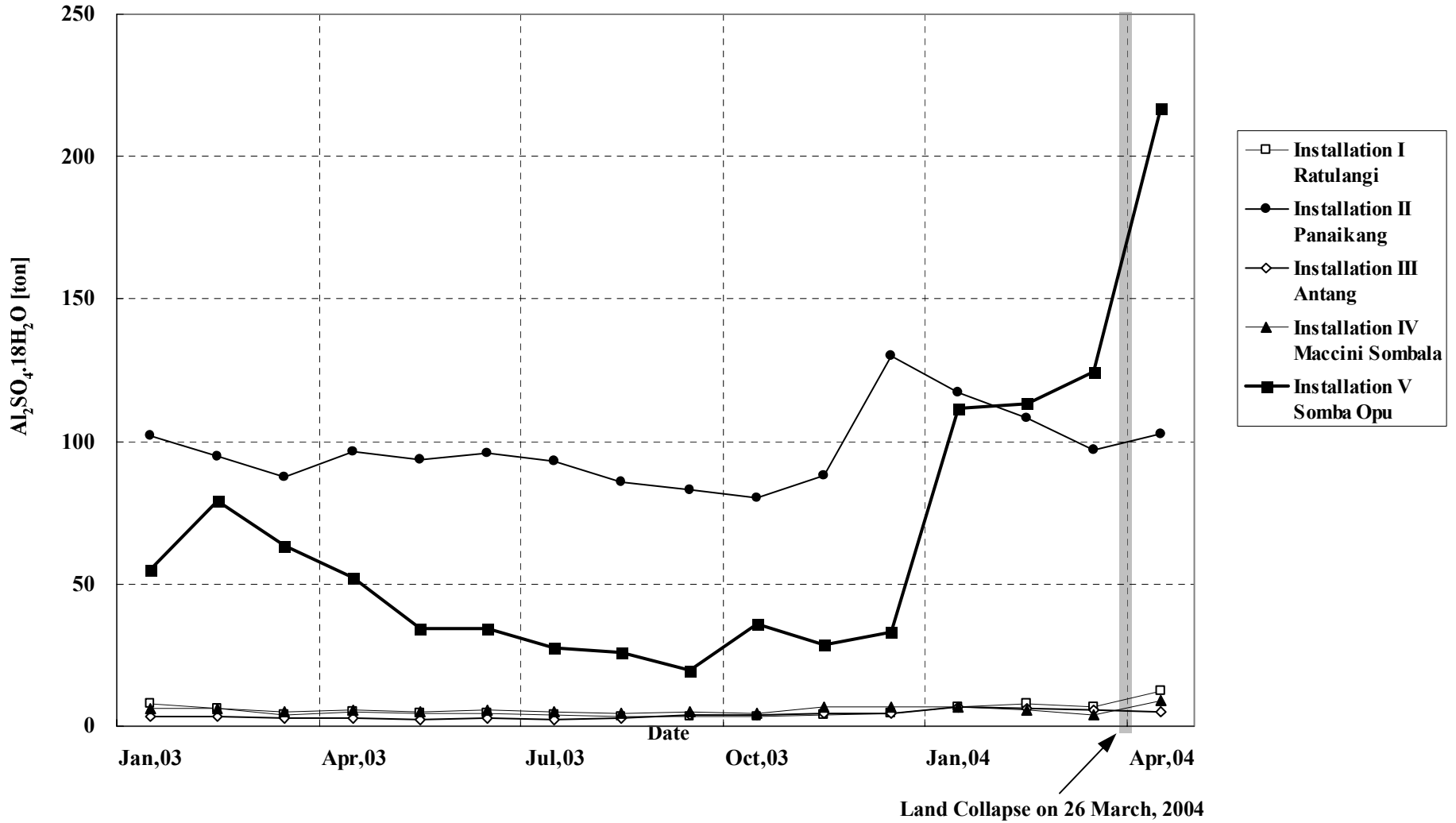
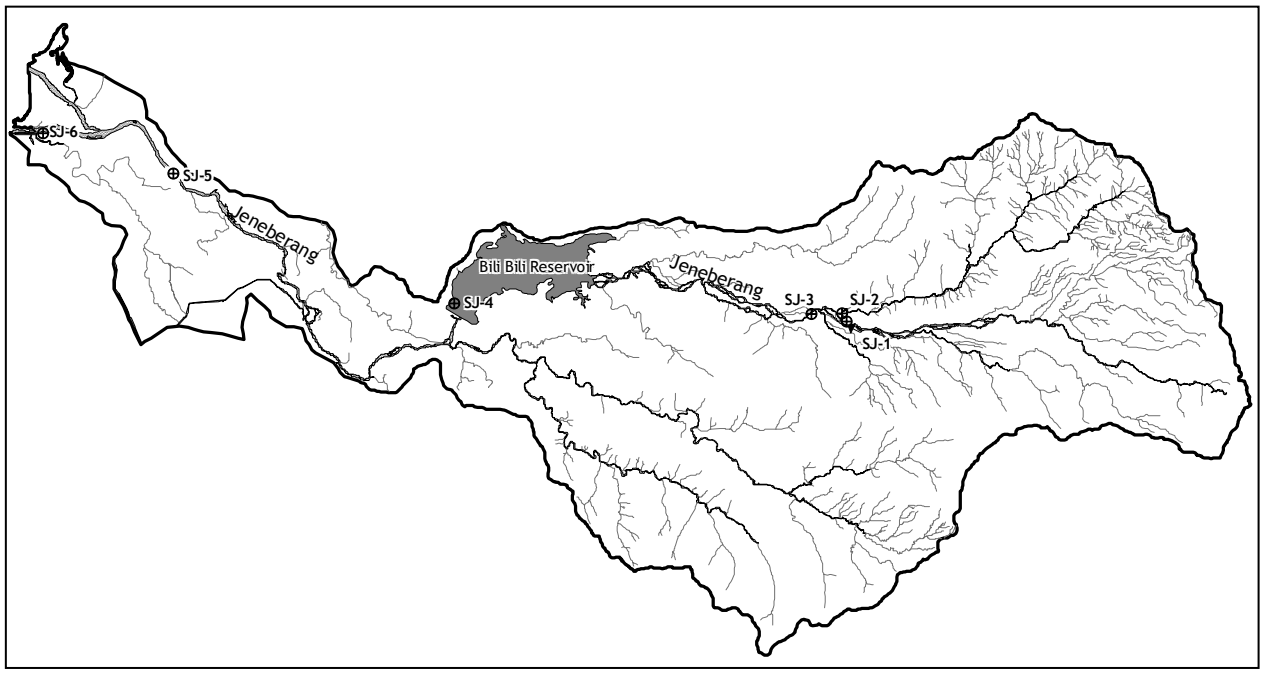


Figure F1.7 Consumption of Aluminum Sulfate ($Al_2SO_4.18H_2O$) of 5 WTP in PDAM Makassar



A. Sampling Date: November 1999-January 2000

No	Parameter	Unit	No.1	No.2	No.3	No.4	No.5	No.6
1	pH		7.1	7.3	7.6	7.0	6.8	6.8
2	Total Suspended Solids (TSS)	mg/L	7	2	24	9	32	18
3	Biochemical Oxygen Demand (BOD)	mg/L	9	10		11		
4	Chemical Oxygen Demand (COD)	mg/L	14	15		17		
5	Dissolved Oxygen (DO)	mg/L	8	7	6	7	6	7

B. Sampling Date: July 2001

No	Parameter	Unit	No.1	No.2	No.3	No.4	No.5	No.6
1	pH		7.926	7.146	7.777	8.465	7.988	7.959
2	Total Suspended Solids (TSS)	mg/L	29	21	19	9	19	128
3	Biochemical Oxygen Demand (BOD)	mg/L	27.3	3.9	10.4	4.5	13.0	27.3
4	Chemical Oxygen Demand (COD)	mg/L	42	6	16	7	20	42
5	Dissolved Oxygen (DO)	mg/L	8.03	6.90	8.60	7.03	5.68	5.16

C. Sampling Date: September 2002

No	Parameter	Unit	No.1	No.2	No.3	No.4	No.5	No.6
1	pH		6.877	7.871	6.703	7.813	7.661	8.068
2	Total Suspended Solids (TSS)	mg/L	44	37	24	54	48	26
3	Biochemical Oxygen Demand (BOD)	mg/L	1.72	3.15	6.8	1.35	7.18	9.5
4	Chemical Oxygen Demand (COD)	mg/L	2.65	5.92	13.46	2.24	13.26	16.93
5	Dissolved Oxygen (DO)	mg/L	6.85	8.14	7.67	7.71	7.74	7.70

Source: PROKASIH Annual Report Year 1999/2000, 2001, and 2002, BAPEDALDA South Sulawesi Province

Figure F2.1 Water Quality Monitoring Data by PROKASIH (1999-2002)

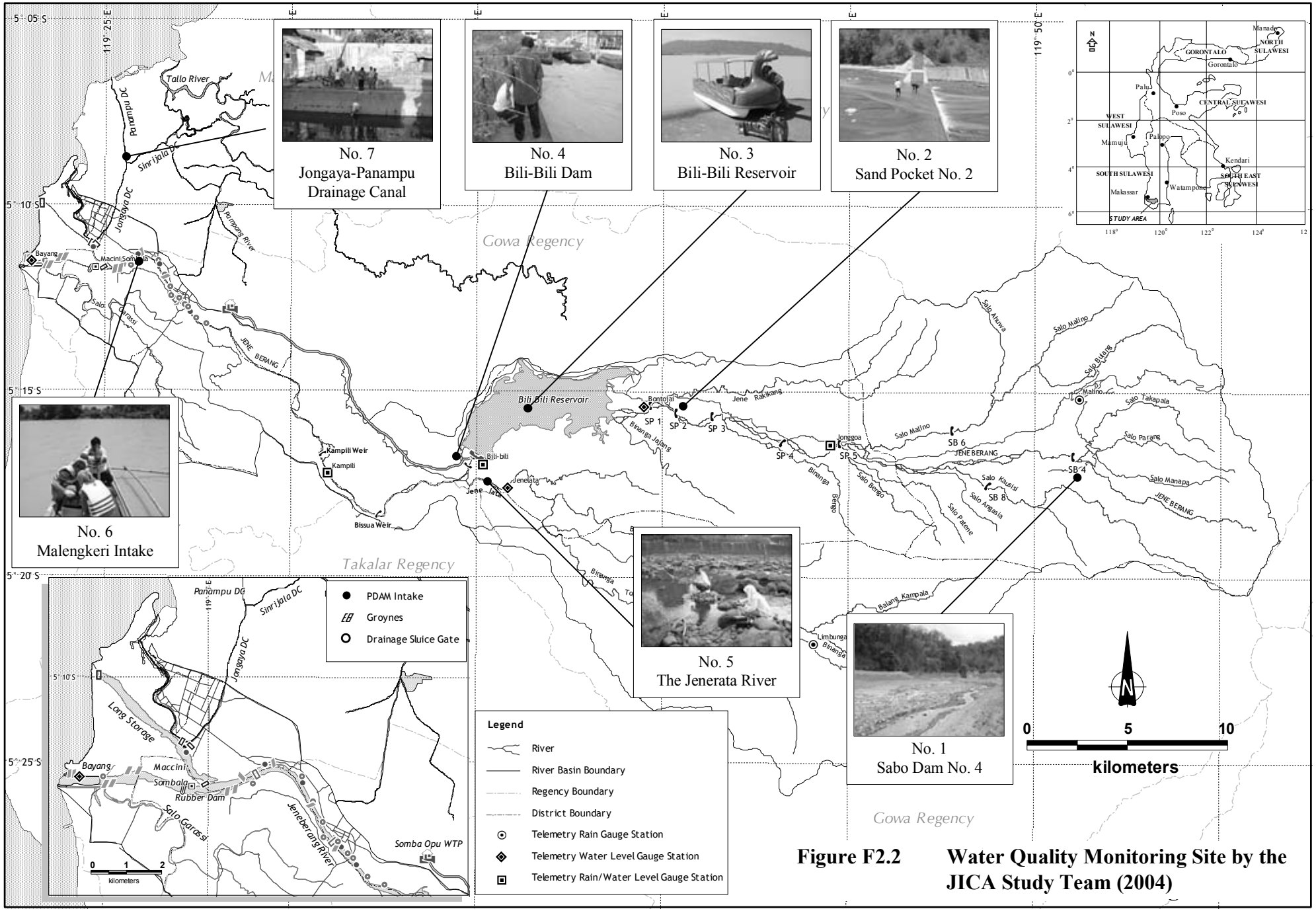


Figure F2.2 Water Quality Monitoring Site by the JICA Study Team (2004)

