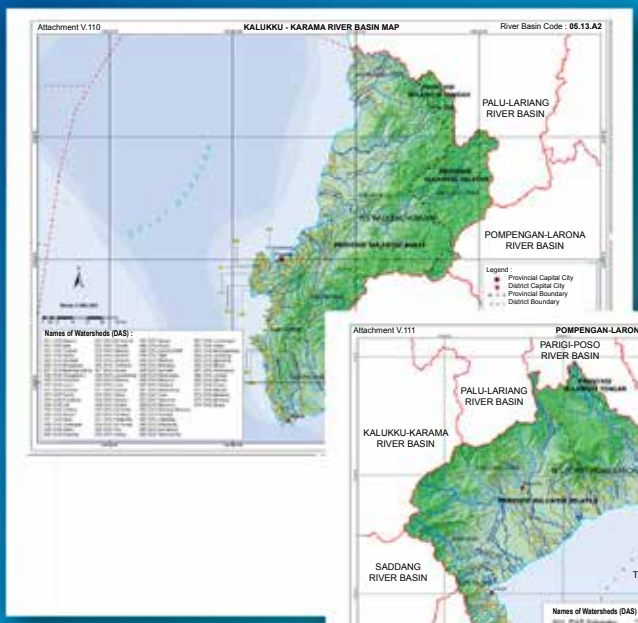
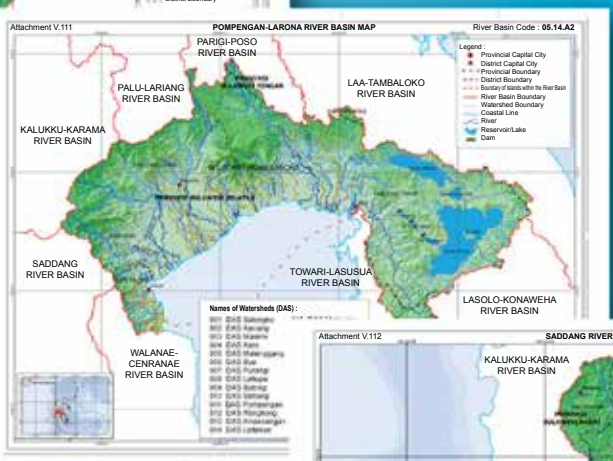
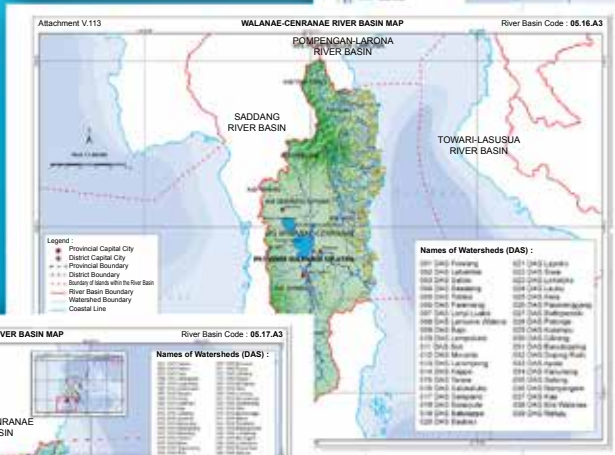
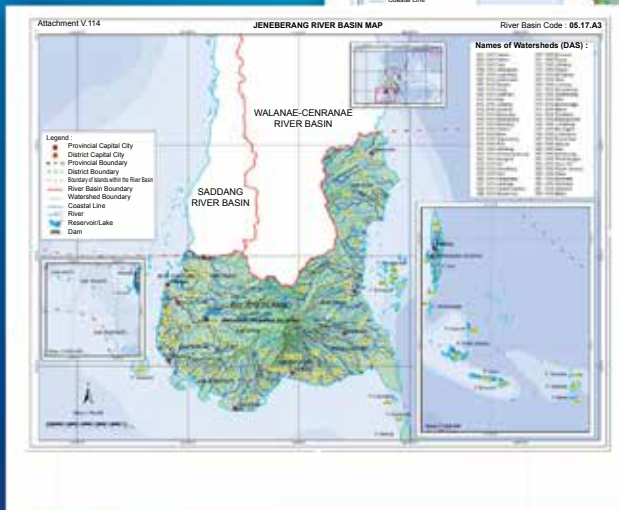
A6. LARGE RIVER BASIN ORGANIZATION OF POMPENGAN-JENEBERANG









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1. DESCRIPTION OF ORGANIZATION

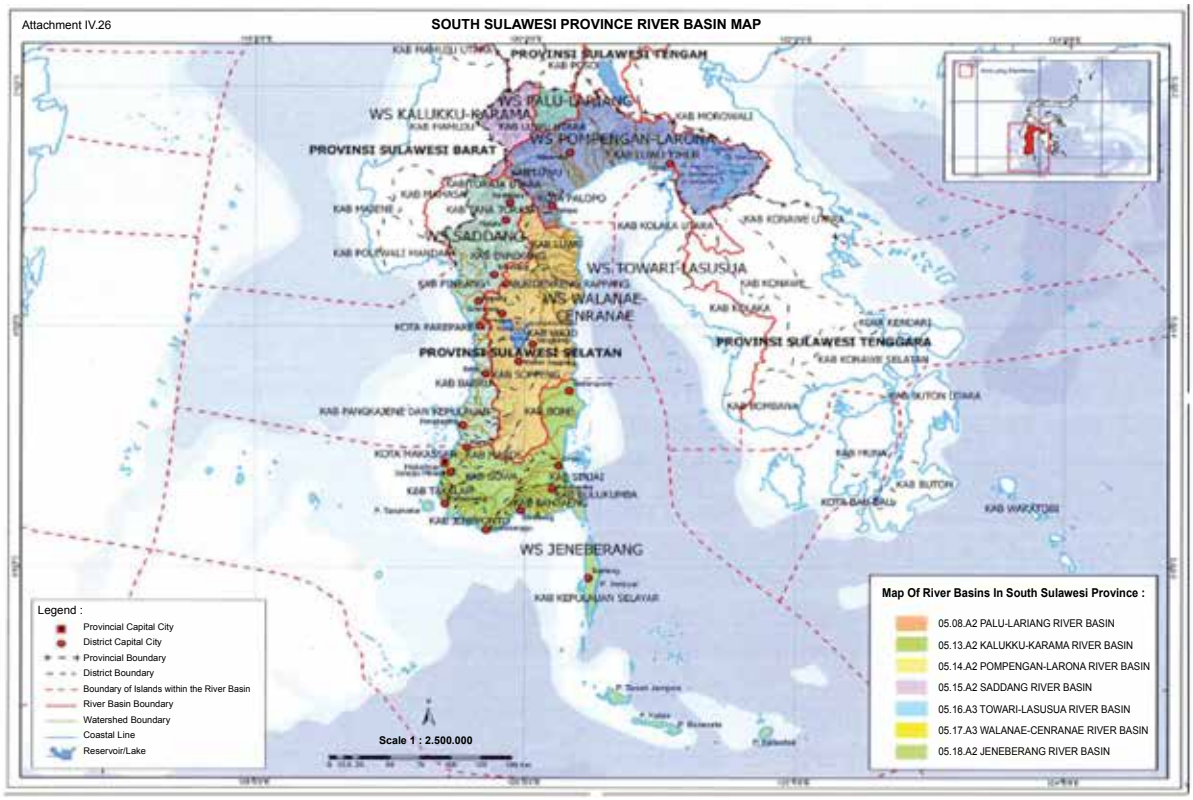


Figure 1: Work Area of BBWS Pompengan-Jeneberang

1.1. General Information

Name	:	Balai Besar Wilayah Sungai Pompengan-Jeneberang
Address	:	Jl. Sekolah Guru Perawat No. 3
Municipality	:	Makassar - 90222
Telephone	:	(0411) 868 781; 868 792
Facsimile	:	(0411) 868 781; 868 792
Website	:	http://www.bbws-pompenganjeneberang.org
E-mail	:	sisda.bbwspj@yahoo.co.id
Legal Basis	:	Regulation of Minister of Public Works Number 23/ PRT/M/2008
Work Area	:	

Name of River Basin	Code	Classification
Kaluku-Karama River Basin	05.13.A2	Cross-provincial
Pompengan-Lorena River Basin	05.14.A2	Cross-provincial
Saddang River Basin	05.15.A2	Cross-provincial
Walanae-Cenranae River Basin	05.16.A3	National Strategic
Jeneberang River Basin	05.17.A3	National Strategic

1.2. Brief History

1986	:	Jeneberang River Improvement Project
1998	:	Master Project for Jeneberang River
2007	:	Balai Besar Wilayah Sungai Pompengan-Jeneberang (Large River Basin Organization of Pompengan-Jeneberang)

1.3. Organizational Structure

The Balai Besar Wilayah Sungai (BBWS) Pompengan-Jeneberang is categorized as a type-A large river basin organization which organizational structure consists of:

1) Administration Department
2) Program and Evaluation Division
3) Water Source Network Implementation Division
4) Water Utilization Implementation Division
5) Water Resources Operation and Maintenance Division

There are 5 (five) work units in the implementation of the organization's operational budget, namely:

1) Work Unit of BBWS Pompengan-Jeneberang

2) Non-Vertical Work Unit for Particular Purpose (SNVT) for Water Source Network Implementationin South Sulawesi

3) Non-Vertical Work Unit for Particular Purpose (SNVT) for Water Source Network Implementation in West Sulawesi

4) Non-Vertical Work Unit for Particular Purpose (SNVT) for Water Utilization Implementation in South Sulawesi

5) Non-Vertical Work Unit for Particular Purpose (SNVT) for Water Utilization Implementation in West Sulawesi

1.4. Human Resources

BBWS Pompengan-Jeneberang has 684 employees, which consist of 515Civil Servants and the rest are Non-Civil Servants.

Table 1: Civil Servant Employees

Educational Level	Technical	Non- Technical	Total
S2 (Master's Degree)	43	5	48
S1 (Bachelor's Degree)	57	109	166
D3 (3-year Associate Degree)	19	5	24
Senior High School	64	171	235
Junior High School	-	19	19
Elementary School	-	23	23
Total	**183**	**332**	**515**

Table 2: Non-Civil Servant Employees

Educational Level	Technical	Non- Technical	Total
S2 (Master's Degree)	-	-	0
S1 (Bachelor's Degree)	17	27	44
D3 (3-year Associate Degree)	2	2	4
Senior High School	12	58	70
Junior High School	-	22	22
Elementary School	-	29	29
Total	**31**	**138**	**169**

1.5. General Condition of Work Area

The work area of BBWS Pompengan-Jeneberang extends to 62,482 km², with a population of 7,520,204 persons (data as per June 2006, www.sulsel.go.id). The work area consists of:

1) Three Provinces, namely:

   (1) South Sulawesi Province,
   (2) West Sulawesi Province, and
   (3) Southeast Sulawesi Province.