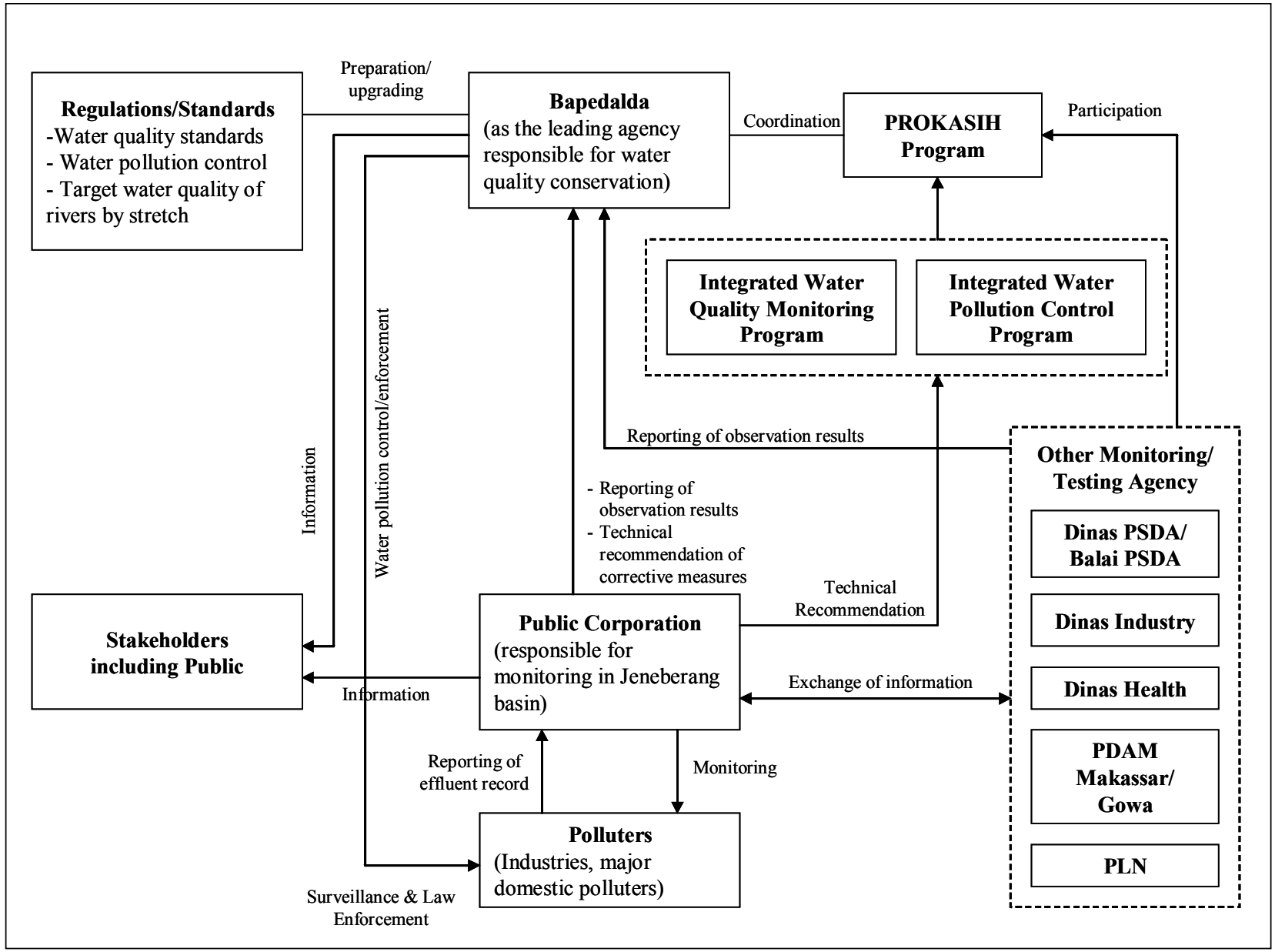


Figure F4.1 Demarcation of Roles and Responsibilities

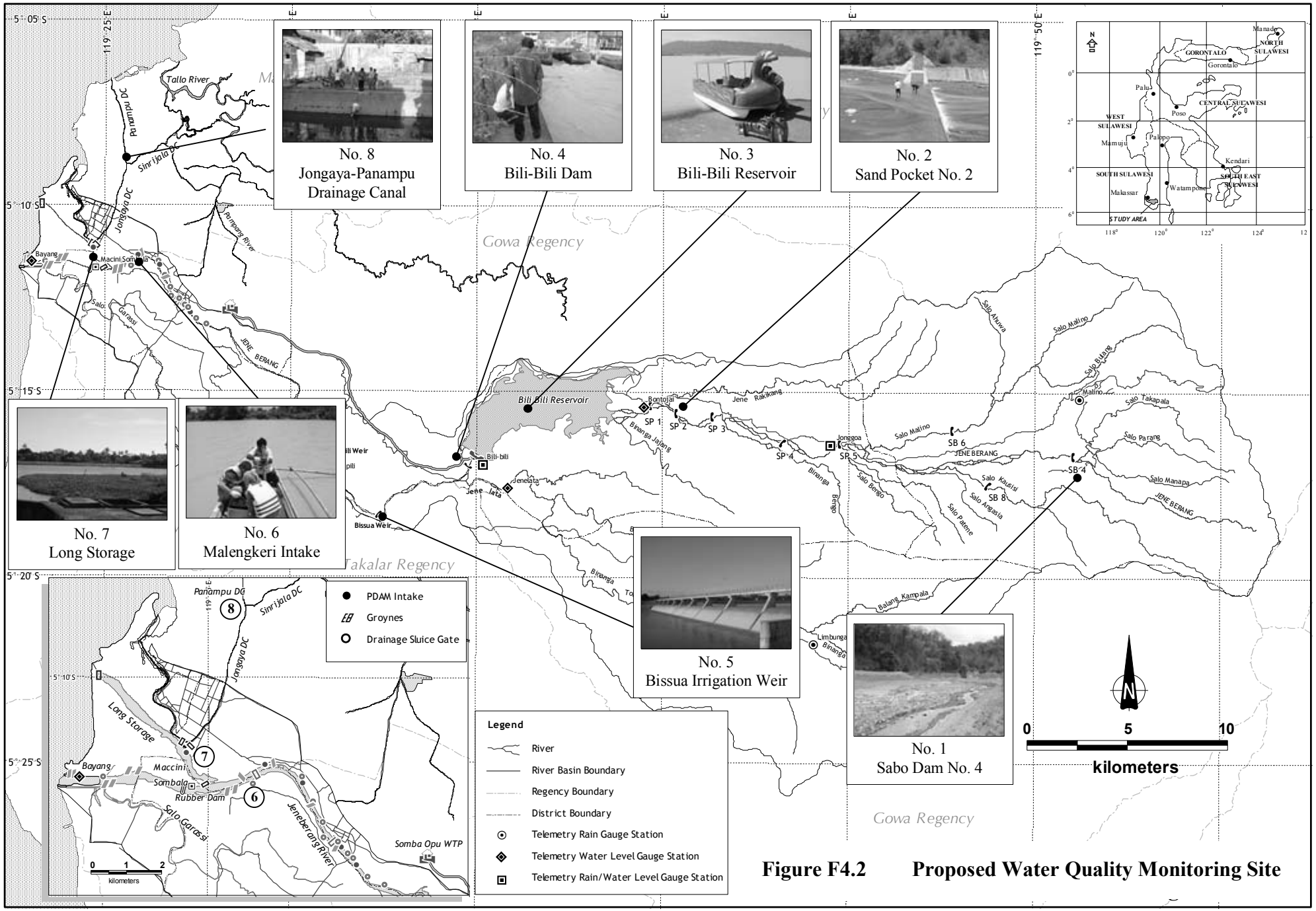


Figure F4.2 Proposed Water Quality Monitoring Site

Supporting Report G

WATERSHED MANAGEMENT

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Supporting Report G

WATERSHED MANAGEMENT

G1 Introduction

This Supporting Report G describes the outline of watershed management issues which the new Public Corporation should take into account in conducting the river basin management. The main focus was placed among others on forestry conservation, natural environment conservation, and fishery development and conservation.

Since the Study Team has no assignment of watershed management expert, the study in this Report is mostly dependent on the outcome from a study conducted under this Study by an Indonesian expert (Ir. Totok Prawitosari, Hasanuddin University), supplemented with findings in a previous study [1].

[1] Study on Integrated Management of Jeneberang River Basin – Phase II, Center for Environmental Study, Hasanuddin Unversity (UNHAS), 2001

G2 General Condition of Jeneberang River Basin

G2.1 Overview

Jeneberang River Basin is located in South Sulawesi Province. As natural resources, Jeneberang River Basin provides considerable benefit for various development sectors such as agriculture, industry, mining, municipal water supply, etc.

A major water source in the basin is the Bili-Bili multi-purpose dam/reservoir which was completed in 1999. The dam is located at mid-reach of the Jeneberang mainstem, about 30 km from the estuary. The purposes of the reservoir development are (i) flood control for Makassar City and surrounding area, (ii) raw water supply for Makassar and Sungguminasa, (iii) irrigation water supply to Bili-Bili – Bissua – Kampili irrigation schemes, and (iv) hydroelectric power generation at the dam.

In the upstream area, horticultural farming has been developed in relatively steep lands. The farming intensively uses fertilizer and pesticide. Forest area in upstream area has been promoted to become public forest and industrial forest which produces firewood and other wood requirements. In March 2004, a gigantic-scale of collapse of quay occurred in the Bawakaraeng mountain area, which is causing a large quantity of sediment yields and excessive turbidity of water since then.

In the midstream area, in the reach before the Bili-Bili reservoir, there is a large area of paddy fields both at quite steep lands and terrace area along the river. High intensity of fertilizer and pesticide application is commonly applied in these paddy field areas.

The downstream area lower than Bili-Bili dam consists of agricultural lands, semi-urbanized and urbanized area. The river mouth area has been developed into a modern settlement area or waterfront city as the expansion of Makassar City. This area, known as Tanjung Bunga Resort, turns into business centre, recreation and housing area. Development of such urbanized area generates various problems; i.e. problems associated with land reclamation, pollution, conflicts on land ownership and occupation, and labor transition.

Development of Jeneberang River Basin seemingly brings about new conflict issues that require further handling. For example, use of Bili-Bili reservoir water for clear water supply for municipal requirement has to be seriously purified due to high turbidity of raw water quality. Fertilizer and pesticide are still intensively applied in the upstream agricultural area. People in upstream area need to improve their income, whereas the downstream area requires clear water. Both the interests are important to consider. Such environmental issues, either contradictive or progressive, need further clarification to find a comprehensive watershed management plan.

G2.2 General Description of Jeneberang River Basin

G2.2.1 Astronomical Location and Topographical Condition

(1) Astronomical Location

Jeneberang River Basin is geographically located at 05^{o} 05' 00" – 05^{o} 25' 00" of South Latitude and 119^{o} 20' 00" – 120^{o} 00' 00" of East Longitude. Most part of Jeneberang River Basin area belongs to Kabupaten Gowa and less part mainly in downstream area belongs to Kota Makassar and Kabupaten Takalar. River Basin located in Kabupaten Gowa covers seven Kecamatan, namely Tinggi Moncong, Parangloe, Bungaya, Bontomarannu, Sombaopu, Pallangga and Bajeng, all partially, while in Kota Makassar covers three Kecamatans, namely Tamalate, Manajang and Mariso, and in Kabupaten Takalar a part of Kecamatan Polombangkeng Utara.

(2) Topographical Condition

Topographical condition of Jeneberang River Basin can be divided into three morphological units, namely; mountainous, hilly to undulated and alluvial plain. The three morphological units are described as below.

a. Mountainous area in upstream area

This morphological unit is volcanic mountain peak, body and foot. The top portion of Lompobattang Mountain has a steep land and hard relief with a steep ground slope about 28 to 40 degrees. Top portion has altitude of about 1,750 to 2.876 meters above sea level. Mountain side of basin at this top portion is generally steep.

There are two calderas in the top portion; namely Bawakaraeng caldera towards west side direction and Porong caldera towards east side direction. Mountain side of the two calderas has steep slopes, close to vertical, and therefore landslide frequently occurs at the mountain side of calderas, notably in Bawakaraeng caldera in rainy season. The debris material yielded from landslides flows into the upper valley of Jeneberang River as cold lava and finally pours into the Bili Bili reservoir unless they are trapped in the upstream reach. There is a concern that excessive inflow of sediments into the Bili Bili reservoir will reduce the service life of the reservoir.

The mountain body portion shows medium to quite hard relief views with a steep slope about 16 to 23 degrees. Altitude on this region is about 350 to 1,750 meters above sea level. The rivers have a large and deep valley, where it is presumed that landslide occurred in the past. For example, in the upstream area of Jeneberang and Cilindu River Basin located in the west and south slope of Lompobattang Mountain body, the rivers are in young stage characterized with cross-section of "V" shape, where vertical erosion appears to be prominent.

The mountain foot portion is found in the west side of Jeneberang River around the Bili-Bili dam and in the area downstream of Bili-Bili dam. The area is slightly sloped, waving with a steep ground slope of about 3 to 8 degrees. The altitude of the region is about 28 to 325 meters above sea level. The rivers are in mature to old stage that is characterized by valley section of "U" to widely-opened 'U' shape with many meanderings.

b. Hilly to undulated land in midstream area

This morphology consists of soft and hard relief hills. Hard relief hills is mostly distributed in the midstream area, and at a lesser extent in part of the downstream area forming spherical to ellipsoid hill shape having a slope generally of 8 to 27 degrees, with altitude ranging from 30 to 273 meter above sea level. The spherical hills basically formed by intrusion of basalt, diabase and diorite heavy rocks, and ellipsoid hills basically formed by tuff rocks inter-bedded with decayed clay stone.

c. Alluvial plain in downstream area

Alluvial plain largely distributes in the lower reach of the Jeneberang River. The plain consists of flat land and mild sloped fields having a slope of about 3 to 8 degrees, formed by coastal alluvial deposit, swamp deposit, river terrace deposit and river alluvial plain. Jeneberang River at this alluvial plain has many meanderings.

G2.2.2 Hydrological Condition

(1) Basin Features

According to topographic map scale 1:50,000, total catchment area of Jeneberang River is about 762 km^2. Extent of upstream and midstream areas are about 647.7 km^2 at the confluence point of Jeneberang and Jenelata (the largest tributary of Jeneberang), which covers Jeneberang sub-basin of about 384.4 km^2 and Jenelata sub-basin of about 263.3 km^2, while the downstream area amounts to 102.3 km^2.

In the midstream area, Bili-Bili multi-purpose reservoir stands with a surface area of about 18.5 km^2 which have been operated since 1999 for flood control, raw water supply, irrigation and power generation. Particularly for irrigation requirement, three irrigation schemes have been developed i.e.: Bili-Bili (2,360 ha), Bissua (10,758 ha) and Kampili (10,545 ha).

(2) River Discharge

According to the study result conducted by CTI Engineering in Definitive Plan Report (March 1999), monthly mean discharge for 20-year period of Jeneberang and Jenelata Rivers based on a tank model analysis is as shown below:

Mean Discharge of Jeneberang and Jenelata River (m^3/s)

River	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Jeneberang	103.2	94.0	62.1	40.5	19.4	9.9	8.4	3.8	5.4	8.7	21.6	60.6	36.2
Jenelata	49.3	45.3	30.3	24.3	12.0	7.1	3.8	1.4	2.0	3.5	13.4	35.6	18.8

Source: CTI Engineering Co. Ltd. and Ass. Draft Definitive Plan Report, March 1999

G2.2.3 Land Use

According to data from Dinas Forestry of Gowa Regency (2004), land use in the Jeneberang River Basin was dominated by forest (45.34 %), grass land (27.30 %), paddy field (12.99 %), mixed estate crop field (7.29 %), dry crop field (4.9 %), dam reservoir area (1.54 %) and urban area (0.61 %).

Land Use in the Jeneberang River Basin

No	Classification of Land Use	Upper Reaches from Confluence with Jenelata		Lower Reaches from Confluence with Jenelata		Basin Total	
		(ha)	(%)	(ha)	(%)	(ha)	(%)
1	Forest Area	32,929	53.4	1,716	11.7	34,646	45.3
2	Grass Land	18,193	29.5	2,668	18.1	20,861	27.3
3	Mixed Estate Crop Field	2,280	3.7	3,284	22.3	5,564	7.3
4	Paddy Field	3,892	6.3	6,035	41.0	9,927	13.0
5	Dry Crop Field	3,227	5.2	548	3.7	3,775	4.9
6	Dam Reservoir Area	1,170	1.9	-	0.0	1,170	1.5
7	Urban Area	0	0	465	3.2	465	0.6
Total		61,691	100	4,716	100	76,408	100

Source: Department of Forestry Services, South Sulawesi Province, 2004
Note: This land use statistics show slightly different features from the figures in other literatures, presumably due to use of different land use classification criteria.

Figure G2.1 shows the land use in the Jeneberang river basin. It is noted that land use classification used in Figure G2.1 is slightly different from those of the above table, since the both are based on land used data of different sources. Figure G2.2 shows a land use plan contemplated by PDAS[2].

G2.3 General Condition of Environment

G2.3.1 Water Quality

Water quality condition is as described in Supporting Report F. Only a summary description is given in this Chapter. The description of river water quality given herein is based on previous researches and PROKASIH (clean river program) activities, whereas for liquid waste is based on monitoring data of Bapedalda Gowa Regency. Hence, the data referred to herein and in Supporting Report F are different each other.

[2] Regional Office of Watershed Management reporting DG land Rehabilitation and Social Forest Affairs in the Ministry of Forest and Plantation (MFP)

(1) River Water Quality

In the year of 2001, Environmental Research Center of Hasanuddin University (CEPI – PPLH UNHAS) has conducted a study on water quality of Jeneberang river basin. Summary of the study result is presented below.

Analysis result on water acidity (pH) at four measurement locations (Upper Jeneberang River, Jongaya, Terong River and Mangempang River, all located upstream from the Bili Bili reservoir), measured from April 1995 to March 1999, showed neutral values which ranges of 6.50~7.80 in upstream part and 6.77~7.70 in downstream part. The pH in the Bili Bili reservoir itself was also neutral, with range of 6.95~7.31. These neutral values are supported by the fact: (i) total nitrogen (T-N) content measured at all locations was low in the range of 0.022~0.243 mg/l; (ii) total phosphor content was low in the range of 0.002~0.093 mg/l.

Dissolved oxygen (DO) content was in the range of 5.33~7.43 ppm. These values roughly met the Class-I water quality standard, which is higher than 6 ppm. The DO value was very much influenced by the sample depth; deeper sample has generally lower DO compared to the sample taken close to the surface.

Biochemical Oxygen Demand (BOD) values observed in the upstream area were within the range of 0.89~9.75 mg/l. These measured BOD values can only meet the requirement of Class-III water quality standard (< 6 ppm). Particularly in the reservoir water, the detected BOD content was in the range of 1.62~7.96 mg/l. The value in the deeper position (from the surface) was higher than that of the surface.

Chemical Oxygen Demand (COD) values detected in all periods from 1995/1996 to 1999/2000 were in the range of 5.37~24.67 mg/l. The highest COD value was observed at the location of the highest BOD value, and it occurred in the dry season. The COD value inside the reservoir water was in the range of 7.33~16.39 mg/l.

Total Coliform (T-C) content in the periods from 1995/1996 to 1999/2000 varied from 200~8,300 colonies/100 ml. T-C value in the reservoir water showed lower value, which was in the range of 530 ~770 colonies/100 ml. Fecal Coliform (F-C) content were generally low, varied from 0~717 colonies/100 ml. The highest F-C content was found in the Terong River and Mangempang River location. F-C content in the reservoir water was low, varied from 0~8.7 colonies/100 ml. Both T-C and F-C values meet the Class-I water standards (1,000 colonies/100ml for T-C and 100 colonies/100ml for F-C).

In general, the parameters of water quality in the period from 1995/1996 to 1999/2000 fluctuated much due to weather changes as well as constructional and operational activities of the Bili-Bili multi-purpose dam. An obvious parameter fluctuated was suspended solid (SS) content, because of the dam construction work during the period of 1995/1996 and 1996/1997. In the 1997/1998 period, there was practically no impact of construction activities upon the

water quality anymore. The high SS content observed thereafter was thought due chiefly to the activities of agriculture along the river and C-class mining in the river channel.

The SS content of the reservoir water was very much related to rainfall in the dam's upstream area. It was very obvious that, when it rains, SS in the river mouth was considerably high, namely 485.0 mg/l in November 2000 and 521.0 mg/l in December 2000. Similarly, the observed turbidity was also high when it rains, with 239 NTU in the river mouth in November 2000 and 257 NTU in December 2000.

In summary, the water quality of Jeneberang River is still at an affordable level without much contamination of river water in the reach upstream of Bili Bili reservoir. However, this is the observation before the Bawakaraeng land collapse in March 2004. Subsequent regime of water quality, especially SS and turbidity, should be monitored carefully.

G2.3.2 Wastewater Quality

According to the wastewater monitoring conducted by Bapedalda of Kabupaten Gowa for 22 wastewater sampling points (factories) in year 2003, it was identified that some parameters of wastewater quality had exceeded the quality standard specified in the Governor's Decree No. 14/2003. The sampling points are located mostly in Sunguminasa area downstream from the Bili Bili dam.

Monitoring result shows that, out of 22 sampling points, TSS parameter exceeded the standard of A-group at four sampling points which are mostly restaurant and kiosk. Acidity (pH) parameter exceeded A-group quality standard at four points which are food/drink manufacturers. Biological Oxygen Demand (BOD-5) parameter exceeded at almost all monitoring points, except for two samples from printing company and hotel in Malino. Similarly, only 3 samples met the A-group standard of Chemical Oxygen Demand (COD), which come from printing company and hotel. Recapitulation of monitoring result for wastewater is shown in Table G2.1.

The sampling test above showed that effluent from factories is much contaminated in terms of BOD-5 and COD.

G2.3.3 Air Quality

Air quality data was obtained from monitoring result conducted by Bapedalda of Gowa Regency in year 2003. According to the monitoring result, it was identified that almost all air quality parameters at nine monitoring points met the standard of Governor's Decree No. 465 of 1995.

There was 1 (one) parameter exceeding the quality standard namely PM10 at three monitoring points, located at intersection road of Sangata, Pakkato Village and Pallangga Bus Station. This condition indicates that air particle content of 10 μ at some places had exceeded the quality standard due to traffics on main roads. Recapitulation of air quality is shown in Table G2.2.

G2.3.4 Historical Inheritance and Tourism

In the Jeneberang River Basin area, there are three historical inheritances in the basin that have cultural tourism function; namely, Fort of Somba Opu (near rubber dam), Balla Lompoa (near Sungguminasa) and Sultan Hasanuddin Grave (near Sungguminasa). Tourists' attention against the cultural/historical objects was quite high in the past, but tends to decrease from year to year. Statistics show that visitors of Balla Lompoa decreased from about 7,585 visitors in 1999 to 7,493 visitors in 2000 and 6,099 visitors in 2001.

In the Jeneberang River Basin area, particularly in Kabupaten Gowa, there are 14 hotels and inns with about 212 rooms and 443 beds. Numbers of occupants in 2001 were about 5,707 occupants, increases to 7,519 occupants in 2002. Tourism activity in the basin is presently of moderate extent.

Tourism Facts in the Jeneberang River Basin

No.	Item	Unit	Total
1.	Tourism Object	Unit	8
2.	Hotel	Unit	14
3.	Hotel Room	Room	212
4.	Bed	Unit	443
5.	Occupant	People	7,519

Source: Kabupaten Gowa, in figures 2002

Meanwhile, a resort has been developed in the downstream area, precisely at Jeneberang River mouth area, which also attracts tourists as a waterfront city called Tanjung Bunga Resort.

G2.3.5 Social Aspects

Agriculture was the prominent livelihood of inhabitant in the Jeneberang River Basin. Kind of agricultural activities developed by local people was food crops such as paddy, corn, beans, vegetables and evergreens (cacao and coffee). Seasonal crops are cultivated by local people on relative flat lands in upstream, midstream and downstream of the river basin. Vegetables are only cultivated in upstream area such as Kecamatan Tinggi Moncong, while evergreens cultivated at steep-slope lands in upstream and midstream areas.

Harvested area and average production of each seasonal commodity cultivated by local people are shown in Table G2.3 and G2.4, respectively. The largest harvested paddy area is in Kecamatan Pallangga, where the area percentage of this Kecamatan located outside of the Jeneberang River Basin is quite large.

Development of tourism sector, either in upstream area (Malino), midstream area (Bili-Bili) and downstream area (Tanjung Bunga), had contributed to improvement of local people's income, either as major income for livelihood or additional income.

(1) Upstream Area

Kecamatan Tinggi Moncong is located in the upstream area of the Jeneberang River Basin This Kecamatan has a large harvested paddy field area, which is more larger than other palawija commodities. Being blessed with high altitude and cool weather, Kecamatan Tinggi Moncong is the main producer of vegetables in the basin. Area of vegetables field in the Kecamatan is quite larger compared with the other Kecamatan.

Horticultural farming in this Kecamatan has grown remarkably since 1990s after migration of farmers from West Java led by a person named H. Ilyas. This West Jawa farmers group has transferred most valuable knowledge and experience of horticultural farming to the local people over a long period. Kind of commodities developed are tuber crops (potatoes), cabbage, leeks, tomato, broad beans, and other kind of peas/beans.

Economically, the horticultural farming in upstream area have raised living standard of the local people. Indicators of improvement of local people living standard can be identified through: (i) increase in numbers of local people to conduct hajj; (ii) the use of special vehicle (hardtop) to transport agricultural inputs and horticultural yields (whereas this type of car has been considered exclusive in Makassar area); (iii) almost every household have motorcycle; (iv) their children have learned or are under learning in university; and (v) the openness of accommodating women labor including women from other regions in the horticultural farming.

In addition to natural and human (especially those from West Java) resources potential, high horticultural farming intensity in this region has been supported by high market demand as well. The largest demand comes from Borneo Island and Makassar City. Kind of horticultural products delivered to Borneo market has higher quality than those for Makassar City. Thereby, amount of profit obtained from Borneo market might reach three times higher than profit obtained from Makassar City market.

Compared with paddy field and dry field farming, horticultural farming is more intensive. It uses land cultivation method in the form of dike embankment which is properly modified according to rainfall condition, extensive fertilizer and pesticide application, and crops shifting system based on market demand.

As a tourism town, some communities in Malino earn their income from tourism sector, either as employee of hotel, villa keeper, vegetables/fruits seller or other activities.

(2) Midstream Area

Besides food crops farming, communities in the midstream area of Jeneberang River Basin are earning their income from evergreen products, reservoir fishery farming as well as worker/labor for industrial crop forest companies.

According to a study conducted by CEPI-PPLH UNHAS in 2003, it was clarified that the existence of Bili-Bili multi-purpose reservoir has opened a new employment in the form of lake fishermen and floating net-caged fish farming. It was estimated that about 20 % of inhabitants formerly living in the reservoir location rely their living on fishery. Not less than 26 boats were operated in the reservoir waters, while number of floating net-cages was still only 5 units. Fishery Services of Gowa local government has spread young fish 3 – 4 times a year regularly. However, since there was no limitation on small sized net (2 inches) application, accordingly the reservoir seems to be out of fish obliviously. Now, fishermen are unable to catch large-size fish or saleable fish anymore. Moreover, since the Mt. Bawakaraeng collapse has occurred, turbidity level of the reservoir waters increase greatly and the waters environment is not suitable anymore for some kind of fishes.

PT. INHUTANI (a government-owned industrial forest corporation) has provided new field of work as farm worker, and also allow the farmers who want to cultivate alley crops around the main crops. However, these efforts were considered less promising for the local people's livelihood, because income from the two aforesaid works is considered relatively small and also because of irregularity of the works.

Other sources of revenue come from boat rental for the visitors who want to enjoy reservoir water panorama by using boat. Visitors tend to increase in numbers on Saturday and Sunday or at the time of school holiday period. Additionally, food stalls grow at reservoir side which provides reservoir fish (it is said that fish is now caught in the upstream rivers).

(3) Downstream Area

Local people in the downstream area of Jeneberang River Basin earn their livelihoods from sand mining, civil servant and employees in coastal tourism sector.

Around the rubber dam, there are 3 (three) public mining activities that excavate river bed sediments mainly sand accumulated around the rubber dam. Mining operation was mainly done in the areas of sand bars which have been formed before the rubber dam was constructed. Other mining activities are located on the left side of Jeneberang river mouth or at coastal area of Barombong Beach. These mining have been operated for a long time having started before the rubber dam was constructed.

Around the rubber dam, it was observed that not less than 20 boats were mining from the depths of not less than three meters under water. The 20 boats were organized by three mining coordinators. They claim ownership of the nearby land as their own land which is used as sand stockpile areas before transported by truck. Each boat has two miners. Sand is collected manually by using an iron bucket with a stick sized to suit the depth of sand mining. The iron bucket sink into the river by one of the miners from the boat and the other miner pulls out the bucket when it is loaded. The mined sand is accumulated on the boat.

Every boat has mining capacity of about 5 - 8 m^3 per day or about 2 – 3 trucks per day. Thereby, it was estimated that 100 to 160 m^3 of sand is mined in one day at the aforesaid location. In miners' perception, sand is available for mining as long as the river has water in it, particularly when flood occurred. Even in the state no flood comes, the miners observed that every mining operation sized 3 x 3 meters in area is recovered by sand in 3 days. This fact indicates that sedimentation in the reach of the Jeneberang river mouth is still continuing and its quantity is estimated still relatively high. It is presumed that the sediments come from the Jenelata river since the sediments from the Jeneberang mainstream are being trapped by the Bili Bili dam.

In Jeneberang river mouth area, coastal tourism has been developed long time ago, namely in Tanjung Merdeka and Tanjung Bunga areas. Development of some facilities and infrastructures, particularly at the delta area which have been reclaimed since 1960s, has changed the area into tourist visiting spots. A number of villas, restaurants and karaoke bars have been constructed at this area and high-class housings now are under construction in the surrounding area. This tourism object has been visited by many domestic visitors or overseas tourists, particularly on holidays (Sunday, school holiday) and during Ramadan holidays.

Up till now, local fishermen do not recognize neither adverse nor beneficial effects of the Bili-Bili multi-purpose reservoir. Number of fish caught and their income are still same as before. The fishermen have a perception that "number of fish caught will be very depended on blessing of God and has no relation with other factors". However, they aware that fish catching area tend to move to offshore area.

G2.4 Environment Management Requirement

G2.4.1 Forest Conservation

Change on land coverage has been occurred during last ten years. Area of natural forest coverage has decreased by 859.5 ha per year (3.32 % per year) and paddy field about 159.0 ha per year (0.78 % per year). There is a tendency of forest conversion into dry land farming with a growth rate of about 673.6 ha per year (3.04 % per year) and into settlement area at about 259.5 ha per year (7.83 % per year). Prominent conversion was horticultural farming, whereas settlement in the form of villa construction. Such land conversion was prominent in the upstream area.

Land use conversion with reduction of forest area in the upstream area will generate impact against forest ecosystem. Such condition will generate further effect on hydrology, which in turn affects other aspects such as increase of max-min discharge ratio, drought duration in downstream area, and so on.

The need on forest conservation should be jointly pursued, not regarding the matter as merely the Forestry Services' responsibility. Comprehensive planning by involving all stakeholders is required so that all parties feel the responsibility.

G2.4.2 Conservation of Natural Resources

Degradation on other natural resources environments such as river environment, mining and other resources were caused by the lack of government apparatus and communities' knowledge on sustainable natural resources management. Therefore, it is required to formulate integrated natural resources management concept in order that absence of management of certain natural resources will not cause disadvantageous effect to other resources.

G2.4.3 Fishery Resources

Number of households engaged in fishery sector is presently 2,748 RTP (RTP: fisherman household), which corresponds to about 2.31 % of total households within Kabupaten Gowa. Out of the total RTP, those engaged in fish culture amount to 1,419 and those engaged in fishing in common waters amount to 1,329.

Fish catching by RTP for commercial and non-commercial purpose along the Jeneberang River is being done without considering the carrying capacity of fishery resources, which is causing over-fishing. Therefore, sustainable management of fishery resources is required.

G3 Forest Conservation

G3.1 Forest Resources Condition

G3.1.1 Land and Forest Coverage

(1) Land Coverage

According to CEPI-PPLH UNHAS study in 2001, it was identified from the interpretation of Landsat images in year 1987 and 1996 and Spot image in year 1996 that a considerable change in land use coverage has taken place during the period. The result is summarized below.

Changes of Land Use Cover in the Jeneberang River Basin

No	Kind of Cover Crops	Landsat 1987		Landsat/Spot 1996	
		Area (ha)	%	Area (ha)	%
1	Forest	25,845	34.46	17,250	23.00
2	Dry-land	22,118	29.49	28,845	38.46
3	Wetland paddy	19,973	26.63	18,383	24.51
4	Settlement Area	3,314	3.93	5,909	7.69
5	Bushes	3,750	6.15	4,613	6.15
	Total	75,000	100.00	75,000	100.00

Source: Center for Environmental Survey of Hasanuddin University (CEPI-PPLH UNHAS), 2001

Note: Some figures above are different from those shown in table in G2.2.3, which is due to different origin of the data

Because of population growth and development activities, land coverage in the upstream area of Jeneberang has changed year by year. Horticultural farming practice and tourism activities in the upstream area generated change on land coverage pattern from forest area into lands for horticulture cultivation and tourism supporting facilities and infrastructures. Local people (generally farmers) have cleared the forest away for new agricultural land and also for housing land (villa). Moreover, agricultural investors had a role in land coverage change as well.

As shown in table above, within one decade (1987 – 1996), land coverage in the form of forest area decreases about 10 % from 25,845 ha (1987) to 17,250 ha (1996). Presently, forest is found around Mt. Lompobattang at 1,500 – 2,800 meter above sea level (masl) and along Bulu Bila, Bulu Ruku-Ruku, Bulu Serongan regions in the range of 1,300 – 1,500 masl, as well as some forests coverage in scattered locations at upstream area at 700 – 1,000 masl with steep land slope over 40%. Additionally, there is also crop forest in Kecamatan Parangloe, which is managed by PT. INHUTANI. Figure G3.1 shows the distribution of forests by type.

Land coverage on dry-land farming including dry field, rainfed paddy field, estate crop field and mixed estate crop field increased about 9 % from 22,118 ha to 28,845 ha which is largely found at steep lands with inclination of about 10 – 30 %. This dry-land farming is mainly cultivated by local people in the upstream area of Jeneberang River Basin in the form of horticultural crops in Bulutana Village, cacao and coffee in other villages within Kecamatan Tinggi Moncong, and

corn, cassava as well as sugar cane estate cultivated by PTP Nusantara XIV (a state-owned estate company).

Paddy field is generally found in the relatively mild-slope land. Large areas of paddy fields exist in the downstream area being cultivated intensively under the Bili-Bili, Bissua and Kampili irrigation schemes. Paddy field is also found in the middle reach of Jeneberang River; some are along the river terraces along the river channel in the reach upstream of Bili-Bili reservoir.

Settlement is generally of clustered model. Such model has been applied since flat land area is very limited particularly in the upstream area. Settlement area increased within one decade by about 3 % from 3,314 ha (1987) to 5,909 ha (1996). This increase took place mainly around Malino in the upstream area.

(2) Forest

a. Natural Vegetation

According to CEPI-PPLH UNHAS study in 2001, almost all natural vegetations within Jeneberang River Basin particularly at lowland area have been converted into agricultural land and settlement areas. Therefore, plants growing in such areas are cultivated crops. However, some kinds of plants reflecting and representing natural vegetation characteristics are still found. For example, there are some Palmyra Palm and other kind of trees that indicates vegetation of monsoon-influenced.