2) Eighteen Regencies, namely:

(1)	Bantaeng	(10)	Maros
(2)	Barru	(11)	Pangkajene Islands
(3)	Bone	(12)	Pinrang
(4)	Bulukumba	(13)	Sinjai
(5)	Enrekang	(14)	SidenrengRappang
(6)	Gowa	(15)	Soppeng
(7)	Jeneponto	(16)	Takalar
(8)	Luwu	(17)	TanaToraja
(9)	North Luwu	(18)	Wajo

3) Three Municipalities, namely:

   (1) The Municipality of Makassar
   (2) The Municipality of Palopo
   (3) The Municipality of Pare-pare

4) Five River Basins, consisting of three cross-provincial river basins and two national strategic river basins, namely:

   a) Pompengan-Larona River Basin

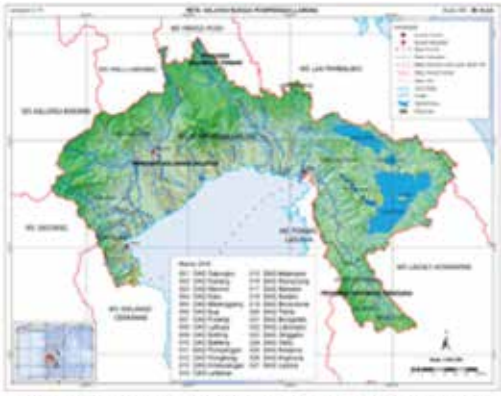


Figure 2: Pompengan-Larona River Basin

The Pompengan-Larona River Basin is a river basin that crosses two provinces, namely the South Sulawesi Province and the Southeast Sulawesi Province. This river basin covers an area of 11,253 km², and consists of 27 watersheds.

The main rivers are the Balease River (length 95 km; area of watershed 995 km²), Kalaena River (length 85 km; area of watershed 1,900 km²), Larona River (length 120 km; area of watershed 4,600 km²), Pompengan River (length 71 km; area of watershed 439 km²).

Other rivers which watersheds cover an area of more than 100 km² are:

(1)	Angkona River	Area of watershed: 385 km²
(2)	Kebo River	Area of watershed: 185 km²
(3)	Rongkong River	Area of watershed: 1.646 km²
(4)	Bangkudu River	Area of watershed: 116 km²

b) Kaluku-Karama River Basin

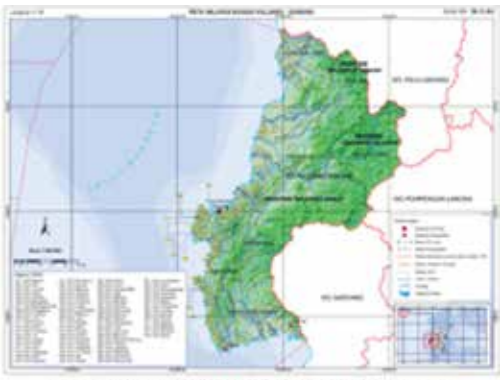


Figure 3: Kaluku-Karama River Basin

The Kaluku-Karama River Basin is a river basin that crosses three provinces, namely the West Sulawesi Province, South Sulawesi Province and Central Sulawesi Province. This river basin covers an area of 12.107 km², and consists of 24 watersheds.

The main rivers are the Karama River (length 150 km; area of watershed 5,574 km²), Budong-Budong River (length 100 km; area of watershed 2,000 km²).

Other rivers which watersheds cover an area of more than 100 km² are:

(1)	Kaluku River	Area of watershed: 419 km²
(2)	Palapang River	Area of watershed: 150 km²
(3)	Lamu River	Area of watershed: 912 km²
(4)	Mandar River	Area of watershed: 664 km²
(5)	Manyamba River	Area of watershed: 196 km²
(6)	Malunda River	Area of watershed: 390 km²

c) Saddang River Basin

Figure 4: Saddang River Basin

The Saddang River Basin is a river basin that crosses two provinces, namely the South Sulawesi Province and the West Sulawesi Province. This river basin covers an area of 7,574 km², and consists of 74 watersheds.

The main rivers are the Mappili/Maloso River (length 114 km; area of watershed 1,712 km²), Saddang River (length 150 km; area of watershed 5,453 km²).

Other rivers which watersheds cover an area of more than 100 km² are:

(1)	Galang-galang River	Area of watershed: 140 km²
(2)	Kunyi River	Area of watershed: 379 km²
(3)	Rappang/Karanjae River	Area of watershed: 777 km²
(4)	Pule River	Area of watershed: 381 km²
(5)	Polong/Lampe River	Area of watershed: 492 km²
(6)	Lipukasi River	Area of watershed: 358 km²
(7)	Lampoko River	Area of watershed: 119 km²
(8)	KerajaRiver	Area of watershed: 174 km²
(9)	Sagiri/Paremba River	Area of watershed: 167 km²

d) Walanae-Cenranae River Basin

Figure 5: Walanae-Cenranae River Basin

The Walanae-Cenranae River Basin is a national strategic river basin that is located in the South Sulawesi Province. This river basin covers an area of 7,380 km², and consists of 39 watersheds.

The main river is the Walane River (length 250 km; area of watershed 740 km²).

Other rivers which watersheds cover an area of more than 100 km² are:

(1)	Gilirang River	Area of watershed: 513 km²
(2)	Siwa River	Area of watershed: 252 km²
(3)	Awo River	Area of watershed: 385 km²
(4)	Paremang River	Area of watershed: 809 km²
(5)	Bajo River	Area of watershed: 390 km²
(6)	Suli River	Area of watershed: 188 km²
(7)	Sampano River	Area of watershed: 178 km²
(8)	Kera River	Area of watershed: 165 km²

e) Jeneberang River Basin

Figure 6: Jeneberang River Basin

The Jeneberang River Basin is a national strategic river basin that is located in the South Sulawesi Province. This river basin covers an area of 9,331 km², and consists of 58 watersheds.

The main rivers are the Jeneberang River (length 80 km; area of watershed 860 km²), and Tangka River (length 65 km; area of watershed 439 km²).

Other rivers which watersheds cover an area of more than 100 km² are:

(1)	Matuju River	Area of watershed: 122 km²
(2)	Pasempa River	Area of watershed: 239 km²
(3)	Barebok River	Area of watershed: 125 km²
(4)	Patiro River	Area of watershed: 330 km²
(5)	Salangketo River	Area of watershed: 296 km²
(6)	Sinjai River	Area of watershed: 130 km²
(7)	Cepek River	Area of watershed: 136 km²
(8)	Aparang River	Area of watershed: 283 km²
(9)	Tiro River	Area of watershed: 190 km²
(10)	Bampang River	Area of watershed: 149 km²
(11)	Balangtiyeng River	Area of watershed: 208 km²
(12)	Bijawang River	Area of watershed: 153 km²

(13) Jene Klara River Area of watershed: 357 km²
(14) Jene Tambaroya River Area of watershed: 243 km²
(15) Jene Allu River Area of watershed: 122 km²
(16) Jene Cikoang River Area of watershed: 123 km²
(17) Jene Pamukulu River Area of watershed: 389 km²

1.6. Hydrology

Rainfall data are obtained from the 63 rainfall stations in the Jeneberang River Basin. The obtained rainfall data range from the data of 2000 until now.

Table 3: Locations of Rainfall Stations

No	Name of Rainfall Station	No	Name of Rainfall Station	No	Name of Rainfall Station	No	Name of Rainfall Station
1	Maccope	17	Pandang	33	Salomekko	49	Panakukkang
2	Cakura	18	Di Bettu	34	BatuBassi	50	Kampili Dam
3	Bengo	19	Tanralili	35	Komara	51	Serre
4	Manere	20	Bulobulo	36	Likupande	52	Pamukulu
5	Sanregohulu River	21	Lekopancing River	37	Bayang-bayang	53	Pamukulu Dam
6	Maroangin	22	BPA Walenna	38	Aparang River	54	Jenemarung
7	Pakeli	23	Bantimurung	39	Kampili	55	Cakura
8	Balantieng River	24	Aparang III	40	Malino	56	Malolo
9	Toata	25	Onto	41	Marrada	57	Pappa Watershed
10	Pamukulu Watershed	26	Tino Toa Pnk	42	Mangempong	58	BontoKappong
11	Paitana	27	Falakka Dam	43	BiliBili	59	Bangkeke
12	Salojirang	28	Seka	44	Jonggoa	60	Kalamisu
13	Camming	29	Maloloi	45	Limbunga	61	Bulukamase
14	Palaka River	30	Kampili	46	Maros Watershed	62	Sinjai Kota
15	Padangloang	31	Moti	47	Salojirang	63	Tangka Watershed
16	Pallatae	32	Kelara Dam	48	Takalar		

1.7. Watersheds, Rivers and Tributaries

The work area of BBWS Pompengan-Jeneberang, which consists of five river basins, has 222 watersheds, with details of each river basin as shown by the following Table 4:

Table 4: Watersheds and Main Rivers

River Basin	Watersheds	Main Rivers	Rivers with Watersheds > 100 Km²	Rivers with Watersheds < 100 Km²
Pompengan – Larona River Basin	27	4	4	19
Kaluku - Karama River Basin	74	2	6	66
Saddang River Basin	24	2	9	13
Walanae - Cenranae River Basin	39	1	8	30
Jeneberang River Basin	58	2	17	39
Total	**222**	**11**	**44**	**167**
	100%	**5%**	**20%**	**75%**

There are 11 main rivers or 5% of the total number of watersheds, while the number of rivers which watershed areas are more than 100 km² is 44 rivers or 20% of the total number of watersheds, and the remaining are rivers which watershed areas are less than 100 km².

1.8. Budgets of 2010, 2011, and 2012

The BBWS Pompengan-Jeneberang receivesits budget from the Budget Implementation List (DIPA), andthe budget has continued to increase in the past three years. In fact, the 2012 Budget Implementation List increased more than twice that of the 2010 Budget Implementation List, as shown in Table 5 below.

Table 5: Budget Implementation List (DIPA) of BBWS Pompengan-Jeneberang

Type of Fund	FY 2010	FY 2011	FY 2012
Employee Expenditures	7,644,609	6,076,612	9,857,352
Goods Expenditures	30,843,435	51,968,502	66,964,894
Capital Expenditures	424,565,354	684,139,601	864,830,886
Total	**463,053,398**	**742,184,715**	**941,653,132**

1.9. Issues

a. Forest Damages, Forest Conversion, and Crop Conversion

Forest damages, forest conversion, and crop conversion occur mainly in upstream area, which is in Gowa Regency. The area functions as a conservation area as well as a water catchment area. Most of the agricultural lands in the area have been converted into horticultural lands. This brought negative impacts on environmental carrying capacity which leads to increased areas of critical lands, surface erosion and increased runoff.

In Jeneberang Watershed, there are critical lands extending to 219.74 km², spread over the areas of Takalar Regency, Gowa Regency, and the City of Makassar. Forest areas now extend to only 8,259 hectares or 13.3%, far below the normal limit of 47% as mandated by Law Number 41 of 1999 on Forestry.

At present, the Jeneberang Watershed is dominated by dry-land farming which covers an area of 29,334 hectares (47.52%). The area of underbrush is larger than forest area, which is 12,530 hectares (20.3%). This condition causes an increase on the rate of erosion that leads to the Bili-bili Dam.

b) Floods

Flooding in agricultural and residential areas is caused by the inability of river channels to accommodate riverwater discharge. Frequent flooding occurs in some rivers, namely the Maros River, Sinjai River, Bialo River, PappaRiver, Allo River, Tamanroya River, Calendu River, Pampang River and Tallo River.

Flood events data recorded between 2005 to 2009 showed 14 flood events with various inundation areas, inundation levels and inundation durations,as follows:

Figure 7: Floods in Moncongloe, Manggala and Biringkanaya sub-regencies, January 2012

- Inundation areas: 50 to 8,000 hectares;
- Inundation levels: 100 to 400 cm;
- Inundation duration: 3 hours to 2 days.

The records also showed that flooding also occurred in Mangottong, Kalamisu, Tangka, Bikeru, Balantieng, Teko, Kelara, Tarowang, Pokobulo, Tonra and Bontomanai watersheds. The floods also inundated plantation areas, fisheries, and infrastructures such as roads, bridges and canals, and also caused some casualties.

c. Erosion and Sedimentation

The increase in erosion and sedimentation has led to siltation and decreased water storage capacity, especially in Maros Watershed, Pappa Watershed, and Tamanroya Watershed.