Highly covered land by natural vegetation was only found at steep hills and mountain ranges, so that it forms separated regions one another.

Vegetation in the mountain range area was characterized by epiphyte plants such as orchid that grows on trees. Other characteristics are smaller tree dimension, more uniform canopies (treetop), more height (upper side), more moss-growing found along with higher altitude.

Whitten et al. (1984) describes that natural vegetation at lower portion of Lompobattang mountain foot has largely changed due to forest clearance for agricultural land including for coffee plantation and vegetables. Dutch occupation has introduced pine trees since early 1930s which up to now has broadly been developed by the Department of Forestry Services.

At lower portion of the mountain, there are still kinds of original conifer, *Podocarpus*, as well as k.o. maple namely *Acer caesium*. At upper portion, forest plants were dominated by *Leptospermum* which grows along with Vaccinium, Styphelia and Rhododendron. At height above 2,500 masl, only k.o. oak and Leptospermum are largely found, while at the mountain peak, Rubus and Vaccinium as well as various kinds of herb and grass are growing.

More specific observation on vegetation composition at Mt. Bawakaraeng was done by Oka (1999). Defined plots were sloped areas in the range of 1,600 – 2,400 masl, located in the catchment area of the Jeneberang River. It was identified that pine trees mixed with bushes

and rare trees were found at height of about 1,600 – 1,750 masl. Natural vegetation that forms forest was found at height of about 1,750 – 2,300 masl. In the area higher than 2,300 masl, only small plants were found.

Wood plants found around the aforesaid regions were generally families of Aquifoliaceae, Theachea, *Fagacea, Elaeocarpaceae, Daphniphilaceae,* and *Podocapaceae.* Species found within plots of 20 x 20 m at 1,800 – 2,300 masl were *Poocarpus neriifolius, Evodia* sp., *Illex* sp., and species from *Euphorbiaceae* family. Eugenia species were mostly found at lower elevation.

At height of about 1,800 m, canopy structure shows that Eugenia is the dominant plant with branch length of more than 15 m. Lower layer (5 – 15 m) is formed of Illex sp., Paveta sp. and one species of Euphorbiaceae. Clump layer (1.3 – 5 m) is dominated by Illex sp., Eugenia sp., Camellia sp., and young plant of Persea sp. with young natural lowest stratum of trees, clumps and herbs.

At elevation of 2,300 m, vegetation is characterized by small trees with many branches and wide canopy. Top stratum (> 3m) is dominated by Illex sp., and underneath is by Illicium sp. with young natural Podocarpus neriifolius and Camellia sp.

Stand structure found at respective elevations abovementioned is shown in Figures G3.2 and G3.3.

b. Forest Area

Information on forest area was obtained through deep interview to Head of Department of Forestry Services of Kabupaten Gowa and references to previous studies. Existing forest area within the river basin is classified herein to natural forest, crop forest, and industrial crop forest.

Natural Forest:

Existing natural forest at upland, particularly around mountain side of Lompobattang-Bawakaraeng, lies at height of about 1,500 m above. Natural forest at lowland has been converted into mixed estate crop field. For example, a kind of plant that forms natural forest around Bili-Bili dam site was thorny bamboo. This thorny bamboo was cleared away and the land is now utilized to grow eucalyptus, acacia tree and tea plantation.

The other kinds of converted natural forests were existing forests alongside the river (riverine forests or gallery forests). One of functions of such forests is for maintaining ecological function of the river, preventing sediment inflow and stream bank erosion. Existing gallery forest was only found at upland of steep slope area where the river runs and flows along the mountainside foot. The converted gallery forest was mostly used for settlement and agricultural field because of the fertile alluvial soils. From Bili-Bili reservoir

towards upstream reach, gallery forest is generally converted into paddy fields and mixed estate crop fields which are planted with various tree crops. Such cultivated crops provide direct benefit for farmers or local people as well as daily basic needs such as bamboo, various kinds of fruits (banana, avocado, mango, and petai {k.o. tree that produces beans with pungent odor}). There is also legume that can be used as fertilizer crop and livestock food, and also as fence materials for yards and estates, for example Gliricidia.

Various existing trees in this mixed estate crop field have formed quite dense stands, so that the land is completely covered, particularly at steep sides of the riverbank. Even so, there are still fields along the riverbanks which are exposed and have no vegetation in some locations. Such condition is largely found in the downstream part where settlement is denser than the upstream area. Another factor causing exposed land is the existence of sand and stone mining activities which removes not only vegetation but also gives damages on the river banks due to excavation.

Crop Forest:

Crop forest comprises various species. Crop forest having the largest area is pine crop forest (*Pinus merkusii* Jungh. Et de Vr.). The pine tree has been introduced during the Dutch occupation period since 1930s. Up till now, Department of Forestry Services continues to grow pine trees since it provide benefit as commercial wood and latex which can be exported overseas. Massive cultivation was done during last 20 years under a land rehabilitation and reforestation program.

According to the available data at Malino Forest Ranger Office, Kecamatan Tinggi Moncong clarifies that, since reforestation program was commenced and continued until year 1999, land cultivated for pine trees has reached 5,500 ha in the upstream area within the Malino Forest Ranger region.

There are old pine tree forests aged more than 30 years around Malino and in the mountain side area of Mt. Bawakaraeng and Lompobattang. Some part of old pine tree forests in Malino has been re-developed as tourism forest with area of 3,500 ha.

Industrial Crop Forest:

Some species that grows fast has been cultivated in the midstream area (less than 1,000 masl.) of Jeneberang River Basin by PT. INHUTANI, for production of industrial wood raw material. Extent of forest area which is under jurisdiction of PT. INHUTANI is about 3,597 ha. Major species cultivated are *Acacia mangium, Eucalyptus deglupta* and *Parasianthes falcataria.*

Gmelina arborea has been cultivated to protect reservoir side area. Such trees was planted in quite dense distance, number of trees being more than 10,000/ha. A measurement result of three-year aged trees showed that its growth was quite good. Such trees has formed dense

stands just along the reservoir side area with height of about 6 to 14 m (9.23 m in average) and diameter of about 3.82 to 21.82 cm (11.08 cm in average).

Some people living in villages around the pine forests utilize the land under the stands of pine trees to grow coffee. For example, in Sicini village, coffee (robusta) is cultivated under the 28-year aged stand with cropping distance between 0.5 – 1.5 m. In addition, banana was also cultivated at side portions of coffee. In addition to pine tree, other exotic species cultivated in the areas are *Acacia mangium, Eucalyptus deglupta, Paraserianthes valcataria*. These three species are particularly developed by PT. INHUTANI which has large forest area in the midstream part of the Jeneberang River Basin.

Other acacia species, namely *Acacia deccurrens,* is largely planted by local people around Malino and Kanreapia regions to be used as firewood. This species is also sold by farmers as pulp raw material when Gowa Paper Mill was operated before.

Local farmers around the area are also growing *Eucalyptus Alba* inside or outside boundaries of their field. Product from the trees is largely used for construction material and carpentry.

G3.1.2 Logging Activities

Data on forest logging activities was obtained through deep interview to the Head of Department of Forestry Services of Kabupaten Gowa, Ir. Umar Wahyu, on July 6, 2004.

Basically, there were two kinds of logging activities, namely legal logging and illegal logging. Legal logging includes the logging being done by Forestry Services or companies, who have logging concession (HPH or HTI) and conduct the logging in accordance with technical requirements of silviculture such as harvesting, thinning out, land clearance for cultivation of seedling area, etc. These activities do not generate any loss for the government since they apply proper and accountable methods.

Illegal logging is logging activities done by other parties without authorization from Forestry agencies or without legal concession. Such activities generate disadvantageous effects on the forestry environments, besides no revenue comes into the governments. Illegal logging disturbs the forest ecosystem since this activity is not friendly to the environment and not paying attention to the preservation principles. Illegal logging activity is generally done by local people in favor of other parties or by local people who want to clear the forest for agricultural land.

G3.1.3 Issues from Forestry Services and Communities

(1) Issues for Forestry Services

Currently, major issue for Forestry Services is the change of forest regions to other uses. For example, forest area classified as the Ordinary Production Forest Region of about 1,000 ha at Parangloe village was converted to settlement area to accommodate the people relocated from

communities who experienced land collapse in upstream area (Lengkese and Panaikang) in March 2004. In the case of this example, new forest region was specified at two locations to substitute the forest lost: one is within the region of Tamalate Village, Manuju Sub-district of about 400 ha (Tallo River Basin), and the other is within the region of Cikoro Village, Tompobulu Sub-district of about 600 ha (Kelara River Basin).

Another issue is the difficulty in clarification of forest boundaries. Forest boundary often changes due to deforestation without information to Forestry Services.

(2) Issues for Communities

Main issue for communities are the occurrence of disasters, like the case of land collapse occurred at Sicini village in March 2004. The area was part of Protected Forest region. Direct impact generated by the disaster was very extensive since the forest land has been destroyed. The forest is in many cases one of livelihood sources for the communities.

G3.2 Forest Conservation Activities

G3.2.1 Conservation Activities under Implementation by Forestry Services

Forestry Services of Kabupaten Gowa has a vision of accomplishing forest conservation by providing a professional management for communities' welfare through self-determination approaches. To achieve the vision, Forestry Services has a mission to restore, maintain and improve forest functions as one of livelihood alternatives and as production resources though conducive institutional development and interactive communities' participation.

(1) Five Year Program (FY 2003 – 2007)

Based on these vision and mission, forest conservation is placed as one of priority objective of Gowa Forestry Services. Since year 2003, Gowa Forestry Services is implementing a master plan of Forest Conservation Sector for 5-year period (2003 – 2007). The plan was incorporated in the National Campaign for Land Rehabilitation and Forest Rehabilitation (GNRHL). The plan consists of:

(i) Land Rehabilitation on Public Forest,
(ii) Construction of Recharge Well,
(iii) Construction of Seeding Bed,
(iv) Construction of Check Dam, and
(v) Reforestation.

Proposed conservation program is shown in Tables G3.1 to G3.5 and summarized below.

Summary of Forest and Land Rehabilitation Programs in Jeneberang Basin, 2003 – 2004

No	Activities	Quantity	Location
1	Land Rehabilitation / Public Forest a. Area(ha) b. Seed requirement (Seed)	 1,075 537,500	Tinggimoncong, Bungaya
2	Recharge Well Construction a. Total (unit)	 24	Tinngimoncong, Bungaya, Parangloe
3	Seedling a. Volume (unit) b. Production (Seed)	 19.75 3,585,000	Tinngimoncong, Bungaya, Parangloe, Bontomarannu, Barombong, Sombaopu
4	Check dam construction a. Total (unit) b. Length of dam (mean, meter)	 37 34.38	Tinngimoncong, Bungaya, Parangloe
5	Forest Rehabilitation / Reforestation a. Area (ha) b. Seed requirement (Seed)	 2.95 5,900,000	Tinggimoncong, Bungaya

Source: Forest Agency, Kabupaten Gowa, 2003

(2) Program for FY 2003 – 2004

Of the total five-year program above, part of the programs have been implemented or under implementation for the period of 2003-2004.

Land rehabilitation on public forest has been done for 425 ha in Kecamatan Tinggimoncong and Bungaya by providing seeds of about 212,500. Three recharge wells are constructed at Kecamatan Tinggimoncong, Bungaya and Parangloe. Seeding bed construction for 785,000 seeds has been done at Kecamatan Tinggimoncong, Bungaya, Parangloe, Sombaopu and Bontomarannu. Meanwhile, 11 check dams have been constructed with respective length of between 10 – 65 meters at Kecamatan Tinggimoncong, Parangloe and Bungaya. Reforestation activities have been done in the area of about 2,100 ha in protected forest, limited production forest and ordinary production forest areas.

G3.2.2 Conservation Activities by Communities

Conservation activities by communities in Jeneberang River Basin are carried out by establishing community groups, namely Kelompok Tani Hutan (Forest Farmers Group), Kelompok Tani Penghijauan (Reforestation Farmers Group), Kelompok Pelestari Sumberdaya Alam (Natural Resources Conservers Group) and Non-Government Organizations Consortium.

a. Forest Farmers Group (Kelompok Tani Hutan (KTH))

This farmers group is guided and directed by Forestry Services, which is the origin of farmers group that carries out social forestry. Members of the farmers group are the communities who live around protected forest area and are designated by special authorization to cultivate in the protected forest area. Authorization was directly designated by Minister of Forestry with recommendation from the Head of Gowa Forestry Services. This authorization is based on Law No. 41 of Year 2000 on Forestry, which provides opportunities to the communities to exploit the protected forest.

Cultivatable kinds of plants in the protected forest area are 70% for forest plants and 30% for multi-purpose tree species that are non-forest wood plants such as petai (*k.o. tree that produces beans with pungent odor*), jackfruit, breadfruit, coffee, etc. Seed requirements are provided by Forestry Services or by communities themselves.

b. Reforestation Farmers Group (Kelompok Tani Penghijauan (KTP))

This Farmers' group members are peasantries that care reforestation activities outside of forest area. Kind of plants are selected based on their own needs. However, if Forestry Services has stock of such kinds of plants, communities may have it free of charge.

c. Natural Resources Conservers Group (Kelompok Pelestari Sumber Daya Alam (KPSA))

Organizationally, this group has a large network of nation-wide and active at entire sectors such as; forestry, agriculture, plantation and fishery. The major activities are natural resources conservation in broad meaning. Periodically, KPSA carries out national convention held in different places, and give awards to the best KPSA nationally. In Jeneberang River Basin, KPSA which is located at Malino, have ever achieved national level award.

d. NGO Consortium

The consortium have 7 (seven) NGOs that are active in environmental sector and obtained legalization from Kabupaten Gowa government. Name of the consortium is Karaeng Lompoa which consists of: (i) Baruga Cipta, (ii) Insan Cita, (iii) Lembaga Mitra Lingkungan, (iv) Lembaga Bumi Indonesia, (v) Yayasan Madani Lestari, (vi) Karaeng Pattingalloang and (vii) Lembaga Pemerhati Lingkungan Karampuang.

This consortium has obtained authorization from Kabupaten Gowa government. Every activity that requires NGO assistance in Kabupaten Gowa must be recognized by this consortium and executed by one of the consortium members. Such activities can be in the form of institutional or communal capacity development, as well as physical forestry activities on the field. Capacity development can be in the form of training, education, advocacy, dissemination, etc, whereas the physical activities are tree planting, demonstration plot (model plantation), etc. The consortium is also involved in the activities of GNRHL (National Campaign for Land Rehabilitation and Forest Rehabilitation).

G3.3 Illegal Logging Control

Control on illegal logging activities has been done in several ways such as (i) intensifying control on illegal logging by Forest Ranger, (ii) taking punishment to every person who involves in illegal logging, (iii) socialization on hazard of illegal logging, and (iv) installation of warning and caution posts in the forest area bordered with settlement area and roads.

According to Forestry Services, it is planned to form an integrated team for illegal logging control consisting of forestry agency, police, prosecutor plus representatives from other related

agencies (Bapedalda, Universities). Additionally, Forestry Services has also established Kelompok Pengaman Hutan (Forest Protector Group) in every RPH (Forest Ranger Resort) at Kecamatan level, consisting of about 60 peoples for each group. The groups have run their activities during two years in cooperation with forest rangers. The groups have duties to organize fire fighting activities and protection against any kinds of disturbances such as clearance, stealing, illegal logging, etc. There are 6 (six) RPHs within Jeneberang River Basin, for each of which a Forest Protector Group has been organized.

G4 Environmental Resources Conservation

G4.1 Environment Condition of Jeneberang River Basin

G4.1.1 Deterioration of Water Quality

According to CEPI-PPLH UNHAS study in 2001 as described before, the result of water quality analysis showed that tested parameters of suspended solid, turbidity and color of river water during the rainy season has 50 times higher than the dry season measurement results. This fact is assumed to be due to loose soil structure as well as geological factor in the upstream area (particularly, Majannang and Sicini area) where is prone to frequent land slides. The level of above parameters is now being aggravated more seriously as a result of land collapse occurred at Mt. Bawakaraeng (Sicini area) in March 2004.

The study result also showed that river water having nitrogen content of about 0.294 mg/l and phosphate about 0.069 mg/l flows into the reservoir, which indicates intensive use of fertilizers in the upstream agricultures.

G4.1.2 Sediment Yield

Bili Bili reservoir is designed to have a sedimentation capacity of 29 million m^3 (out of gross reservoir storage capacity of 375 million m^3). This sedimentation capacity was originally designed to accommodate sediment yield of 1,500 $m^3/km^2/year$ from a 384.4 km^2 catchment for the period of 50 years. This was estimated based on the basin condition prevailing at the time of dam design. Subsequently, a revised estimate of sediment yield rate was made incorporating the change of basin conditions; reassessed as 1,794 $m^3/km^2/year$[3]. The balance from the original estimate; 294 $m^3/km^2/year$, was planned to be trapped in Sabo dams and sand pockets, eight in total, built in the reaches upstream of the Bili Bili dam. As mentioned before, another subsequent study by UNHAS estimated that the yield rate may be as large as 2.043 $m^3/km^2/year$.

A particular aspect that the Jeneberang basin is now confronting is the bulky yield of sediments from the Bawakaraeng area caused by recent mountain slope collapses. This aspect is discussed separately in Supporting Report E.

G4.1.3 Ecological Issues

Deep interview with the Head of Bapedalda of Kabupaten Gowa was done on June 28, 2004 in order to identify ecological issues in Jeneberang River Basin. The interview noted that ecologically two environmental issues have been taking place; namely, urban environment and non-urban environment.

[3] Detailed Design of Environmental Improvement Works and Raw Water Transmission Main in the Bili Bili Multipurpose Dam project (Phase II), October 1994, CTI Engineering

(1) Urban Environment

Bapedalda Gowa recognizes that urban environment issues consist of (i) ground water pollution, (ii) town development deviated from urban spatial plan, and (iii) air pollution that exceeds the quality standard.

a. Ground water pollution

Some studies (e.g. JICA study conducted in 1994) reported that groundwater is being contaminated with saline water in some part of coastal area, although the extent is still not of a major problem. While, other information source says that relatively low quality of groundwater in the area is due to particular property of soils. Another problem arising is that households' shallow wells are contaminated by inflow of sudsy water, which is presumably due to pollution by detergents. Further study is needed to grasp the actual condition of salinization/contamination of groundwater.

b. Town development deviated from Urban Spatial Plan

It is reported that more than 20 % of urban development activities around Sungguminasa do not conform to spatial plan determined by the regional government. This circumstance is closely related to the location of Sungguminasa which is adjacent to Makassar City. Development of urban area in Sungguminasa area is rapidly increasing, while monitoring activity by the regional government (Dinas Spatial Plan) is frequently left behind from development activities.

c. Air Pollution

Based on monitoring activities conducted in accordance with 'blue sky campaign program' by Bapedalda, it was identified that PM 10 parameter has exceeded the prescribed quality standard at some places within the urban area in Sungguminasa (see Subsection G2.3.3). Accordingly, high particle content about 10 microns at urban sky may have a possibility to generate ISPA (respiratory disease).

(2) Non-urban Environment

Bapedalda Gowa recognizes that the following are major environmental issues observed recently:

- Land collapse at Sicini village at foot of Mt. Bawakaraeng in the upstream area of Jeneberang River basin
- Need of relocation of households which were affected by the land collapse to Parangloe village
- Deterioration of Jeneberang River water quality, especially due to the Bawakaraeng land collapse
- Illegal logging in forest area.

Some aspects of these issues are described in foregoing Chapter G2.

G4.2 Environmental Conservation Activities

Bapedalda of Kabupaten Gowa is conducting various activities including monitoring of river water quality, wastewater quality, and air quality. Such activities are being conducted in line with national programs, known as 'Clean River Campaign' (PROKASIH) and 'blue sky campaign program'. Some of the monitoring results are presented in foregoing Chapter G2.

G4.2.1 Environmental Preservation Programs

(1) Environmental Preservation Program by Bapedalda

According to interview result with the Head of Bapedalda of Kabupaten Gowa, the followings are summary of Bapedalda Programs for the budgetary year 2004:

(i) Human resources development of Bapedalda personnel by dispatching 2 (two) staffs to A-Group EIA Courses.
(ii) Blue Sky Campaign; air quality monitoring and analysis
(iii) Clean River Campaign; river water and wastewater quality monitoring and analysis
(iv) Bangun Praja; for clean urban environment
(v) Formulation of local regulation draft on gas emission
(vi) Providing vegetation plant seeds for communities who live in bordered region with forest area
(vii) Dissemination to farming groups regarding environment-friendly agricultural practices
(viii) Urban vegetation
(ix) Encouragement for Kalpataru (environment preservation contribution)
(x) Formulation of UKL/UPL (Environmental Monitoring & Management Plans)

(2) Environmental Preservation Program by Communities

Environmental preservation activities done by communities are generally led by Non-Government Organizations (NGOs), although their activities basically depend on other parties programs (including the governments') wherein the NGOs are invited to participate in; for example, land rehabilitation program of Forestry Services Gowa. In this case, Forestry Services provides seeds to be planted at communities' land via NGO in accordance with public forest building program.

According to the Head of Bapedalda of Kabupaten Gowa, other activities done by NGOs are generally education, dissemination and training to communities on environment preservation.

G5 Fishery Development and Conservation

G5.1 General

Agricultural sector has a strategic role for Kabupaten Gowa's economy, which contributes to about 43.76% of total GRDP, while fishery sub-sector's contribution is about 0.32% (CBS, 2002). Significant role of agricultural sector is generated by utilization of natural resources potential including fishery sector.

In Gowa Regency, there area some potential fishery resources such as coastal fishpond, fresh-water fishpond, and paddy field, swamp, river and reservoir. Kind of prominent fishery commodities are gold fish (carp), blue dye fish (nila), red nila, milk fish and shrimp.

This chapter describes the potential of fishery in the Jeneberang river basin and Bili Bili reservoir in particular.

G5.2 Fishery Condition of Jeneberang River Basin

G5.2.1 River and Swamp Fishery

Area of public waters in Gowa Regency as of year 2002 consists of swamp (413 ha) and river (618 ha) with involved RTP of about 1,185 RTP (RTP: Fisherman household). Quantity of fish production (caught fish) in the public waters was about 377.4 ton with total production value of about Rp. 1,388 billions. Kind of fishery gears used are gill-net static, fishing rod, bubu, and others, as tabulated below.

Kind of Fishing Gears and Trips in Gowa Regency, 2002

Fishing Gear	Swamp		River	
	Unit	Trip	Unit	Trip
1. Gill-net static	366	50,461	1,023	41,943
2. Fishing rod	554	41,620	857	31,275
3. Bubu *	655	56,942	903	38,180
4. Others	1,748	70,792	1,456	95,257
Total (2002)	2,323	219,815	4,239	172,285
Last Year (2001)	3,321	219,413	4,237	172,057

Source: Fishery and Marine Services of Gowa Regency, 2002.
Note: * Plaited rattan fish trap

Kinds of caught fish are; Common Carp (Cyprinus carpio), Javanicus Java Carp (Carp Puntius), Nile Tilapial (Trichogaster pectoralis Spotted Gourami), Gabus (Ophiocephalus striatus – Murrel), Nilem (Osteochilus hasselti - Carp) and Sepat Siam.

Number of fish production by kind in swamps and rivers is shown in table below.

Fish Production by Kind at Swamp and River in Gowa Regency, 2002

Kind of Fish	Production (ton)	
	Swamp	River
1. Common Carp (*Cyprinus carpio*)	51.3	27.6
2. Javanicus Java Carp (*Carp Puntius*)	23.9	20.1
3. Nile Tilapial (*Trichogaster pectoralis Spotted Gourami*)	49.8	41.6
4. Gabus (*Ophiocephalus striatus - Murrel*)	26.8	14.6
5. Nilem (*Osteochilus hasselti - Carp)*	13.1	12.6
6. Sepat Siam	17.2	14.0
7. Others	29.8	34.4
Total (2002)	212.9	164.5
Last Year (2001)	211.1	163.0

Source: Fishery and Marine Services of Gowa Regency, 2002.

Table above shows that fish productions in years 2001 and 2002 are almost similar, although a little increase was attained in 2002. Common carp production volume was mostly caught from swamp, while Nile Tilapial was largely caught in the river. Out of total fish production, the values production from swamp and river were about Rp. 713.3 million and Rp. 537.25 million, respectively. Fish production value is presented in table below.

Production Value by Kind at Swamp and River in Gowa Regency, 2002

Kind of Fish	Value (Rp. 1000)	
	Swamp	River
1. Common Carp (*Cyprinus carpio*)	354,900	193,200
2. Javanicus Java Carp (*Carp Puntius*)	56,765	47,745
3. Nile Tilapial (*Trichogaster pectoralis Spotted Gourami*)	174,300	144,200
4. Gabus (*Ophiocephalus striatus - Murrel*)	90,000	65,700
5. Nilem (*Osteochilus hasselti - Carp)*	29,475	28,750
6. Sepat Siam	42,730	34,790
7. Other	75,065	49,875
Total (2002)	823,235	564,260
Last Year (2001)	713,300	537,250

Source: Fishery and Marine Services of Gowa Regency, 2002.

G5.2.2 Fishpond Aquaculture

Area of aquaculture, either brackish or freshwater farming, was about 721.7 ha in 2002, with total involved RTP of about 954 households. Area of aquaculture and number of involved RTP are shown below:

Area of Aquaculture and Numbers of Involved RTP in Gowa Regency, 2002

Kind of Culture	Area (ha)	RTP*
1. Coastal fishpond	156.0	126
2. Fishpond	166.2	414
3. Paddy field	398.5	414
Total	720.7	954

Source: Fishery and Marine Services of Gowa Regency, 2002.
Note: * RTP: Fishermen Household

Table above shows that paddy field fish culture was the largest area (398.5 ha) with total fish production of about 118.1 ton. Production value of total fish production was about Rp. 826.75 million. Fish production by kind is shown in table below:

Fish Production (ton) by Kind in Gowa Regency, 2002

Kind of Fish	Production (ton)		
	Coastal Fishpond	Fishpond	Paddy field
1. Milkfish	36		
2. Shrimp	14.7		
3. Crab	3.1		
4. Carp		69.5	118.1
5. Nile (Nila)		17.3	
6. Other kinds of fish	4.3		
Total (2002)	58.1	86.8	118.1
Last Year (2001)	56.1	85.5	117.4

Source: Fishery and Marine Services of Gowa Regency, 2002.

Table above shows that Milkfish, Shrimp, Crab, Carp and Nile were the largest kind of fish cultured in Kabupaten Gowa. Fish production for all kinds of aquaculture was generally increased than in the previous year due to high response of communities against market opportunity mainly in fulfilling protein supply for tourists and communities.

Production value of aquaculture products is shown below.

Fish Production Valueby Kind in Gowa Regency, 2002 (Rp. 1000)

Kind of Fish	Value (1000)		
	Coastal Fishpond	Fishpond	Paddy field
1. Milkfish	204,000		
2. Shrimp	809,550		
3. Crab	72,025		
4. Carp		486,400	826,750
5. Nile (Nila)		59,500	
6. Other kinds of fish	11,250		
Total (2002)	1,096,825	545,900	826,750
Last Year (2001)	1,010,375	500,450	973,875

Source: Fishery and Marine Services of Gowa Regency, 2002.

Table above shows total production value of fishponds aquaculture is almost same between 2001 and 2002, but that of paddy field showed a large drop of the order of Rp. 15.2 million in 2001.

G5.3 Fishery Resources Conservation

Fish catching in the common waters or along the Jeneberang River including in the Bili-Bili Reservoir, either for commercial and non-commercial purpose, is the real necessity for the local people. The resources will be endangered if not properly conserved. Government of Kabupaten Gowa via Fishery and Marine Services has carried out the following development efforts:

(a) Freshwater culture development (in fishpond and paddy field), which aims at the intensification of production and quality improvement.
(b) Coastal fishpond culture development, which aims at intensification improvement by means of efficient and effective technology application and introduction.

(c) Fish catching activities in the common waters (swamp, river and reservoir), which is guided to rationalize the resources utilization by means of restocking. Additionally, catching technique improvement is attempted including arrangement of kinds, number and size of net-mesh for fishing gear.

(d) Freshwater young fish business development, being led by *Balai Benih Ikan* (Spawning Centre) and *Unit Pembenihan Rakyat* (Public Spawning Unit), aims at improving young fish quality and quantity through single young fish spawning.

G5.4 Fishery Potential in the Bili-Bili Reservoir

G5.4.1 Present Fishing Activity

Major kinds of fish caught in the Bili-Bili Reservoir are Common Carp (*Cyprinus carpio*), Javanicus Java Carp (*Carp Puntius*), Nile Tilapial (*Trichogaster pectoralis Spotted Gourami*), Gabus (*Ophiocephalus striatus - Murrel*), Nilem (*Osteochilus hasselti - Carp)* and Sepat Siam. Production quantity and value from fishing activity in the Bili-Bili reservoir are summarized below.

Fish Production Quantity and Value by Kind in the Bili-Bili Reservoir, 2002

Kind of Fish	Production (ton)	Value (Rp.1000)
1. Common Carp (*Cyprinus carpio*)	30.9	216,300
2. Javanicus Java Carp (*Carp Puntius*)	12.2	28,975
3. Nile Tilapial (*Trichogaster pectoralis Spotted Gourami*)	48.7	170,450
4. Gabus (*Ophiocephalus striatus - Murrel*)	8.1	36,450
5. Nilem (*Osteochilus hasselti - Carp)*	4.9	11,025
6. Sepat Siam	10.5	26,095
7. Other	14.5	37,615
Total (2002)	129.8	526,910
Last Year (2001)	125.5	509,515

Source: Fishery and Marine Services of Gowa Regency, 2002.

In the year 2002, total fish production in the Bili-Bili Reservoir was 129.8 ton with an increase of about 4.3 ton from the previous year (2001). Table above shows that Nile was the largest production in quantity of about 48.7 ton, while Carp was the highest production value at about Rp. 216.3 millions. Number of trips and production quantity by type of fishing gears is shown below.

Number of Trips and Production Quantity by Kind of Fishing Gear (Bili-Bili Reservoir, 2002)

Kind of Fishing Gear	No. of Units	Trip	Production (ton)
1. Gill-net static	298	12,012	84.1
2. Fishing rod	128	7,987	15.9
3. Bubu *	58	3,214	5.5
4. Other	60	9,772	24.3
Total (2002)	544	32,985	129.8
Last Year (2001)	542	32,850	125.5

Source: Fishery and Marine Services of Gowa Regency, 2002.

Note: * Plaited rattan fish trap

As indicated in table above, the largest fishing gear used by RTP is gill-net static of 298 units. Fish production by using gill-net static (84.1 ton) was larger than other fishing gear in 2002. The use of gill-net static increased from the previous year, and is foreseen to increase further. It is required to formulate a regulation on fishing gear dimension (size) to prevent over-fishing in the Bili-Bili Reservoir, particularly for gill-net static.

CEPI-PPLH UNHAS Phase II study result (2001) showed that total Nile and Carp population in the Bili-Bili Reservoir was estimated about 33,259 millions fish and 1,693 millions fish, respectively. If it is assumed that average weight of Nile and Carp about 15 gram and 323 gram respectively, thus, biomass for both fish is about 498.9 ton and 546.8 ton, respectively. Carrying capacity of the Reservoir per unit area was estimated about 269.7 kg/ha for Nile and 295.6 kg/ha for Carp. Calculation result for Nile and Carp production in the reservoir was 98 kg/ha/year for Nile and 33 kg/ha/year for Carp. If the effective reservoir area is 1,233 ha (out of 1,850 ha at surcharge water level), these correspond to 120.8 ton and 40.6 ton, respectively.

However, the fish production in the reservoir tends to decrease due partly to over-fishing. A measure to be introduced is to guide fishermen to use the nets having mesh sizes of there inches. A previous study[4] mentioned that, in the case of use of larger sized nets, the production of Nila Fish and Gold Fish would increase by about 30 % and 15 %, respectively.

G5.4.2 Fish Culture Potential in Bili-Bili Reservoir

Fishery development in the Bili-Bili reservoir is planned to promote fish production with main aim of supporting the welfare improvement of communities who live around the reservoir. One of consequences derived from fishery development is the creation of employment opportunities, especially for the communities around the reservoir. The role of fishery sector is also to contribute to stimulating tourism especially in sport fishing and foodstuff consuming for visitor.