In Jeneberang Watershed, the erosion and sedimentation that occurred were extraordinary due to the collapse of Mount Bawakaraeng's caldera or crater wall. Due to the collapse of the caldera, until March 26, 2004, it was estimated that as many as 250 to 300 million m³ of materials slid into the Jeneberang Watershed.

A survey conducted in 2008 shows that there are still materials in a volume of 145 million m³ which are in an unstable condition and have the potential to cause a collapse, as follows:

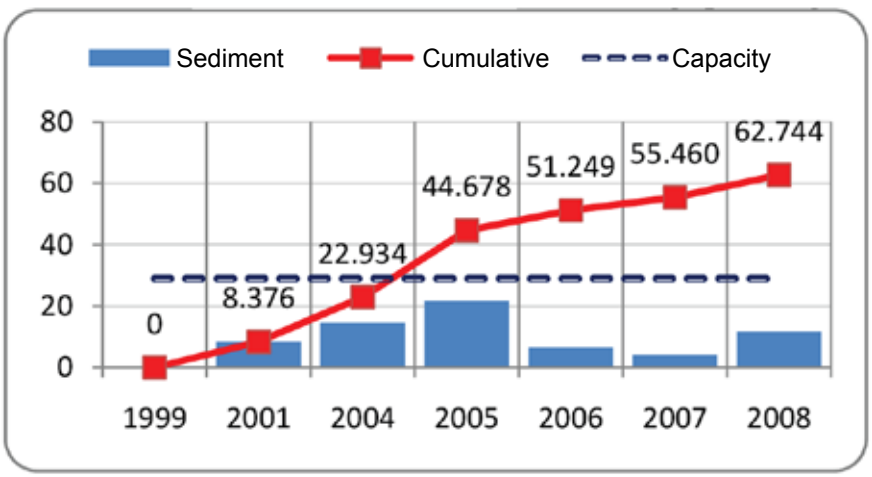
- North Caldera : 12,906,500 m³
- East Caldera : 111,073,000 m³
- South Caldera : 21,088,500 m³
- Total : 145,068,000 m³

Such phenomenon has caused disasters in residential areas, fields, estates, and 1,500 hectares of agricultural lands and infrastructures including school buildings in the downstream area. As many as 32 persons died due to being buried by the slide and no less than 6,333 people were evacuated from their homes.

This longsoran slide has changed the river body that was filled with deposits and also caused sedimentation in Bili-bili Reservoir. Results of the BBWS Pompengan-Jeneberang survey show that sedimentation in Bili-bili Reservoir amounted to 22,934 million m³, in which 14,558 m³ of the total amount occurred in 2004 after the Bawakaraenglongsoran.

Meanwhile, the sediment storage (dead-storage) volume of the Bili-bili Reservoir is only 29 million m³, as shown in Table 6 below.

Table 6: Sedimentation Rates of Bili-bili Reservoir (x million m³)



Source: BBWS Pompengan-Jeneberang

The cumulative amount of the sediments that entered into the reservoir until 2008 will reach more than 62 million m³. Therefore, it will certainly lead to tremendous losses and multiplier effects that could even reach the dam's lower area if no quick and appropriate measure is taken to overcome the problem. The Bili-bili Dam itself is located only 35 kilometers away from the caldera wall.

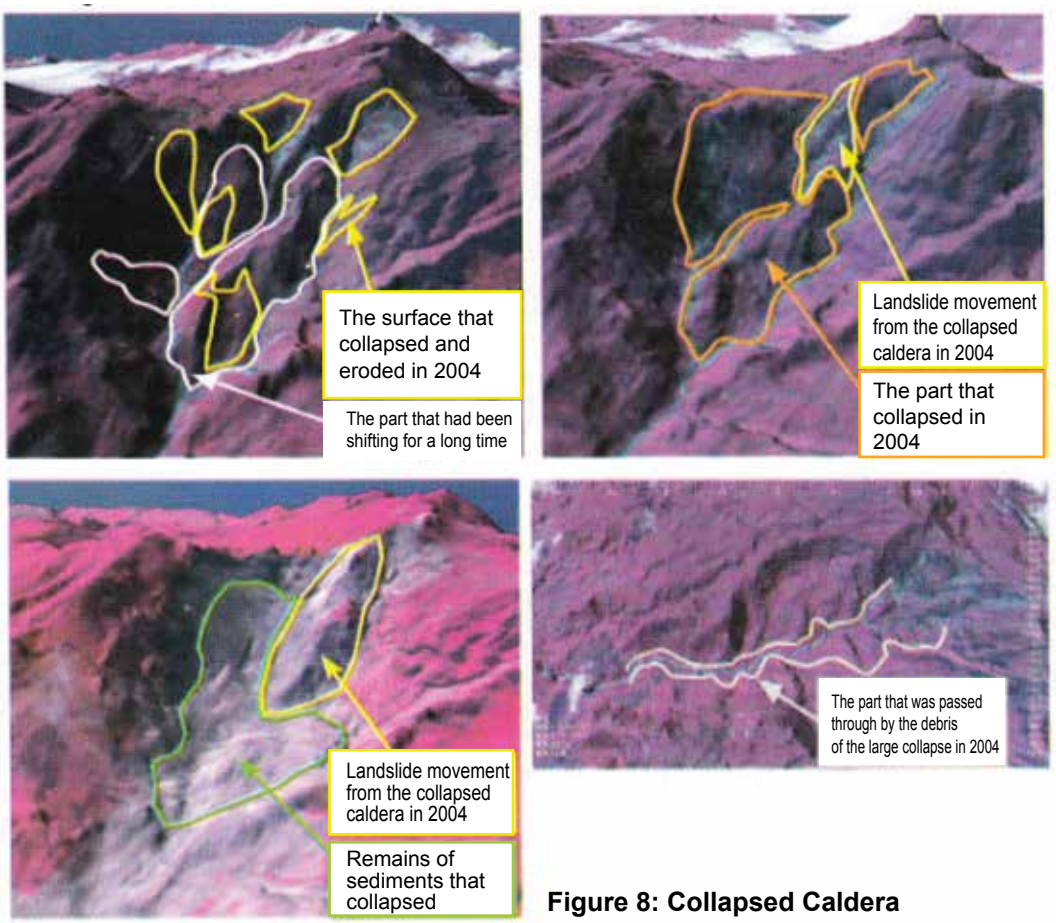


Figure 8: Collapsed Caldera

d. Seawater Intrusion and Coastal Abrasion

Seawater intrusion occurs in the estuary of Jeneberang River, while coastal abrasion occurred in seven regencies and one city, namely Makassar. Overall, the coastal length that experienced abrasion was 122.89 kilometers as shown in the Table 7 below.

Table 7: Coastal Abrasion in Jeneberang River Basin

No	Regency	Name of Beach	Critical Coastal Length (Km)
1	Takalar	Galesong, Cikoang, Parappa, Papo, Saro, Mangesu, Beru, Tamasaju, MuaraJeneberang, Mangindara, Takalar, Topejawa, Boddia, Mandi	28.16
2	Bantaeng	Cabodo, Tappanjeng, Borongkalukua, Maricaya, Tompong, Lembang, Lamalaka, Ujung Labbu, Pasoronggi, Mattoanging, Rappoa, TonroKassi, Gallea, Lambocca, Makkaninong	12.58
3	Bulukumba	Ela-Ela, Merpati, Tanaberu, Bintorere, Menara, Lappa'E, PasarCikkeng	11.84
4	Sinjai	Sinjai Beach	3.58

5	Selayar Islands	Bonea, Joo Village, Turungan Hamlet, Benteng Municipality, Bonelohe Village, Maharayya Hamlet, Barugaiya, Parak Hamlet, Appabatu, Baruyya, Bua-Bua, Padang Hamlet, Tongke-Tongke Hamlet	33.89
6	Jeneponto	Batule'leng, Ujung, Binamu, Arongkeke, Pattontongan, Bahari, Tino	22.01
7	Maros	Maros Beach	5.27
8	Kota Makassar	TanjungBunga Beach	5.55
Total			**122.89**

2. WATER RESOURCES MANAGEMENT

2.1. Water Resources Conservation

The water resources conservation aspect of the water resources management in Jeneberang River Basin is broken down into the following sub-aspects:

- Sub-aspect of water resources protection and conservation
- Sub-aspect of water preservation
- Sub-aspect of water quality and water pollution control

Efforts of conservation are carried out through several activities as follows:

a) Maintaining the continuity of water infiltration and water catchment area functions,
b) Controlling the utilization of water sources,
c) Recharging water in water sources,
d) Managing sanitation infrastructures and facilities,
e) Protecting water resources in relation to development activities and land utilization in areas around water sources,
f) Controlling land cultivation in the upstream area,
g) Managing the riparian area of water sources,
h) Rehabilitating forests and lands, and
i) Preserving protected forests, nature reserves and conservation areas

2.2. Water Resources Utilization

The water resources utilization aspect of the water resources management in Jeneberang River Basin is broken down into the following sub-aspects:

- Sub-aspect of water resources administration
- Sub-aspect of water resources provision
- Sub-aspect of water resources use
- Sub-aspect of water resources development
- Sub-aspect of water resources exploitation

Figure 9: Bili-bili Dam

Most of the utilization of water resource potentials in BBWS Pompengan-Jeneberang is for meeting irrigation requirements, which is 82% to 96% of the total requirements as shown in the Table 8 below. Overall, the average irrigation water requirements amount to 91.18% of the total water requirements.

Table 8: Irrigation Water Requirements and Total Water Requirements

No	River Basin	Irrigation Area (Ha)	Water Requirements in 2002		% Irrigation
			Irrigation	Total	
1	Kaluku – Karama River Basin	16,350	437.50	482.60	90.65%
2	Pompengan - Larona River Basin	34,271	749.70	814.40	92.06%
3	Saddang River Basin	93,724	2,397.20	2,522.00	95.05%
4	Walanae - Cenranae River Basin	95,904	2,739.10	2,862.70	95.68%
5	Jeneberang River Basin	99,245	2,538.70	3,079.20	82.45%
Total, Average		**339,494**	**8,862.20**	**9,760.90**	**91.18%**

The water requirements are fulfilled by a variety of water sources, such as lakes, artificial lakes (situ), traditional reservoirs (embung) and primarily by the reservoirs that have been built, as shown in Table 9 below.

Table 9: Dams

No	Dam	Regency	Height (M)	Storage Capacity (x 1,000 M³)
1	Bakaru	Pinrang	15	5,800
2	Balabono	Soroako	99	32,000
3	Bili-Bili	Gowa	34	375,000
4	Kalola	Enrekang	34	70,000
5	Saomekko	Bone	30	8,200
6	Larona	Luwu	30	600
7	Ponre-Ponre	Bone	55	48,700
8	Karaloe	Jeneponto	73	32,000

2.3. Control of Water Destructive Power

The control of water destructive power aspect of the water resources management in Jeneberang River Basin is broken down into the following sub-aspects:

- Sub-aspect of water's damaging ability prevention
- Sub-aspect of water's damaging ability management
- Sub-aspect of water's damaging ability recovery

a) Flood management

Based on the results of the analysis on flood discharge with 5-year recurrence interval, the watersheds that need to be prioritized in terms of flood control are those watersheds with flood discharge greater than 100 m³/sec. There are 7 of these watersheds, namely Jeneberang, Maros, Bua, Pappa, Tallo, Tangka and Taman Roya.

Flood control consists of both direct and indirect efforts. Direct control is carried out by utilizing irrigation infrastructures, such as embankment construction, river normalization and multipurpose dam construction.