Fish hatchery by using fish floating net-cages is one of fishery activities that may be developed in the Bili-Bili reservoir in the future.

According to the previous UNHAS study, measurement result of average total phosphate concentration in the reservoir waters before hatchery activities during one year (April 1998 – March 1999) is 31.8 mg/m^3. Assuming the maximum total phosphate concentration in tropical reservoir waters to be about 250mg/m^3 (Beveridge,1984), the reservoir capacity to receive additional phosphor load is estimated as 218.2 mg/m^3.

In reference to the Beveridge formula (1984), the maximum amount of phosphor load from fish floating net-cage is calculated as 7.70 gram/m^2/year. If the effective reservoir surface area is 1,233 ha, then the total maximum phosphor load that can be received in reservoir is 94,940

[4] Study on Integrated Management of Jeneberang River Basin – Phase II, Center for Environmental Study, Hasanuddin Unversity (UNHAS), 2001

kg/year. It is also estimated that production of one ton of fish will result to additional 22.6 kg phosphor load into waters (P-environment). Based on these figures, it is calculated that potential weight of fishes that can be produced in the reservoir from fish floating net-cage is about 4,200 ton/year.

On one hand, the production of fishes in floating net-cages is estimated as 15 kg/m^3. Based on this production level, should the fish floating net-cage have a depth of 2.5 m, then the proposed fish floating net-cage gross area is about 5.6 ha or 0.5 % of the effective reservoir area. On one hand, according to an criterion proposed by the Fishery Centre of Research and Development of Agricultural Department (1991), appropriate area of fish hatchery by fish floating net-cages using intensive system is 0.25 – 1.0 % of effective reservoir waters. The figure of 0.5 % above falls in this allowable range.

The above indicates that Bili-Bili reservoir has a great potential of developing fish hatchery industry, which should be promoted with priority.

A constraint having arisen recently is the excessive turbidity of reservoir water due to sediment yield from Bawakaraeng mountain collapse. Lack of sun lights in turbid water will certainly causes unfavorable condition for bleeding fry young fishes. It is expected, however, that the current excessive turbidity will diminish within several years, once Sabo works presently envisaged by Proyek Induk (JRBD) is completed and sediment yield from the upstream part becomes less.

G6 Watershed Conservation

G6.1 Main Focuses in River Basin Management

From the aspect of river basin management by new Public Corporation, the main interests will be placed on the following:

(a) Reduction of sediment yield from the upper basin
(b) Conservation of water resources by increasing water holding capacity in the upper basin
(c) Conservation of natural environments in the river course
(d) Conservation of fishery resources, particularly in the Bili-Bili reservoir

Of the above, item (a) - reduction of sediment yield will need the utmost attention and the Corporation's active participation.

G6.2 Measures for Reduction of Sediment Yield

There are various types of measures, both structural and non-structural measures, for reducing sediment yield. Among others, measures requiring less investment cost would be the combination of non-structural measures; such as forest management and improved land use practices. Focusing particularly on these aspects, description is given in the succeeding sections.

G6.2.1 Reforestation

As described before, transformation on the forestry resources is taking place due mainly to uncontrolled conversion from natural forest to crop forest, cultivation and settlement areas, and further from crop forest to cultivation and settlement areas in the last moment. A major driving force of this forest transformation is the expansion of horticulture plantation, especially potatoes and vegetables, which has good and continuous marketability.

Natural forest and crop forest are not the only forests threatened by the horticulture expansion, but also public forest especially around Malino Town up to Kanreapia region. This public forest has been planted with Acacia and Eucalyptus Alba trees since 1970s. The forests had once produced woods for selling to a pulp paper factory, but since the closure of the factory the forest land began to be converted to horticulture lands with cultivation of cabbage and potato mostly.

A report of Dinas Forestry and Land Conservation of Kabupaten Gowa (year 2000) estimated that, during the last ten years, converted forests in the Jeneberang River basin have reached 10-15 % of total forest area. The report stated that existing forests requiring the reforestation program is about 2,050 ha. The reforestation program will be implemented with the leading role of Dinas Forestry Services.

G6.2.2 Forest Management

Other than the reforestation program, UNHAS study in 2001 proposed the following forest exploitation and conservation plans:

(a) Exploitation of existing pine forests by planting coffee with the rule of proper cultivation and silviculture technique so that it may not disturb the trees. Other activity is *gondorukem* production by laboring local people as sap/latex incisors. For example, Dinas Forestry and Land Conservation of Kabupaten Gowa reported that incision activities have contributed additional income for more than 500 families in RPH Malino area. Encouragement of these economic activities will reduce the uncontrolled cutting of trees in the area.

(b) Conversion of public forest to horticulture plantation can still be done by keeping the space for Acacia trees or Eucaliptus, without felling the in-situ existing trees. This method may be realized by applying agro-forestry technique, particularly by preserving dense trees in the edge of plantation areas as erosion and sedimentation control zone.

(c) Intensification of greenbelt functions is done along river and around reservoir by planting multipurpose trees that will contribute to income improvement, particularly in the steep slopes in upstream areas. The width of greenbelts should be sufficiently enough so as to effectively prevent sediment inflow into the water body and be preserved permanently. Lands behind greenbelt may be used for plant cultivation with due care for preventing surface erosions in manners proposed in Subsection G6.2.3 below.

These proposed measures seem to be practical and meet community's requirements in a sense that the lands are still usable for income generation of the communities.

G6.2.3 Land Use Practices

Farming most common in the upstream area is food crop farming in form of rainfed paddy, horticulture plants (vegetables) and plantation. Sediment yield can be reduced by exercising improved practices of land use in those areas.

(a) Paddy Field Farming is found both in flat area and hilly area. In the hilly area, paddy field farming should be done by applying a land use practice in form of bench terracing following contour line.

(b) Horticulture Farming (vegetables) is done in the garden or yard, mixed garden, un-irrigated field, rainfed field, and agro-forestry area. Main vegetables commonly planted are potato, cabbage, leek, and tomato. This horticultural farming is being done in flat to hilly (0 – 40% slope) areas; possibly, farming area in hilly land is subject to extensive erosion. Conservation efforts can be done by making embankments following contour lines, planting along the contour lines (especially for potato), benched terrace, or combination of embankment and terracing.

(c) Plantation business, such as tea, passion fruit, and coffee has been developed by involving investors/corporations (e.g. Nitto Tea, Markisa Malino), although the plantation area is not

increasing so much recently. Coffee plantation still continues expanding; being mainly planted under pine trees (this practice is officially permitted by Forestry Agency). Applied land use efforts are benched terrace, embankment terrace, and planting method following contour lines, or mix/combination of them as well as land covering efforts by year-round vegetation (especially, tea) using rotary crop system.

These measures, if properly executed, would contribute much to the reduction of sediments yields.

G6.2.4 Structural Measures

Typical structural measures conceived in the basin for reducing sediment yield include check dam, sand pocket, gully protection, channel consolidation work, and various types of hillside erosion control work (e.g. planting work, lateral drain, fence work, slope greening work, etc.).

It is assumed that several types of work will be implemented by Dinas Forestry Service of Kabupaten as appropriate for each location. New Public Corporation will provide technical services (design and construction supervision) and also provide funding assistance for those structural woks.

G6.3 Watershed Management by Public Corporation (PJT Jeneberang)

G6.3.1 Role of Public Corporation prescribed in Laws

New Water Resources Law No. 7/2004 prescribes in Article 47 (3) that 'Business entities (incl. Public Corporation) and individuals as intended under paragraph (1) must participate in conducting water resources conservation activities and improving the welfare of the surrounding community'.

'Draft Government Regulation (GR) on Corporatization of Water Resources Management in River Basins', although it is still a draft version, seems to indicate the Kimpraswil's latest concept of the Public Corporation's roles and duties. The Draft GR states in its Article 13 as follows:

(1) the implementation of the activities of water resources management as stated in Article 12 covers conservation, efficient use of water resources and control of water damage force
(2) conservation, as stipulated in (1), includes the activities of water resources protection, water conservation and water quality management

It is understood, on one hand, that the leading role of watershed conservation is taken by Dinas Forestry in the field of forest conservation and by Dinas Plantation / Dinas Agriculture in the field of land use practices in cultivation areas. Hence, the main role of Public Corporation will be participation in those watershed conservation activities on a collaboration concept as sated in the New Water Law.

Collaboration to watershed management activities is one of off-stream services for the Public Corporation (called 'PJT Jeneberang' hereinafter)

G6.3.2 Proposed Watershed Management Activities by PJT Jeneberang

It is proposed that, for the period of mid-term plan, the PJT Jeneberang will provide the following services regarding watershed conservation sector:

Proposed Watershed Management Activities by Corporation

	Description	Purpose
1.	Reforestation and Forest Management (a) Donation of seeds and/or seedlings to Dinas Forestry and communities (b) Provision of technical recommendation regarding priority area of reforestation / forest management, particularly from aspect of sediment yield reduction	SYR & WRC
2.	Management of Land Use Practices (a) Donation of fund for land use practice improvement works undertaken by Dinas of local government and communities (b) Provision of technical recommendation regarding priority area of land use practice improvement, particularly from aspect of sediment yield reduction	SYR
3	Structural Measures for Sediment Yield Reduction (a) Donation of fund for sediment yield control work undertaken by Dinas of local government and communities (b) Planning, design and construction supervision service of structural works in assisting Dinas of local government	SYR
4.	River Environment Conservation (a) Periodical inspection of condition of river course to identify any adverse issues such as physical damages, environmental deterioration, etc., as part of river patrol survey (see Supporting Report E) (b) Implementation of corrective measures as required as part of river channel maintenance work	REC
5.	Fishery Resources Conservation (a) Monitoring of fish culture activities in the Bili-Bili reservoir so that over-development of fish cage aquaculture should not occur (b) Reporting to local government (Dinas Fishery) regarding condition and corrective measures	FRC

Note: SYR: Sediment yield reduction, WRC: Water resources conservation, REC: River environment conservation, FRC: Fishery resources conservation

PJT Jeneberang will conduct periodically survey for observing sediment yield condition of rivers. The survey is carried out as a part of river patrol survey.

G6.3.3 Service Schedule and Cost Estimate

Provision of these services is a burden to the PJT Jeneberang during the initial phase of operation since no direct revenue is expected for the above services. It is proposed that the PJT Jeneberang would commence these services only after the it has established a firm revenue-collecting system; say, commencing the services from the 3rd year after the operation.

It is also proposed that total annual amount of fund donation would be about one (1) % of revenue from water fees. This will be assumed during the mid-term plan period (initial 5-year period), subject to increase in the future depending on expansion of the Corporation's financial ability.

Table G6.1 shows the estimated annual cost of the services by PJT Jeneberang in the field of watershed management.

G7 Capacity Development Plan

In this sector, the leading role is taken by the relevant agencies such as Dinas Forestry, Dinas Plantation, Dinas Agriculture and Dinas Fishery. Hence, the knowledge required for the Corporation may be of subordinate grade just enough for recommending necessary measures from river basin management.

PJT I is conducting similar technical and funding services in the Brantas basin, and hence the procedures of providing the service are already within the knowledge of PJT I.

Capacity development is required for the PJT Jeneberang in the following aspects:

Capacity Development for Watershed Management Service

	Description	Method
1.	Knowledge of Watershed Conservation: ➢ Acquaint with the basic know-how of providing the services - Practices of reforestation and forest management - Practices of land use in slope area, such as terracing, embankment, contour fallowing, etc.	Lecture & site visit
2.	Knowledge of Structural Measures: ➢ Acquire the knowledge of engineering design and construction supervision of structural work, particularly for check dam	Lecture & OJT
3.	Implementation Ability: ➢ Acquaint with the procedures of formulating the works through coordination with local government agencies ➢ Capability of implementing the proposed projects from technical and funding aspects	OJT

Detailed program of capacity development is presented in a CDP Profile Sheet (CDP: Capacity development program) contained in Supporting Report K.

Tables

Table G2.1 Recapitulation of Wastewater Analysis in Gowa Regency

Parameter		TSS	pH	DO*	BOD_5	COD
Unit		mg/l	mg/l	-	mg/l	mg/l
Sampling Location / Source	a	20	10	0	281	480.88
	b	20	7.2	0.8	200	487
	c	376	6.8	0	1050	1314
	d	521	6.8	0.4	1400	1566.4
	e	314	6.9	0	1450	1533.12
	f	150	7.12	0	1350	1650
	g	60	4.86	0	100	173
	h	7	8.03	9.4	40	66
	i	21	6.991	0	60	99
	j	30	6.837	1.8	120	138
	k	280	7.5	0	600	1620
	l	78	6	4.2	480	682
	m	74	13	7.8	105	218
	n	118	6	0	250	430
	o	22	14	3.8	60	114
	p	155	6	0	400	864
	q	35	6.5	0	119	145
	r	111	7	0	1300	1811
	s	100	6..5	0.9	1010	1650
	t	0	6	9.6	570	862
	u	31	6.5	0	49	68
	v	18	6	6.6	700	920
Quality Standard	A-G	200	6.0 – 9.0	-	50	100
	B-G	400	6.0 – 9.0	-	150	300
Remarks		c, d, e, & k don not meet A-G	a, m, & o do not meet A-G	-	Only h & u meet A-G	Only h, I & u meet A-G

Source: Bapedalda of Kabupaten Gowa

Notes: Location of wastewater quality monitoring

a: UD. Kian Jaya, Gowa Regency
b: DHT, Gowa Regency
c: Kiosk Satelit, Gowa Regency
d: Kiosk Sentosa, Gowa Regency
e: Kiosk Delta, Gowa Regency
f: Mangasa Jaya, Gowa Regency
g: PT. Adinata, Gowa Regency
h: Cahaya Terbit, Gowa Regency
i: CV. Tulung Agung, Gowa Regency
j: CV. Cahaya Indra Mulia, Gowa Regency
k: Sumber Pangan, Gowa Regency
l: PT. Usti Makassar Jaya, Gowa Regency
m: UD. Cipta Persada Makmur, Gowa Regency
n: PT. Surya Nusantara Perkasa, Gowa Regency
o: PT. Tiga Permai Tarsis, Gowa Regency
p: PT. Katelindo Tulus Sejahtera, Gowa Regency
q: Limbung Fuel Station, Gowa Regency
r: PT. Uma Pelita Abadi, Gowa Regency
s: PT. Nitto Malino Tea, Gowa Regency
t: Pinang Mas Hotel, Gowa Regency
u: Celebes Hotel, Gowa Regency
v: Pesanggerahan Malino, Gowa Regency

NA: Not available A-G: A Group B-G: B Group

Table G2.2 Recapitulation of Air Quality Analysis in Gowa Regency

No	Parameter	Unit	Sampling Location									Standard
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
1	SO_2	µg/m^3	1.83	1.04	Ur	1.86	1.23	Ur	2.01	3.44	1.85	900
2	CO	µg/m^3	3492	5238	3492	2619	2619	6984	17460	14841	2619	30.000
3	NO_2	µg/m^3	1.2	1.6	4.7	2.3	1.5	4.7	2.6	2.5	1.2	400
4	O_3	µg/m^3	0.06	0.02	0.02	0.02	0.06	Ur	0.06	0.07	0.08	230
5	PM10	µg/m^3	39	377	159	144	130	109	251	129	85	150
6	Pb	µg/m^3	0.159	0.156	0.02	0.02	0.121	0.160	0.167	0.145	0.131	2
7	NOx	µg/m^3	3.5	3.5	7.6	3.9	2.9	7	3.4	7	3.2	92.5

Source: Bapedalda of Gowa Regency

Notes:

1: Intersection road in Kelurahan Tombolo, Gowa Regency
2: Intersection road in Kelurahan Samata/Polong, Gowa Regency
3: Pakkato Village (in front of PT. Katellindo), Gowa Regency
4: Truck Weighing Station at Sungguminasa, Gowa Regency
5: Syech Yusuf Square at Sungguminasa, Gowa Regency
6: Public Fuel Station (in front of Senior High School 1 Sungguminasa, Gowa Regency
7: Pallangga Bus Station, Gowa Regency
8: Central Market at Sungguminasa, Gowa Regency
9: In Front of Public Hospital at Sungguminasa, Gowa Regency
Ur: Unrecorded