Indirect control is more emphasized on risk management, in addition to critical land rehabilitation in upstream area by means of planting trees.

b) Erosion and sedimentation management

Erosion and sedimentation management is prioritized on controlling the landslide materials of Mount Bawakaraeng and preventing sedimentation in downstream area, especially the Bili-bili Reservoir. Materials from the landslide are estimated to amount to 250-300 million m³. It is estimated that until 2008, as much as 140 million m³ have flown and settled along the Jeneberang River and the surrounding area, and as much as 90 million m³ are still deposited in the upstream area near the caldera. There are still materials in a volume of 145 million m³ that are in an unstable condition and have the potential to cause a collapse.

In order to overcome the problem, a sediment control planning model has been prepared as shown in the following Figure 8 and Figure 9.

Figure 10: Sediment Control Model of Mount Bawakaraeng

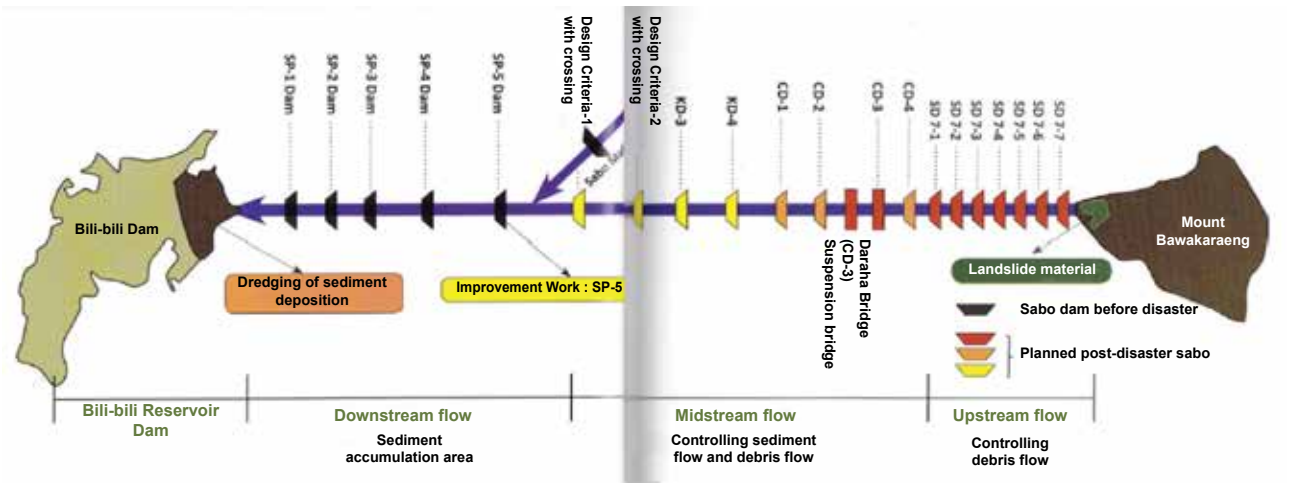


Figure 11: Sediment Control Scheme of Mount Bawakaraeng

- Upstream Management

  The upstream has a very steep slope. At the time ofrain, there is torrential flow and materials glideat a high speed, therefore the damaging ability is very high. A series of seven sabodams (SD) were built to slow down the flow.The existence of sabodam will cause a deposition of material on the upper reaches ofthe construction, and this will lead to a gentle slope of the flow, reduced flow speed, and also reduced damaging ability. These deposits will also stabilize the cliffs of the river channel.

The sabo dams were designed to directly control materials amounting to 1.3 million m³, and indirectly control an amount of 28.2 million m³. Overall, they can control materials amounting to 29.5 million m³.

The constructions of these sabo dams were started by the construction of SD 7-1 in 2005 and the last one constructed was the SD 7-7 in 2011. In addition, as many as 50,000 trees have also been planted on an area of 45 hectares in the upstream to rehabilitate damaged lands.

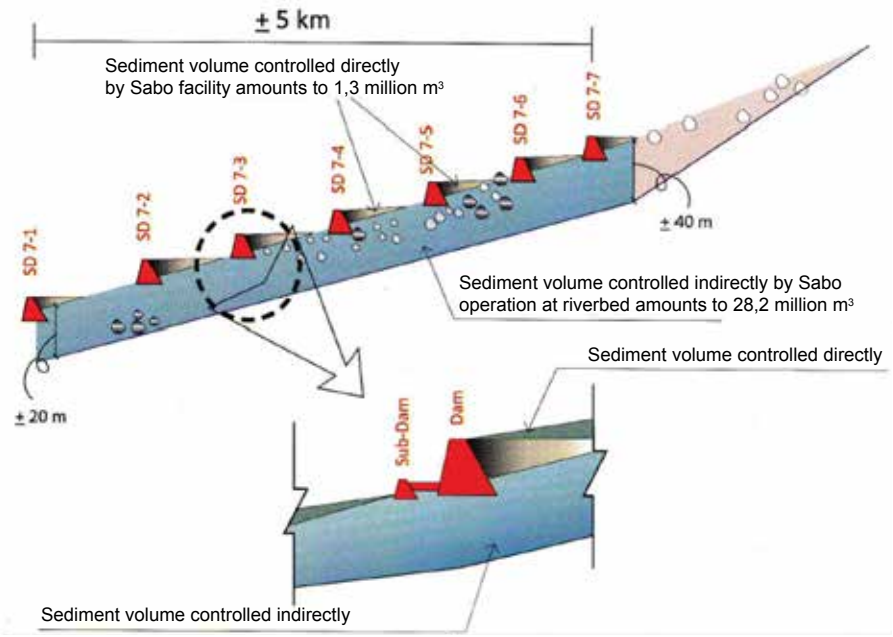


Figure 12: Direct and Indirect Sediment Control

Figure 13: Sabo Dam 7-1 and 7-2
Source: Hazama Co.

Figure 14: Sabo Dam 7-5 and 7-7
Source: Hazama Co.

- Midstream Management

The slope at the midstream is still relatively steep, and therefore the flow speed and the damaging ability are still quite high. In this part, 8 consolidation dams (CD or KD) have been built. The main function is to control vertical and horizontal material flows (debris flow, lahar flow) in order to prevent damages and flow deviation.

The consolidation dams were designed to directly control materials amounting to 1.56 million m³, and indirectly control an amount of 48.43 million m³. Overall, they can control materials amounting to 49.99 million m³.

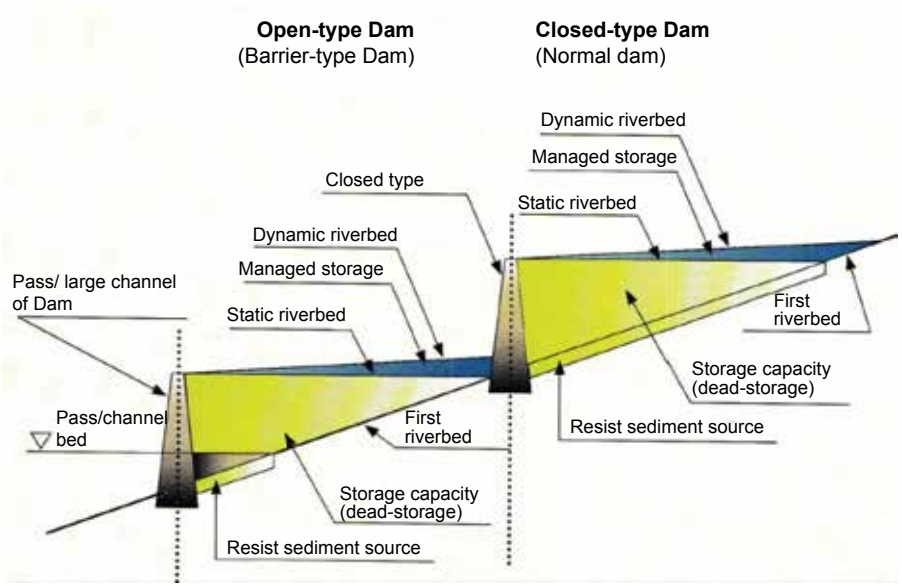


Figure 15: Consolidation Dam
Source: T. Watanabe, 2009

The constructions of the consolidation dams were started in 2007. In addition, 5 units of clean water treatment facilities, 2 crossing roads (in KD-1 and KD-2), as well as 2 suspension bridges (in CD-2 and CD-3), were also built for the local community.

Figure 16: KD-1 and KD-2 that also function as bridges
Photo by SlametWidayadi

Figure 17: CD-2 and CD-3 equipped with bridges
Photo by Hazama Co & YEC

- Downstream Management

Figure 18: SP-5 before Mount Bawakaraeng landslide
Source: BBWS Pompengan-Jeneberang

Figure 19: SP-5 after Mount Bawakaraeng landslide
Source: BBWS Pompengan-Jeneberang

The slope at the downstream is relatively not too steep. The flow from the upstream, which slope is steeper, will suddenly lose its speed when it enters the downstream part, and it then will release the sediments that it carries, which then causes a deposition. This deposition can spread in many directions if it is not controlled. The area of this deposition is known as an alluvial fan.

Before the landslide of Mount Bawakaraeng, 5 sand pockets (SP) had been built in this part from 1997 to 2001 by the Bili-bili Dam Project. After the landslide, these sand pockets were damaged and the material deposition exceeded the sand pockets' carrying capacities.

Due to this, the BBWS Pompengan-Jeneberang rehabilitated the structures and enlarged their capacities. Mining facilities for sand and other materials were also built to release the materials out of the sand pockets which can then be utilized as construction materials. These five sand pockets have an overall carrying capacity of 1,081,000 m^3.

The sediment flow control infrastructures are also equipped with an early warning system as well as a flood and landslide monitoring station in Lengkete Village. In Gowa Regency, clean water infrastructures have been built for the people of Tamalate Village, Parangloe Sub-regency, as shown in the following figure.

Figure 20: Flood and Landslide Monitoring Station in Lengkese Village and Clean Water Infrastructure for the Residents of Tamalate Village, Gowa
Source: YEC

Overall, the distribution of sediments as part of the Mount Bawakaraeng landslide control can be described in the following figure.

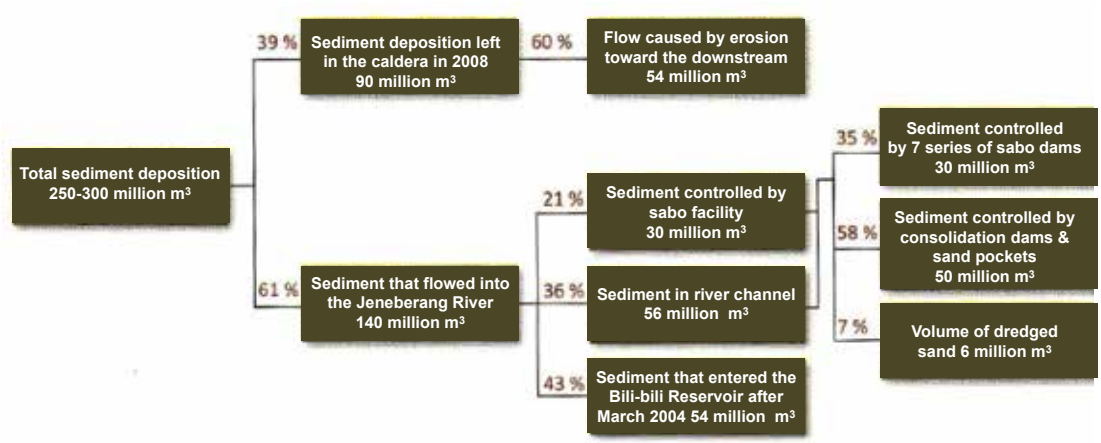


Figure 21: Distribution of Sediments Caused By Mount Bawakaraeng Landslide

c) Seawater intrusion and coastal abrasion control

To prevent seawater intrusion, in 1997, a rubber weir was constructed at a location of 4 km upstream from the estuary. This rubber weir is 210 meters in length and 2.10 meters in height.