Table G2.3 Harvested Area of Wetland and Dryland in the Jeneberang River Basin - Year 2002

Unit: ha

No.	Commodities	District				
		Tinggi Moncong	Parangloe	Bungaya	Bonto-marannu	Pallangga
1.	Wetland paddy	9,731	2,555	3,303	4,909	6,861
2.	Dryland paddy	0	471	-	46	-
3.	Corn	537	1,073	5,478	1,360	121
4.	Cassava	278	462	2,752	1,026	53
5.	Sweet Potatoes	128	12	63	8	32
6.	Soybeans	65	-	-	-	19
7.	Peanuts	534	405	205	-	8
8.	Small Green Pea	10	-	17	-	1,878

Source: Gowa in Figures, 2002

Table G2.4 Productivity of Wetland and Dryland in the Jeneberang River Basin - Year 2002

Unit: Ton

No.	Commodities	District				
		Tinggi Moncong	Parangloe	Bungaya	Bonto-marannu	Pallangga
1.	Wetland paddy	49,900	12,834	16,142	23,613	33,245
2.	Dryland paddy	-	1,825	-	176	-
3.	Corn	2,474	4,161	23,013	5,434	534
4.	Cassava	5,203	8,425	58,881	15,716	921
5.	Sweet Potatoes	1,172	108	581	72	294
6.	Soybeans	111	-	-	-	36
7.	Peanuts	957	736	353	-	13
8.	Small Green Pea	6	-	11	-	1,279

Source: Gowa in Figures, 2002

Table G3.1 Forest and Land Rehabilitation Plan in Jeneberang Watershed 2003 – 2007

Activity: Land Rehabilitation/People Forest

Location		Year	Forest Function	Area (Ha)	Seed Requirement
Kecamatan	Desa				
Tinggi Moncong	Gantarang	2003	APL	100	50,000
		2004	APL	25	12,500
		2005	APL	25	12,500
		2006	APL	25	12,500
		2007	APL	25	12,500
		Sub-total		**200**	**100,000**
	Malino	2003	APL	50	25,000
		2004	APL	25	12,500
		Sub-total		**75**	**37,500**
	Sicini	2005	APL	25	12,500
		2006	APL	25	12,500
		Sub-total		**50**	**25,000**
	Bilanrengi	2004	APL	25	12,500
		2005	APL	25	12,500
		Sub-total		**50**	**25,000**
	Jonjo	2006	APL	25	12,500
		2007	APL	25	12,500
		Sub-total		**50**	**25,000**
	Parigi	2007	APL	50	25,000
		Sub-total		**50**	**25,000**
	Bulutana	2007	APL	25	12,500
		Sub-total		**25**	**12,500**
Bungaya	Bontoloe	2003	APL	25	12,500
		Sub-total		**25**	**12,500**
	Julumate'ne	2003	APL	25	12,500
		2004	APL	25	12,500
		2005	APL	25	12,500
		2006	APL	25	12,500
		2007	APL	25	12,500
		Sub-total		125	62,500
	Bontolempangan	2003	APL	25	12,500
		2004	APL	50	25,000
		2005	APL	25	12,500
		2006	APL	25	12,500
		2007	APL	25	12,500
		Sub-total		**150**	**75,000**
	Sapaya	2003	APL	25	12,500
		2004	APL	25	12,500
		2005	APL	50	25,000
		2006	APL	50	25,000
		2007	APL	50	25,000
		Sub-total		**200**	**100,000**
	Buakkang	2003	APL	25	12,500
		Sub-total		**25**	**12,500**
	Paladingan	2007	APL	50	25,000
		Sub-total		**50**	**25,000**
Total				**1,750**	**537,500**

Source: Forestry Service of Kabupaten Gowa

Note: APL : Public forest used for various purpose (not protected forest)

Table G3.2 Forest and Land Rehabilitation Plan in Jeneberang Watershed 2003 – 2007

Activity: Infiltration Well Structure

Location		Forest Function	Total (Unit)	Type	Dimention
Kecamatan	Desa				
Tinngimoncong	Bilanrengi				
	2003	APL	1	Well	2 x 1 x 3 m
	Sicini				
	2004	APL	1	Well	2 x 1 x 3 m
	2005	APL	1	Well	2 x 1 x 3 m
	Jonjo				
	2005	APL	1	Well	2 x 1 x 3 m
	Majannang				
	2006	APL	1	Well	2 x 1 x 3 m
	2007	APL	1	Well	2 x 1 x 3 m
	Parigi				
	2006	APL	1	Well	2 x 1 x 3 m
	2007	APL	1	Well	2 x 1 x 3 m
Bungaya	Bissoloro				
	2003	APL	1	Well	2 x 1 x 3 m
	2004	APL	2	Well	2 x 1 x 3 m
	2005	APL	2	Well	2x 1 x 3 m
	2006	APL	2	Well	2x 1 x 3 m
	2007	APL	2	Well	2x 1 x 3 m
ParangLoe	Lonjoboko				
	2003	APL	1	Well	2 x 1 x 3 m
	2004	APL	1	Well	2 x 1 x 3 m
	Borisallo				
	2005	APL	1	Well	2 x 1 x 3 m
	2006	APL	1	Well	2 x 1 x 3 m
	2007	APL	1	Well	2 x 1 x 3 m
	Patallikang				
	2006	APL	1	Well	2 x 1 x 3 m
	2007	APL	1	Well	2 x 1 x 3 m
Total			24		

Source: Forestry Service of Kabupaten Gowa
Note: APL : Public forest used for various purpose (not protected forest)

Table G3.3 Forest and Land Rehabilitation Plan at Jeneberang Watershed (1/2) 2003 – 2007

Activity: Seedling

Location		Year	Forest	Volume	Seed Production
Kecamatan	Desa		Function	(Unit)	(Seed)
Tinggi Moncong	Manimbahoi	2003	APL	1	15,000
		2004	HL	0.5	200,000
		2005	HL	0.25	100,000
		2006	HL	0.25	100,000
		2007	HL	0.25	100,000
		Sub-total		**2.25**	**515,000**
	Parigi	2003	APL	1	15,000
		2007	APL	0.25	100,000
				1.25	**115,000**
	Gantarang	2004	HL	0.5	200,000
		2005	HL	0.5	200,000
		Sub-total		**1**	**400,000**
	Bulutana	2004	HPT	0.5	200,000
		2005	HPT	0.25	100,000
		2006	HPT	0.25	100,000
		2007	HPT	0.25	100,000
		Sub-total		**1.25**	**500,000**
	Sicini	2005	APL	0.25	100,000
		Sub-total		**0.25**	**100,000**
	Malino	2006	APL	0.25	100,000
		Sub-total		**0.25**	**100,000**
	Jonjo	2006	APL	0.25	100,000
		Sub-total		**0.25**	**100,000**
Bungaya	Sapaya	2003	APL	1	1,000
		2004	APL	0.25	100,000
		2005	HPB	0.25	100,000
		2006	HPB	0.25	100,000
		2007	HPB	0.25	100,000
		Sub-total		**2**	**401,000**
	Bontolempangan	2005	APL	0.25	100,000
		2006	APL	0.25	100,000
				0.5	**200,000**
	Bissoloro	2005	HL	0.25	100,000
		2006	HL	0.25	100.000
		2007	HL	0.25	100,000
		Sub-total		**0.75**	**300,000**
	Parang Lompoa	2007	APL	0.25	100,000
		Sub-total		**0.25**	**100,000**
	Patallikang	2003	APL	1	15,000
		Sub-total		**1**	**15,000**
Parang Loe	Lonjoboko	2003	APL	1	15,000
		2006	APL	0.25	100,000
		2007	APL	0.25	100,000
		Sub-total		**1.5**	**215,000**
	Manuju	2003	APL	1	15.000
		Sub-total		**1**	**15,000**
	Lanna	2003	APL	1	1,000
		Sub-total		**1**	**1,000**
	Borisallo	2007	APL	0.25	100,000
		Sub-total		**0.25**	**100,000**

Source: Forestry Service of Kabupaten Gowa

Note; HL: Prortected forest, HPT: Limoted production forest, HPB: Ordinary production forest, APL : Public forest used for various purpose

Table G3.3 Forest and Land Rehabilitation Plan at Jeneberang Watershed (2/2) 2003 – 2007

Activity: Seedling

Location		Year	Forest Function	Volume (Unit)	Seed Production (Seed)
Kecamatan	Desa				
Bontomarannu	Sokkolia	2003	APL	1	1,000
		Sub-total		1	1,000
	Nirannuang	2003	APL	1	1,000
		Sub-total		**1**	**1,000**
Barombong	Barombong	2003	APL	1	1,000
		Sub-total		**1**	**1,000**
Sombaopu	Sungguminasa	2003	APL	1	5,000
		2004	APL	0.25	100,000
		2005	APL	0.25	100,000
		2006	APL	0.25	100,000
		2007	APL	0.25	100,000
		Sub-total		**2**	**405,000**
Total				**19.75**	**3,585,000**

Source: Forestry Service of Kabupaten Gowa

Note; HL: Prortected forest, HPT: Limoted production forest, HPB: Ordinary production forest, APL : Public forest used for various purpose

Table G3.4 Forest and Land Rehabilitation at Jeneberang Watershed 2003 – 2007

Activity: Check Dam Development

Location		Year	Forest Function	Total (Unit)	Length of Dam (m)	Remarks
Kecamatan	Desa					
Tinggi Moncong	Jonjo	2003	APL	1	15	Check dam
		2004	APL	1	10	Check dam
		2005	APL	1	10	Check dam
		2007	APL	1	80	Control dam
		Sub-total		**4**		
	Gantarang	2004	APL	2	20	Check dam
		2005	APL	2	36	Check dam
		Sub-total		**4**		
	Parigi	2004	APL	2	30	Check dam
		2007	APL	1	15	Check dam
		Sub-total		**3**		
	Malino	2005	APL	2	35	Check dam
		Sub-total		**2**		
	Manimbahoi	2006	APL	2	30	Check dam
		Sub-total		**2**		
	Bilanrengi	2006	APL	2	35	Check dam
		Sub-total		**2**		
Bungaya	Sapaya	2003	APL	1	15	Check dam
		2004	APL	1	65	Control dam
		2005	APL	1	15	Check dam
		2007	APL	1	15	Check dam
		Sub-total		**4**		
	Julumate'ne	2005	APL	2	35	Check dam
		Sub-total		**2**		
	Bontolempangan	2006	APL	1	65	Control dam
		Sub-total		**1**		
	Paladingan	2007	APL	2	25	Control dam
		Sub-total		**2**		
	Bissoloro	2007	APL	1	68	Control dam
		Sub-total		**1**		
Parang Loe	Tamalate	2003	APL	1	20	Check dam
		2004	APL	2	20	Check dam
		2005	APL	1	20	Check dam
		Sub-total		**4**		
	Lonjoboko	2005	APL	1	65	Check dam
		Sub-total		**1**		
	Borisallo	2006	APL	2	30	Check dam
		Sub-total		**2**		
	Patallikang	2006	APL	2	40	Check dam
		Sub-total		**2**		
	Belapunranga	2007	APL	1	80	Control dam
		Sub-total		**1**		
Total				**37**		

Source: Forestry Service of Kabupaten Gowa
Note: APL: Public forest used for various purpose (not protected forest)

Table G3.5 Forest and Land Rehabilitation at Jeneberang Watershed 2003 – 2007

Activity: Forest Rehabilitation / Reboisasion

Location		Year	Forest Function	Area (Ha)	Seed Requirement
Kecamatan	Desa				
Tinggi Moncong	Gantarang	2003	HL	150	300,000
		2004	HL	100	20,000
		2005	HL	100	200,000
		2006	HL	100	200,000
		2007	HL	50	100,000
		Sub-total		**500**	**1,000,000**
	Bulutana	2003	HPT	250	500,000
		2004	HPT	200	400,000
		2005	HPT	100	200,000
		2006	HPT	100	200,000
		2007	HPT	100	200,000
		Sub-total		**750**	**1,500,000**
	Parigi	2007	HL	50	100,000
		Sub-total		**50**	**100,000**
Bungaya	Bissoloro	2003	HL	150	300,000
		2004	HL	100	200,000
		2005	HL	350	700,000
		2006	HL	100	200,000
		2007	HL	100	200,000
		Sub-total		**800**	**1,600,000**
	Sapaya	2004	HPB	100	200,000
		2005	HPB	150	300,000
		2006	HPB	150	300,000
		2007	HPB	150	300,000
		Sub-total		**550**	**1,100,000**
	Paranglompoa	2005	HL	50	100,000
		2006	HL	50	100,000
		2007	HL	50	100,000
		Sub-total		**150**	**300,000**
	Paranglompoa	2007	HPB	150	300,000
		Sub-total		**150**	**300,000**
Total				**2,950**	**5,900,000**

Source: Forestry Service of Kabupaten Gowa

Note: HL: Prortected forest, HPT: Limoted production forest, HPB: Ordinary production forest, APL: Public forest used for various purpose

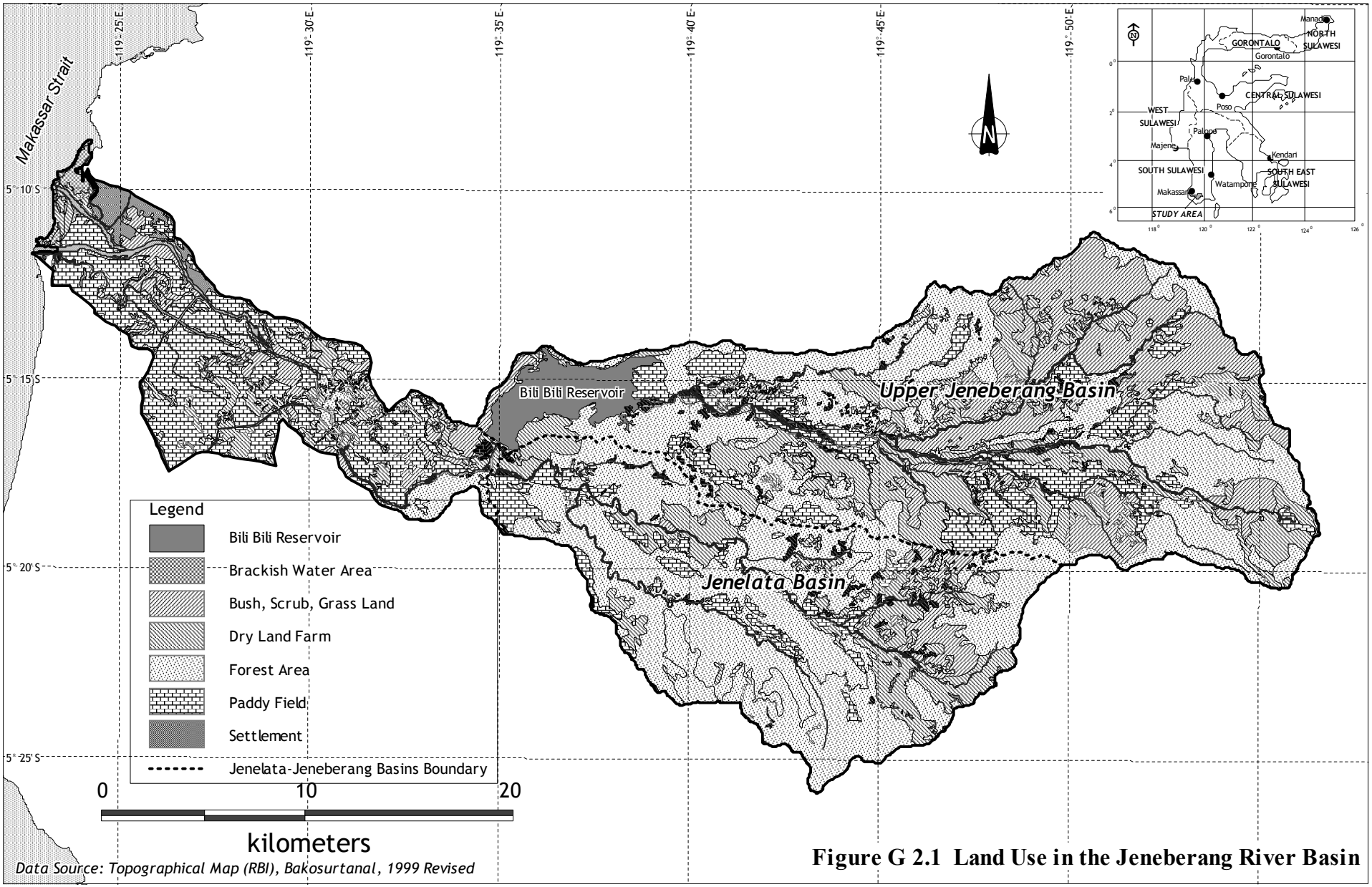
Table G6.1 Watershed Conservation and Management - Estimated Operation Cost