In addition, the construction of a reservoir in the estuary of Jeneberang River (long-storage) had also been completed in 2001. Aside from controlling seawater intrusion into the river, the reservoir is also utilized as raw water supply and for drainage channel flushing in the dry season. This reservoir has a length od 4 kilometers, width of 200-300 meters and storage volume of 1,100,000 m³.

Efforts to manage coastal abrasion are carried out in structural as well as non-structural manners. Non-structural effort is done by replanting mangrove trees, while structural effort is done by building coastal cliff protection and reinforcement structures, including:

- Wave breakers,
- Sea walls,
- Gabions, cribs

2.4. Water Resources Information System

The activities carried out in the preparation of water resources information system are:

- Coordinating with BBWS Pompengan-Jeneberang, Watershed Management Office (BPDAS), Water Resources Management Office of South Sulawesi Province, and other relevant offices that are required to follow the norms, standards, guidelines and manuals of information system management.

- Updating data and information periodically as part of the effort to maintain the accuracy of water resources data and information.

- Accessing specific water resources information.

- Coordinating with legal entities, organizations, institutions, and individuals that carry out water resources information management activities.

Figure 22: Socialization and Workshop on Water Resources Information System

As the providers of water resources information, the Regional Government and BBWS Pompengan-Jeneberangare obligated to maintain the accuracy, validity and timeliness of the data and information. With many problems that exist, it is necessary to manage the data and information related to the water resources in thier work areas in an integrated manner.

Various activities of socialization and workshops have been implemented to introduce the website of BBWS Pompengan-Jeneberang managed by the Water Resources Information System (SISDA) Unit to the public and increase the human resources' competency in conducting a fast, precise and accurate water resources data and information management, as well as to realize the availability of easily accessible water resources data and information.

2.5. Community Empowerment and Participation

Agencies related to water resources management at provincial and regency/municipal levels in the work area of BBWS Pompengan-Jeneberang also have to function as data and information providers for the technical implementation unit of national data and information management, which also selects, stores, delivers and distributes the data and information compiled from the water resources managers in BBWS Pompengan-Jeneberang.

Community empowerment, monitoring and involvement in water resources management are generally carried out through the forum of Water Resources Management Coordination Team (TKPSDA) of river basins that have been established, namely:

1) TKPSDA of Pompengan-Lorena River Basin, number of members: 36 people
2) TKPSDA of Saddang River Basin, number of members: 42 people
3) TKPSDA of Walanae-Cenranae River Basin, number of members: 22 people
4) TKPSDA of Jeneberang River Basin, number of members: 32 people
5) TKPSDA of Kaluku-Karama River Basin, number of members: ... people

Other activities that involve the community are land reforestation and rehabilitation carried out through the forum of the National Movement for Water Safeguard Partnership (GN-KPA). These activities are carried out in watersheds with critical lands, such as in Jeneberang Watershed, Tamangroya Sub-watershed in Gowa Regency. These activities are carried out on a regular basis and are coordinated by the work groups established in many places.

Figure 23: GN-KPA Work Group Secretariat

3. WATER RESOURCES MANAGEMENT IN THE FUTURE

3.1. Comprehensive Management

The work area of BBWS Pompengan-Jeneberang, especially the Jeneberang River Basin, has a high potential for agricultural development, and this makes the fulfillment of irrigation water requirements as the main priority. The agricultural commodities that are highly important are food crops. Agricultural development is directed toward food sustainability by focusing on increasing the national production capacity for strategic food commodities, namely rice, corns, cassava, sweet potatoes, peanuts, mung beansandsoybeans.

The Mamminasata Region is a National Strategic Region. This region will become a megapolitan area in East Indonesia with rapidly growing industries, and this will certainly accompanied by an increase in household, urban, and industrial water requirements. Efforts to meet the clean water requirement for households, urban areas, and industries are planned to carry out by constructing Bontosunggu Dam, Jenelata Dam, and increasing the capacity of SombaOpu Water Treatment Installation in order to guarantee the availability of raw water amounting to 4.7 m^3/sec.

Selayar Islands and Jeneponto Islands are areas with low levels of water fulfullment, and therefore require optimal water resources management. The construction of Kelara, Bontojaya, and Posi dams is expected to help fulfill the raw water requirement for clean water in an amount of 3 m^3/sec.

Furthermore, the management of natural lakes and artificial lakes needs to be optimized for their preservation, utilization and exploitation. In the work area of BBWS Pompengan-Jeneberang, there are at least 57 natural lakes and 30 artificial lakes with potentials for development.

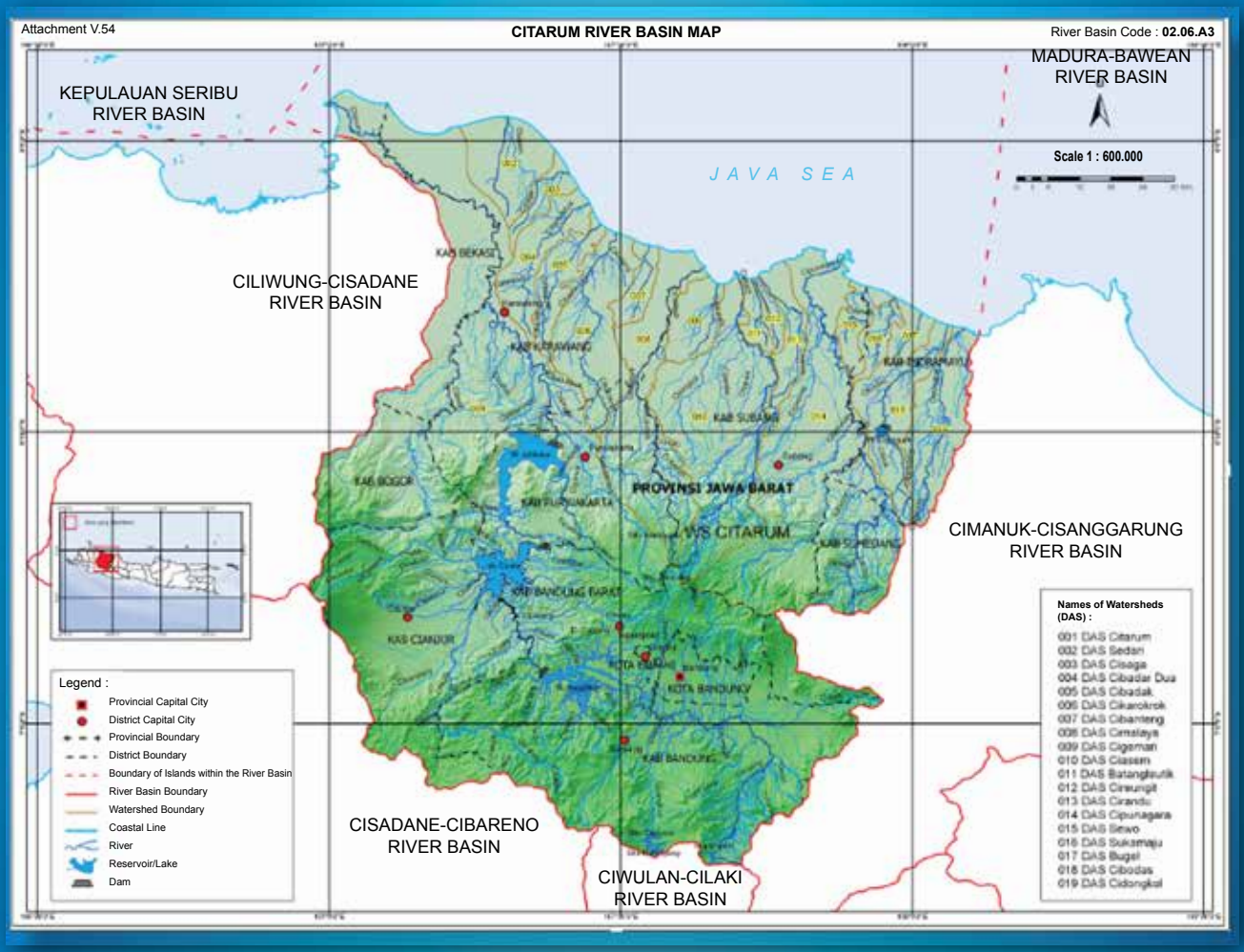
3.2. Implementation Strategy

As has been described in the previous chapter, the work area of BBWS Pompengan-Jeneberang covers 3 provinces, 18 regencies, 3 municipalities, and 3 cross-provincial river basins as well as 2 national strategic river basins, with a total area of more than 60 thousand km^2.

The river basins management, starting from the preparation of the models and plans (carried out by the TKPSDA in the concerned five river basins) as well as the preparation of their programs, activities and implementations, require various coordination, consultations, socializations, etc., which must involve all stakeholders in all work areas. Meanwhile, with the limitation of the National

Budget (although the Budget Implementation Lists in the past three years have continued to increase), it is necessary to determine the priorities in the programs and activities that are to be implemented, by taking into account the effectiveness and efficiency factors, in addition to social consideration, equality, etc.. Of course, the priorities have to remain within the frameworks of the National Long-Term Development Plan (RPJPN), National Medium-Term Development Plan (RPJMN), Strategic Plan (Renstra), Regional Long-Term Development Plan (RPJPD), Regional Medium-Term Development Plan (RPJMD) and the Regional Government Work Plan (RKPD).

A7. LARGE RIVER BASIN ORGANIZATION OF CITARUM



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1. DESCRIPTION OF ORGANIZATION