	Description	Unit	Q'ty	Unit Price (1000Rp.)	Amount (1000Rp.)	Remarks
1	Direct Personnel Cost (Responsibel Section: Sub-Division I-2 (Upstream O&M) of Division I)					
	(1) Head of Technical Bureau (1 person)	M/M	0.5	5,475	2,737	5% of annual M/M
	(2) Head of Division I (1 person)	M/M	2	5,475	10,950	15% of annual M/M
	(3) Head of Sub-Division I-2 (1 person)	M/M	4	4,206	16,824	30% of annual M/M
	(4) Soil mechanical engineer (1 person)	M/M	6	1,675	10,052	50% of annual M/M
	(5) Geologist (1 person)	M/M	6	1,675	10,052	50% of annual M/M
	(6) Structural engineer (1 person)	M/M	6	1,675	10,052	50% of annual M/M
	(7) Field inspector (4 persons)	M/M	12	1,018	12,214	25% of annual M/M
	(8) Computer operator (1 person)	M/M	6	1,031	6,184	
	(9) Driver (3 persons)	M/M	12	1,018	12,214	Note: Other M/M is
	(10) Other assistant staff (20% of above)	LS			18,256	used for Sabo O&M,
	Sub-total				109,536	etc.
2	Labour Cost					
	(1) Labor for helping field surveys	man/day	360	17	6,048	
	(2) Miscelleneous (20%)	LS			1,210	
	Sub-total				7,258	
3	Material and Supplies					
	(1) Maps and satellite image	LS			10,000	
	(2) Consumables	LS			3,000	
	(3) Miscelleneous (20%)	LS			2,600	
	Sub-total				15,600	
4	Equipment					
	(1) Vehicle (fuel, consumables, repair)	car/day	360	100	36,000	
	(2) Computer consumables	No./mo.	6	100	600	
	(3) CAD design tools	No./mo.	6	100	600	
	(4) Miscelleneous (20%)	LS			7,440	
	Sub-total				44,640	
5	Duty Trip and Field Allowance					
	(1) Duty Trip					
	Duty trip to Jakarta					
	- Travel Cost	No.	3	1,500	4,500	
	- Perdiem and lodging	day	6	550	3,300	
	Duty trip to Malang					
	- Travel Cost	No.	3	1,200	3,600	
	- Perdiem and lodging	day	6	400	2,400	
	Sub-total				13,800	
	(2) Field Allowance					
	Field allowance for staff	M/D	300	30	9,000	
	Field allowance for drivers	M/D	150	10	1,500	
	Lodging allowance	M/D	10	200	2,000	
	Miscellaneous (20%)				2,500	
	Sub-total				15,000	
6	Other Direct Costs					
	Report printing cost	LS			3,000	
	Leaflets for public relation	LS			5,000	
	Miscellaneous (20%)				1,600	
	Sub-total				9,600	
7	Contract Work					
	(1) Topographic survey at proposed structure sites	LS			10,000	
	(2) Donation of seeds and/or seedling	LS			20,000	
	(3) Funding for watershed conservation works	LS			40,000	
	Sub-total				70,000	
	Total				**285,434**	

Note: 1. The above estimate is made for annual work volume to be accomplished according to job schedule prescribed in the mid-term operation plan (toward 2011). The work volume will be expanded to this work volume level year by year starting in 2007.

2. Cost for respective years is roughly estimated on the basis of work volume anticipated in each year: herein asuumed as 0 % (no work) in 2007, 20% in 2008 (only preparatory work), 50% in 2009 (only partial services), and 100 % in 2010 onward (full scale operation).

Figures



Data Source: Topographical Map (RBI), Bakosurtanal, 1999 Revised

Figure G 2.1 Land Use in the Jeneberang River Basin

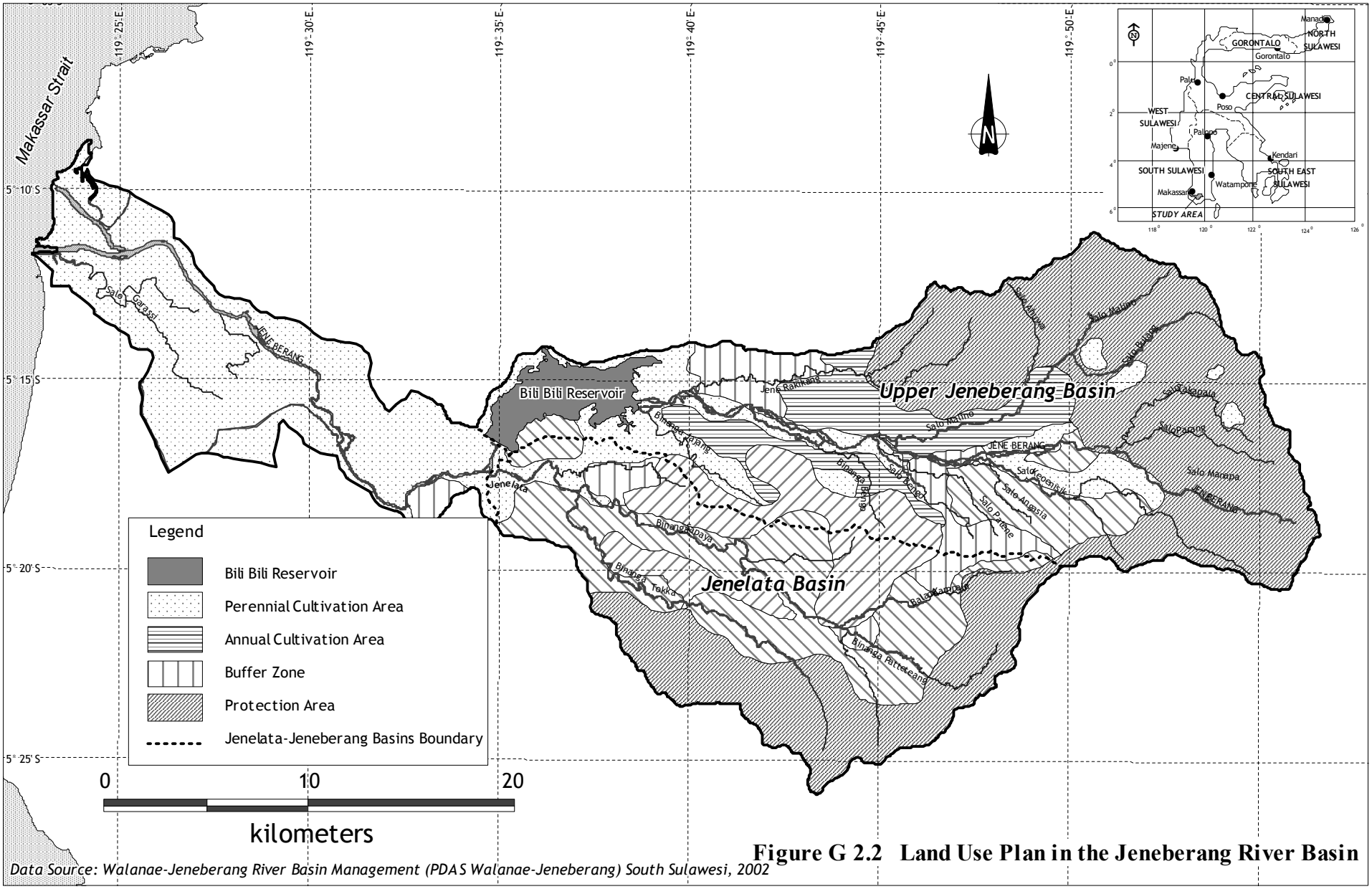


Figure G 2.2 Land Use Plan in the Jeneberang River Basin

Data Source: Walanae-Jeneberang River Basin Management (PDAS Walanae-Jeneberang) South Sulawesi, 2002

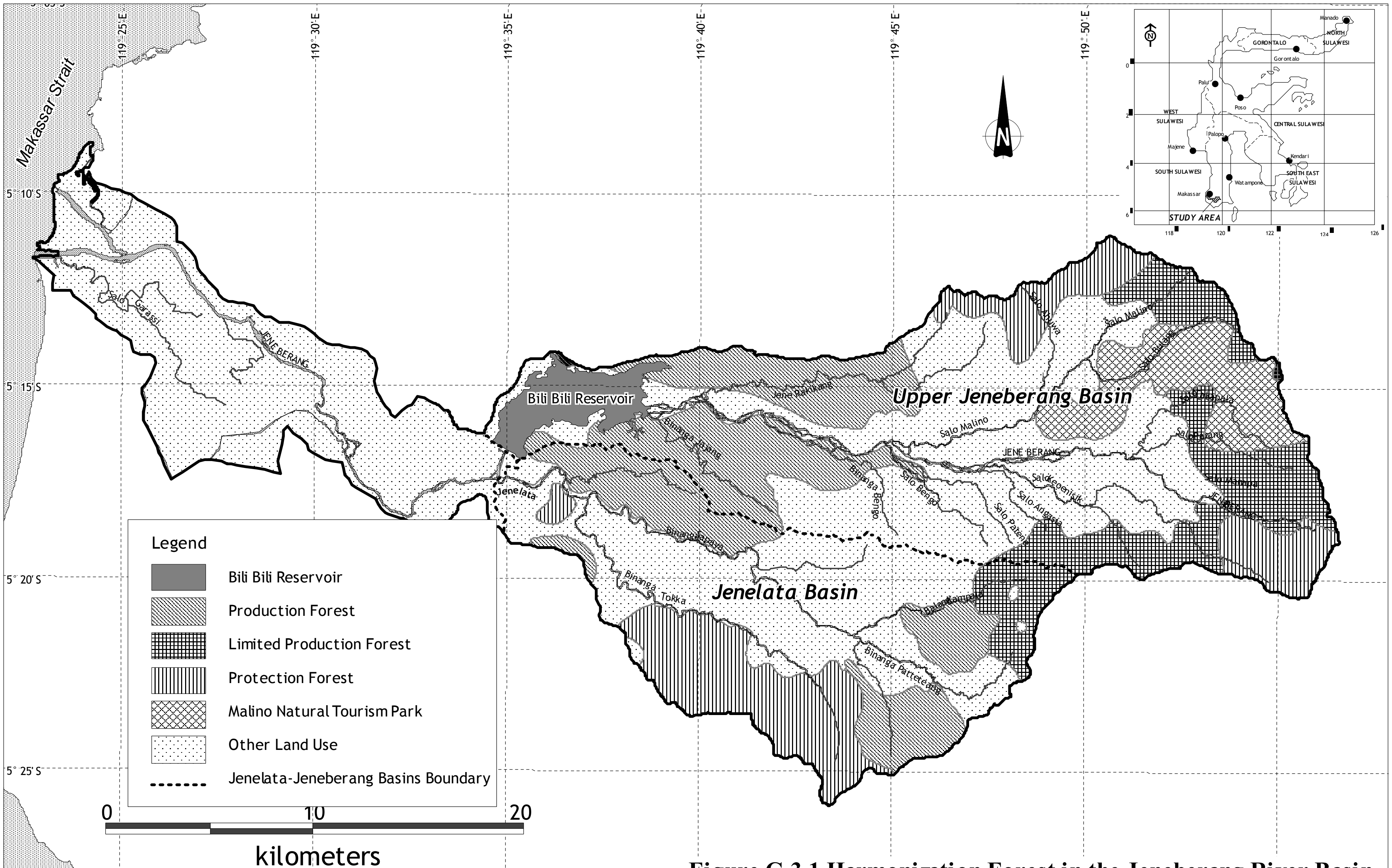
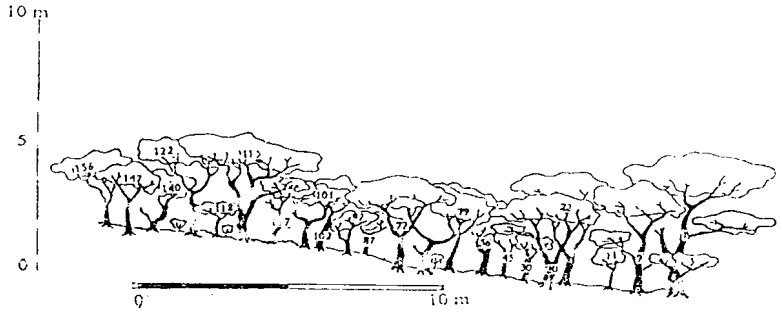


Figure G 3.1 Harmonization Forest in the Jeneberang River Basin

Data Source: Soil Department, Faculty of Agriculture, Hasanuddin University, 2002

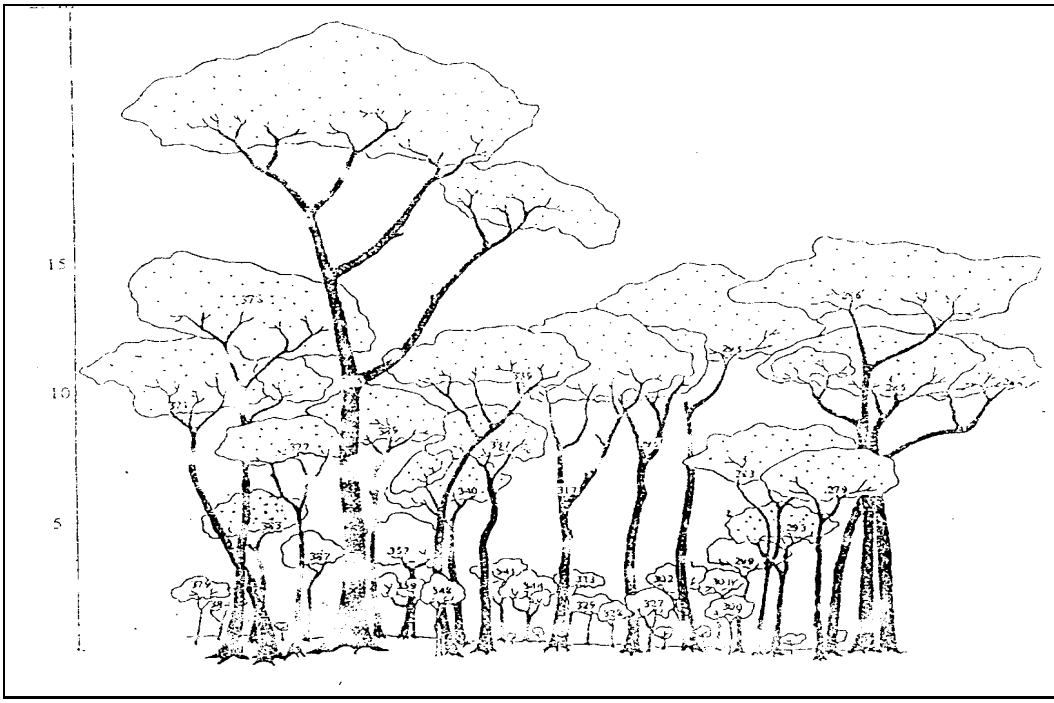
Figure G3.2 Stand Structure of Forests at EL. 2,300 m



Natural forest stands structure at 2.300 m asl. Canopy layers > 3 m, dominated by Illex sp., lower layer is Illicium sp, with young natural Podocarpus neriifolius and Camelia Sp.

Source: UNHAS

Figure G3.3 Stand Structure of Forests at EL. 1,800 m



Source: UNHAS

Natural forest stands structure at 1,800 m asl. Top layer composed by *Eugenia Illex sp*, *Paveta* and one species of *Euphorbiacea* composing second layer (5-15 m) young *Eugenia sp and Camellia sp* and *Persea* composing layer 1,3 – 5 m (Oka, 1999)