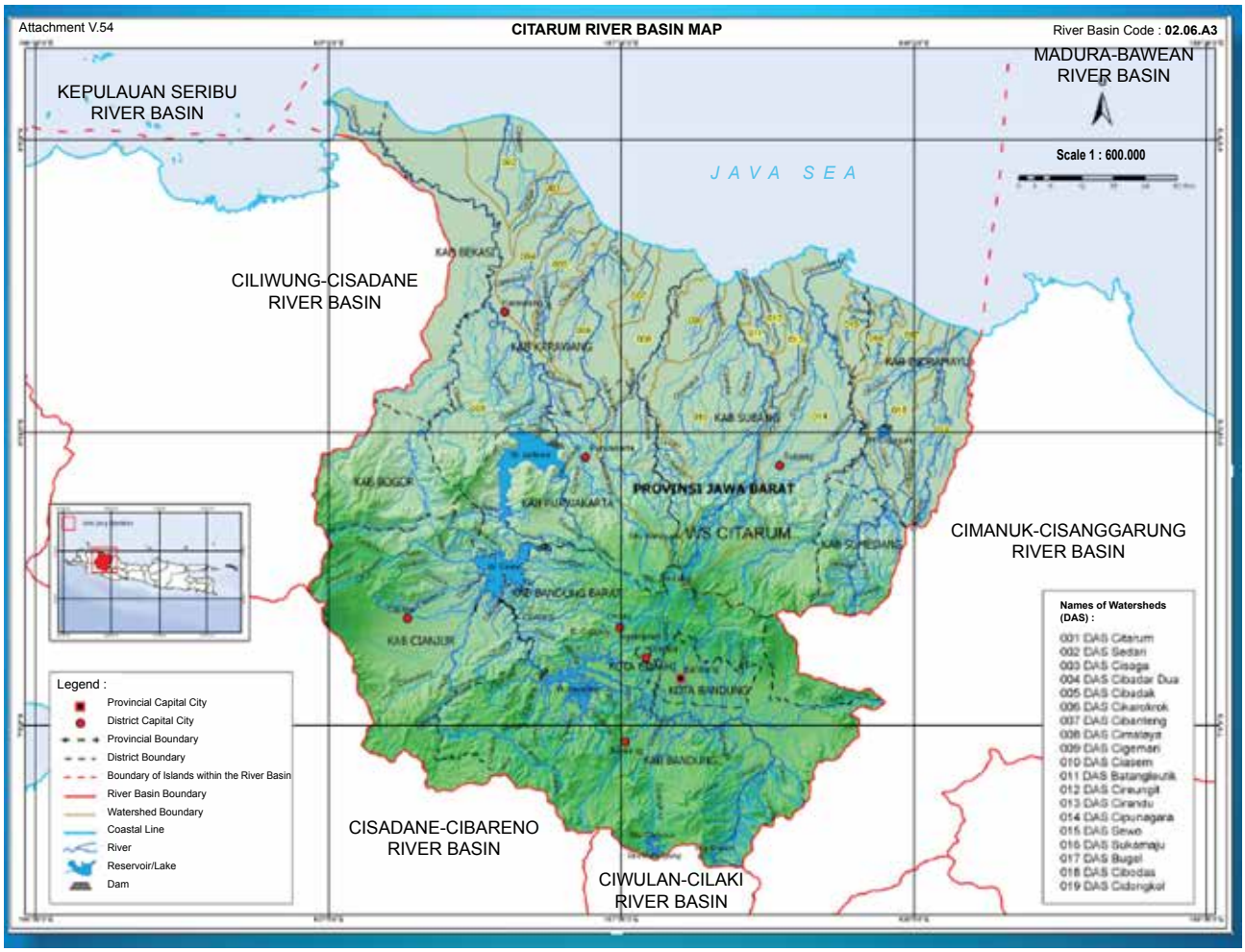


Figure 1: Citarum River Basin

1.1. General Information

Name	:	Balai Besar Wilayah Sungai Citarum
Address	:	Jl. InspeksiCidurianSTA 5600, SoekarnoHatta
Municipality	:	Bandung, 40292
Telephone	:	(022) 7564073
Facsimile	:	(022) 750760
Website	:	
E-mail	:	
Legal Basis	:	Regulation of Minister of Public Works Number 21/ PRT/M/2010 dated December 31, 2010
Work Area	:	Citarum River Basin
River Basin Code	:	02.10.A3
River Basin Classification	:	National Strategic River Basin

1.2. Brief History

1957	:	NationalJatiluhur Multipurpose Project
1965	:	KOPAIRJAT (KomandoProyekPengairanJatiluhur) / Jatiluhur Irrigation Project Command
1967	:	Perusahaan Negara Jatiluhur / State Company of Jatiluhur

1970 : PERUM OTORITA Jatiluhur (POJ), which included PROSIJAT (Jatiluhur Irrigation Project) as the replacement of KOPAIRJAT

1985 : Separation of PERUM OTORITA Jatiluhur and PROSIJAT

1987 : PROSIJAT changed name into BP PSJ (Badan Pelaksana Proyek Serbaguna Jatiluhur) or the Executive Agency forJatiluhur Multipurpose Project. At the time, the organization already had Echelon III-A officials (Decree of Minister for the Supervision of the State Apparatus) and they were proposed to be promoted to Echelon II-B officials.

1994 : Establishment of Master Project for Citarum River Basin Management, which consisted of the Jatiluhur Multipurpose Project and the Upper Citarum River Improvement and Management Project, consisting of:

1. Citarum Water Sources Management and Flood Control Project
2. Citarum Water Sources Development and Conservation Project
3. Citarum Raw Water Project
4. Citarum Irrigation Project

1999 : POJ was changed into PerumJasaTirta II (PJT II)

2005 : Master Project for Citarum River Basin Management changed name into Master Implementer for Citarum River Basin Management Operations

2007 : Balai Besar Wilayah Sungai Citarum (Large River Basin Organization of Citarum)

1.3. Organizational Structure and Human Resources

The organizational structure of the Balai Besar Wilayah Sungai (BBWS) Citarum was established based on the Regulation of Minister of Public Works Number 11A/PRT/M/2006. The organization is categorized as a type-A large river basin organization which is led by the Head of Organization, assisted by the Head of Administration Department and 3 (three) Heads of Divisions.

The Head of Administration Department is assisted by 3 (three) Heads of Sub-departments, while the Heads of Divisions are assisted by 2 (two) Heads of Sections.

In their operations, they are assisted by 2 (two) heads of workunits, namely the Head of BBWS Citarum Work Unit and the Head of Citarum Non-Vertical Work Unit for Particular Purpose (SNVT).

The Heads of Work Units are assisted by several Contract Executive Officers.

In total, there are 329 employees, consisting of 293 civil servants (156 people with technical educational background and 137 with non-technical educational background) and 36 non-civil servants, with details as shown in the following Table 1:

Table 1: Number of Employees in BBWS Citarum

No	EDUCATIONAL LEVEL	TOTAL
1	S III (Doctoral Degree)	1
2	S II (Master's Degree)	20
3	S I (Bachelor's Degree)	54
4	D III (3-year Associate Degree)	31
5	D I (1-year Associate Degree)	-
6	Senior High School/Equivalent	156
7	Junior High School /Equivalent	12
8	Elementary School	19
Total		**293**

1.4. General Condition of Work Area

Citarum River Basin is the largest river basin in the West Java Province. Geographically it is located at 106° 51' 36" East Longitude to 107° 51' 00" East Longitude and 7° 19' South Latitude to 6° 24' South Latitude. The river basin covers a total area of 12,000 km², consisting of 13 regency/municipal administrative regions, namely the City of Bandung, City of Cimahi, Bandung Regency, West Bandung Regency, Cianjur Regency, Karawang Regency, Bekasi Regency, Bogor Regency, Sumedang Regency, Purwakarta Regency, Subang Regency, Sukabumi Regency and Indramayu Regency.

According to the Central Bureau of Statistics/Statistics Indonesia (2009), the population in the Citarum River Basin amounts to 15,303,758 persons, with 10 million of them residing in areas along rivers. The number of population that require the services of the Citarum River is approximately 25 million people, including the 10 million people of Jakarta.

The majority of the population resides in the area called the Bandung Basin, which is the area with the highest level of urbanization. The ideal population for this area is between 3 to 4 million people, but the population grows rapidly in this area as shown by the following prediction:

- 2000: 6,178,955 people
- 2005: 6,923,900 people
- 2009: 7,073,527 people
- 2010: 7,867,006 people
- 2015: 9,107,259 people
- 2020: 10,190,304 people
- 2025: 11,382,200 people

Based on the prediction, a new economic region needs to be opened outside the Bandung Basin.

Forest cover is only 26,544ha (11,5%). The erosion rate in the Upper Citarum Watershed is in a very bad condition with an average value of 491 tons/ha/year.

1.5. General Condition of Work Area

Records on rainfall data from 1950 to 1984 obtained from 10 rain gauge stations located in Citarum Watershed show that the average annual rainfall (arithmetic mean) is 2,478 mm. The majority, which is 68% or 1,679 mm, occurs during the rainy season, and the remaining 32% occur in the dry season. Historically, August is the month with the lowest rainfall, which is 90 mm.

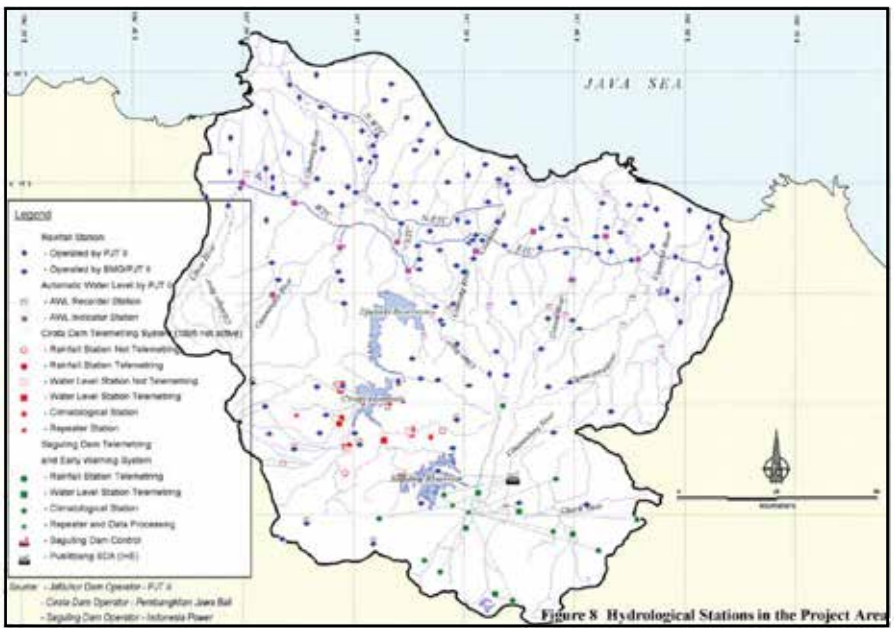


Figure 8 Hydrological Stations in the Project Area

Figure 2: Hydrological Stations

There are many hydrological stations in the Citarum River Basin, including those managed by the managers of dams in this river as shown in Figure 2 above. Some of the stations still have to be operated manually and others are already connected to the telemetering system and data processing, whether for dam operation and maintenance as well as for flood early warning system, such as shown in Table 3 below.

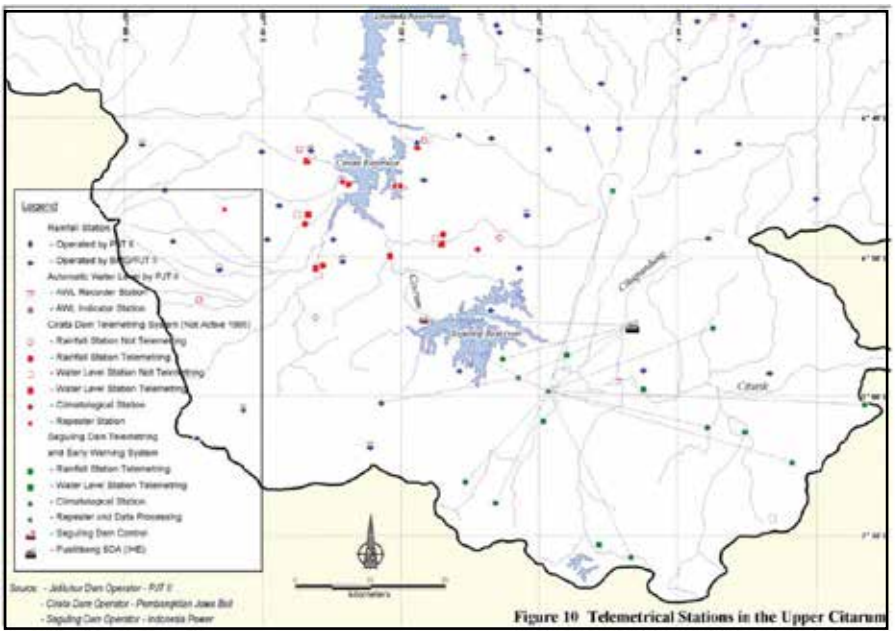


Figure 3: Telemetry Stations in Upper Citarum Watershed

1.6. Watersheds and Rivers

BBWS Citarum stated that it has 13 main Sub-watersheds (or watersheds), while Presidential Decree Number 12 of 2012 has decided that there are 19 watersheds in the Citarum River Basin, as shown in the Table 2 below.

Furthermore, BBWS Citarum stated that it has 21 tributaries, while records show that there are 187 tributaries ranging to the second order.

During the period of 1951 to 1998, the Citarum river discharge in Nanjung Station had experienced drastic changes, which was the increased maximum discharge from 217.6 m^3/sec to 285.8 m^3/sec, while the minimum discharge declined from 6.35 m^3/sec to 5.70 m^3/sec.

Table 2: Watersheds and Sub-watersheds in Citarum River Basin

No	Watershed
001	Citarum Watershed
002	Sedari Watershed
003	Cisaga Watershed
004	Cibadar Dua Watershed
005	Cibadak Watershed
006	Cikarokrok Watershed
007	Cibanteng Watershed
008	Cimalaya Watershed
009	Cigemari Watershed
010	Ciasem Watershed

No	Sub-watershed	Area of Watershed (Km^2)	River Length (Km)
1	Cimahi	32.61	8.22
2	Cibeureum	60.71	11.36
3	Ciwidey	228.36	20.99
4	Cibolerang	60.85	4.99
5	Citepus	36.52	10.98
6	Cisangkuy	280.95	18.80
7	Cigede	145.40	15.42
8	Cicadas	29.71	8.91
9	Cidurian	33.95	8.45
10	Cipamongkolan	42.23	13.79

011	Batangleutik Watershed	11	Cikeruh	190.33	13.78
012	Cireungit Watershed	12	Citarik	257.49	11.50
013	Cirandu Watershed	13	CitarumHulu	363.44	43.85
014	Cipunegara Watershed				
015	Sewo Watershed				
016	Sukamaju Watershed				
017	Bugel Watershed				
018	Cibodas Watershed				
019	Cidongkol Watershed				

According to Untung Haryanto, based on the Catalogue of Rivers, 1995, 1997, 2000, 2002; the results of recording in the Nanjung Station showed a maximum discharge of 455 m³/sec, and a minimum discharge of 5,4 m³/sec.

These changes were obviously due to the increasingly damaged hydrological condition of the watersheds.

1.7. Issues

a) Critical Lands

Figure 4: Very Critical Land

The Decree of Minister of Forestry Number SK.328/Menhut-II/2009 regarding the Establishment of Priority Watersheds as Part of the Medium-Term Development Plan of 2010-2014 has established the Citarum Watershed as one of the 108 critical watersheds.

There are at least 26,437 hectares of land which conditions are categorized as very critical, as shown in Table 3 below. This condition leads to runoff amounting to 3.6 million m³/year.

Table 3: Categories and Areas of Critical Lands

No	Land Category	Area (Ha)	Percentage (%)
1	Very Critical	26,437	1.36
2	Critical	115,988	7.64
3	Rather Critical	273,880	21.69
4	Potentially Critical	468,255	45.01
Total		**884,560**	**100.00**

Source: BP DAS Citarum-Ciliwung

The critical lands are generally found in the upper Citarum, especially in the Cirasea, Cisangkuy, Ciwidey, Ciminyak, Cihaur, Cikapundung and Citarik sub-watersheds, as seen in the following Figure. It can be seen that the sedimentation that occurs in those locations can reach 1,755,517 tons/year.

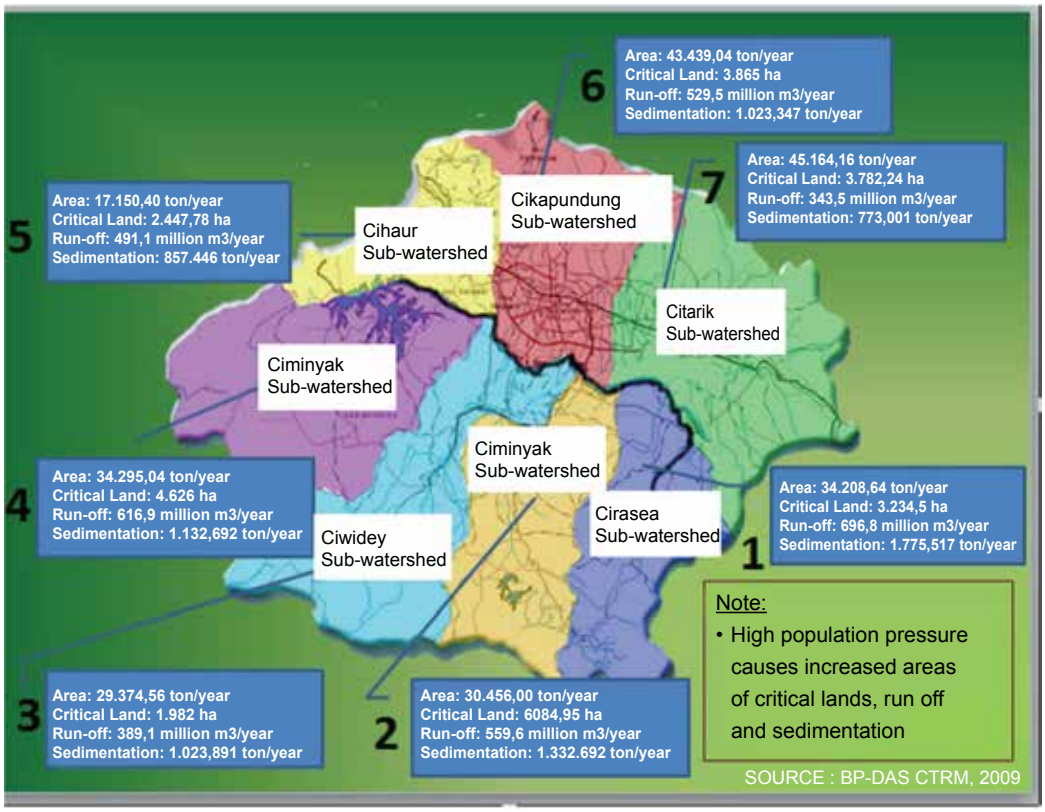


Figure 5: Critical Lands in Upper Citarum

Figure 6: Sedimentation in River Channel

The percentage of lands with heavy and very heavy erosions (>180 tons/ha/year) is 31,4% of the total area of Citarum River Basin. The erosions that occurred at the upper part of Citarum produced an average sedimentation of 8.20 million m³/year in Saguling Reservoir. In addition, the erosions also caused siltation and river channel narrowing as seen in Figure 6.

b) Floods and Droughts

Critical land condition is the main cause of erosion. Furthermore, erosion leads to sedimentation and this sedimentation leads to siltation and narrowing of river channels, irrigation canals, and also reservoirs. On the other hand, land damages have caused increased flow coefficient and in time, all these will give rise to floods and droughts.

Several major floods in Bandung and the surrounding area occurred in 1931, 1945, 1977, 1982, 1984, 1986, 1998, and 2005. The Citarum flooding occurred not only in the downstream but also in the midstream and the upstream.

Figure 7: Flooding in Upper Citarum

Flooding occurred in at least 7 regencies/municipalities, originating from the Citarum River and some of its tributaries, covering a total area of more than 18,460 ha, as seen in Table 4 below.

Table 4: Flood Inundation Areas

No	Regency/Municipality	River	Area of Inundation (Ha)
1	Bandung Regency/Municipality	Upper Citarum	7,500
2	Bekasi/Kerawang	Lower Citarum	1,000
3	Karawang/Subang	Cilamaya	2,400
4	Subang	Ciasem	900
5	Subang	Cipunegara	2,440
6	Subang	Cigadung	no available data
7	Indramayu	Cilalanang	4,000
8	Karawang/Indramayu	Pantai Utara (North Coast)	no available data
9	Purwakarta	Cikao	20

Meanwhile, areas that experience flooding in the rainy season also experience droughts in the dry season, as shown in the following Figure 8.

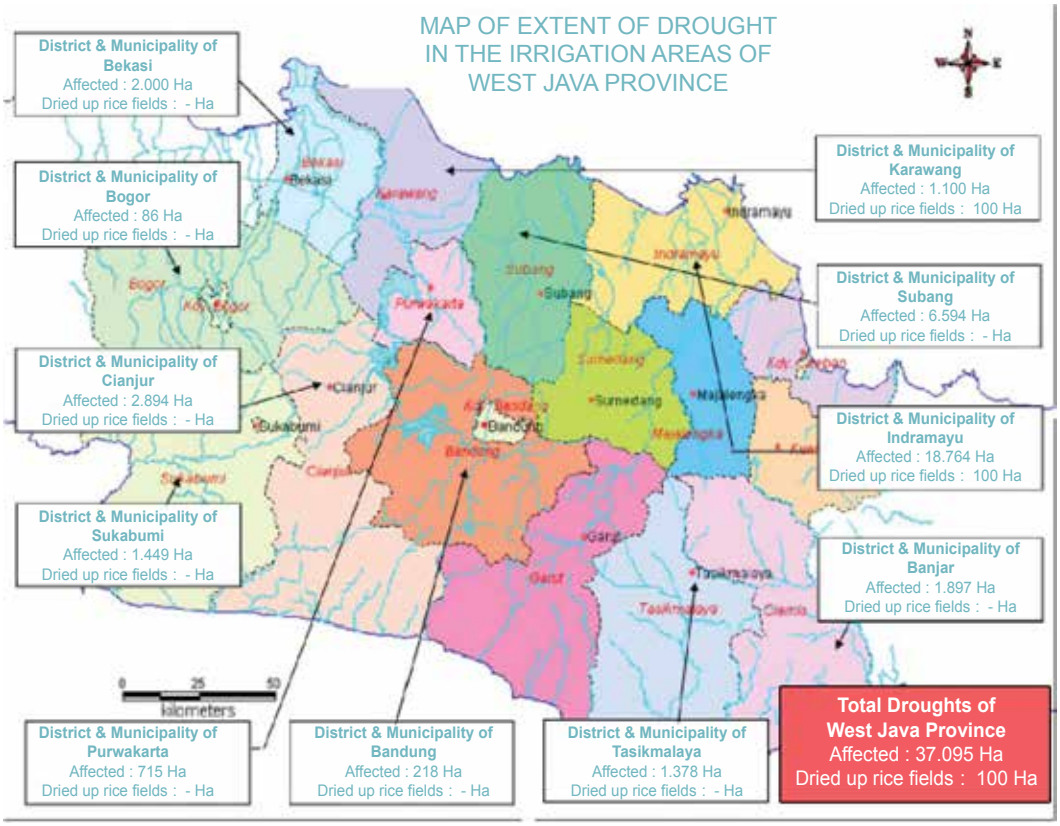


Figure 8: Drought Areas

c) Land Subsidence

Land subsidence in Bandung Basin reaches 4 to 5 cm per year. At present, groundwater abstraction is still under the ideal limit for groundwater abstraction, in which current abstraction is still 25%. However, for several locations in Bekasi-Karawang Groundwater Basin, Subang Groundwater Basin and Batujajar Groundwater Basin, groundwater abstraction has exceeded the ideal limit for groundwater abstraction. Although at the moment groundwater abstraction in the Bandung-Soreang Groundwater Basin is still under the ideal limit for groundwater abstraction (still at 27%), groundwater abstractions in several places such as in Majalaya, Ranca Ekek, Dayeuh Kolot, Leuwi Gajah etc., have exceeded the ideal limit for groundwater abstraction. In these areas, there have been serious decline in groundwater level and land subsidence. Groundwater abstraction through deep wells is frequently carried out in industrial areas, while inhabitants abstract water from shallow wells.

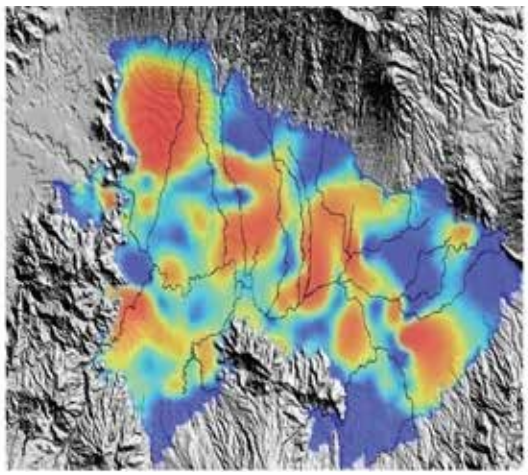


Figure 9: Land Subsidence in Bandung Basin

d) River Pollution

River pollution occurs due to the entering of domestic waste and industrial waste into the river channel, whether deliberately or carried by runoff during the rain. The garbage amounts to 500,000 m³/year. Those that are not accommodated will enter the drainage system and eventually enter the river.

Figure 10: Pollution by Garbage and Industrial Waste

The Citarum Watershed Forum in West Java released information stating that as many as 1.400 industries dispose their liquid waste into the Citarum River. From the thousands of these industries, there are waste of hazardous and toxic substances disposed during nighttime especially when it rains.

A research conducted in 2007 revealed that the status of Citarum's water quality is at the pollution index of D, which is heavily polluted. The Regional Environmental Management Agency (BPLHD) of West Java, in its studies that were carried out three times a year, found contents of nitrite (NO2), lead (Pb), chlorine (Cl), phosphate (PO4), zinc (Zn), boron (B), copper (Cu), and sulfate (SO4) that exceeded the threshold.

e) Settlement Development

At present, the population in the Bandung Basin has exceeded 7 million people, while the ideal number of population in the Bandung Basin is only 3 to 4 million people. The number is predicted to increase to 10,190,304 people in 2020. This condition has driven the people to exploit space, lands, and water resources which eventually will give rise to many new problems.

The following Figure 11 shows how extensive the pressure is that is caused by excessive population, leading to a density level that reaches more than 200 people per hectare.

It is necessary to open up new settlement and economic regions outside the Bandung Basin.

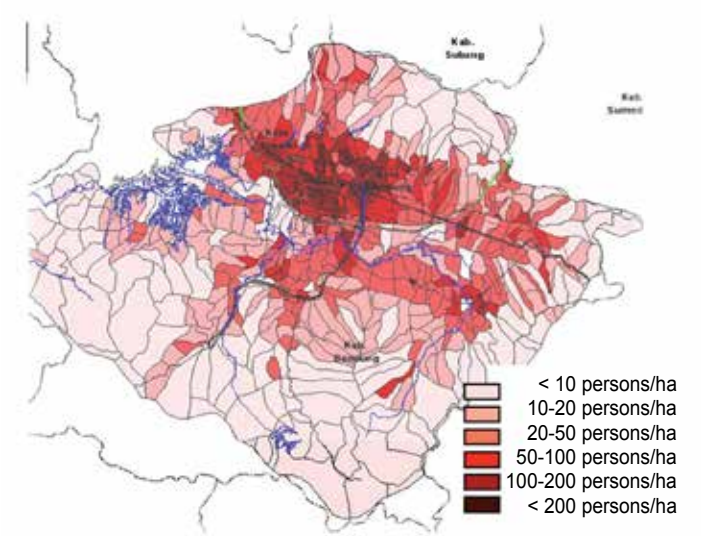


Figure 11: Population Pressure in Bandung Basin

f) Coastal Abrasion

Coastal abrasion in lower Citarum occurred both by nature and by community behavior. Ocean currents and waves are the causes of erosion and also sedimentation at beaches. Coastal sand mining carried out by some of the community and coastal land clearing which turned swamp areas and mangrove forests into fishpond areas exacerbated the coastal abrasion.

Areas that experience coastal erosion at an alarming rate include the Tirtajaya Regency, Cibuaya and Pedes Sub-regency in Karawang Regency, Pusakanagara Sub-regency, Pamanukan Sub-regency and Legokkulon Sub-regency (Subang), Sukra Sub-regency and Kandanghaur Sub-regency in Indramayu Regency.

E. Sri from BPNB categorizes the coastal damages and abrasion rates in Lower Citarum into three groups, namely Low, Moderate, and High, as seen in Figure 12 below.

Source : ESRI, BNPB

Figure 12: Coastal Abrasion Rates in the North Coast of Citarum Watershed

2. WATER RESOURCES MANAGEMENT

2.1. Water Resources Conservation

Water resources conservation is primarily carried out by rehabilitating critical lands according to the target and priority as shown in the following Table and Figure 13.

Source : ESRI, BNPB

Figure 13: Critical Land Rehabilitation Priorities

The types and numbers of structures as well as the target areas can be seen in the following Table 5.

Table 5: Land Conservation Structures

No	Civil Structure	Total	Land Category
1	Check Dam	907	RC, C, VC
2	Detention Dam	109	RC, C, VC
3	Infiltration Well	1.7	PC, RC
4	Gully Plug	219	C, VC
5	Ridge/Bench Terrace		RC, C, VC
6	Blind Ditch		C, VC

Note: RC = Rather Critical, C = Critical, VC = Very Critical, PC = Potentially Critical

Table 6: Targets of Critical Land Management

No	Regency	Target of Management		Total (Ha)
		Inside Forest Area	Outside Forest Area	
1	Bandung Regency	36,914	80,786	117,700
2	West Bandung Regency	40,486	79,438	119,924
3	Bekasi Regency	2,062	36,501	38,563
4	Cianjur Regency	30,018	91,873	121,891
5	Indramayu Regency	1,727	6,639	8,366
6	Karawang Regency	11,249	146,402	157,651
7	Bandung Municipality	33	2,274	2,307
8	Cimahi Municipality	-	606	606

9	Purwakarta Regency	14,270	59,912	74,182
10	Subang Regency	18,341	149,130	167,471
11	Sumedang Regency	9,319	27,866	37,185
	Total	**164,419**	**681,427**	**845,846**

The implementation of vegetative conservation in forest areas is carried out by the Centre for Natural Resources Conservation (BBKSDA), PT Perhutani, and the Regency/Municipal Offices of Forestry, while conservation outside forest areas is done by the Offices of Forestry together with the communities and supported by the private sector, such as by PT KTI and assisted by for instance, PT BUMN Hijau Lestari.

Figure 14: Check Dam Construction and Artificial Lake (situ) Rehabilitation

The implementation of mechanical conservation in river channels and tributaries is carried out by BBWS Citarum, and conservation outside river channels is carried out by the Offices of Forestry.

In addition, BBWS Citarum also conducts rehabilitation on several artificiallakes (situ), such as seen in Figure 14 above.

2.2. Water Resources Utilization

Until today, only 60% of Citarum's total water resource potentials have been utilized. The remaining 40% have not been utilized and are just wasted into the sea. The utilization is mostly for irrigation, which amounts to 84% and for drinking water requirement for Jakarta amounting to 6%, as shown in Figure 15 below.

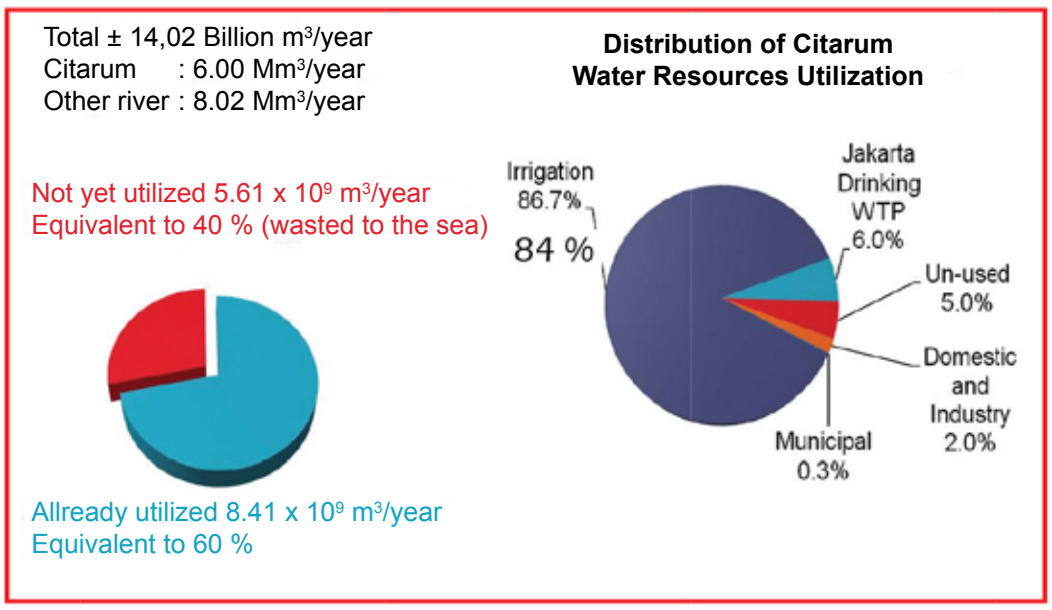


Figure 15: Water Resources Utilization

In order to increase the water resources utilization and also to anticipate the requirements in 2030, several efforts have been planned, including a plan to build several dams. There are at least 18 locations for potential dams. Eight of them deserve to be prioritized, namely Sadawarna, Ciwidey, Cimeta, Sukawarna, Cikapundung, Citerik, Santosa and Cibantarua, as shown in Figure 16 below.

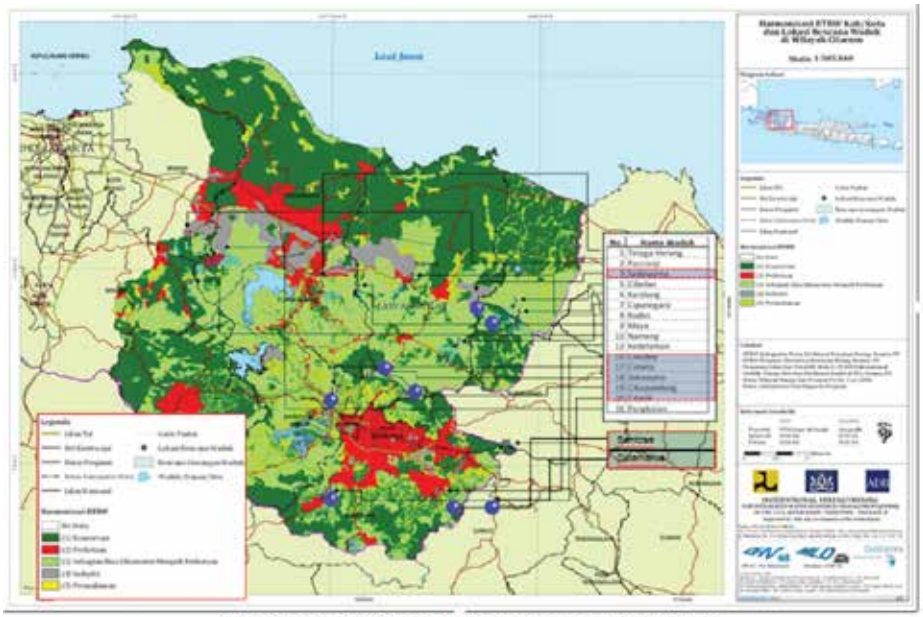


Figure 16: Locations of Planned Reservoirs

The increase of water resources utilization covers for all requirements, which are drinking water, industrial water, irrigation including fisheries and traditional fishponds as well as for encouraging the development of water energy in the form of mini-hydro and micro-hydro power plants.

In addition, it is also necessary to increase the efficiency of water usage, including irrigation, which efficiency is targeted to increase from 55% to 65%.

The water of artificiallakes (situ), field reservoirs or traditional reservoirs (embung) that have been rehabilitated as part of conservation can also be utilized for raw water and local irrigation.

These efforts also need to be accompanied with efforts to increase the efficiency of groundwater utilization and management, such as:

- Building monitoring wells as part of management monitoring and evaluation,
- Building recharge wells,
- Limiting and reducing the granting of groundwater abstraction permit, particularly for industries, especially in Bandung-Soreang Groundwater Basin, Bekasi-Karawang Groundwater Basin, and Subang Groundwater Basin as well as areas which are already provided with clean water,
- Enforcing law against illegal abstractions and abstractions that exceed the limit set in the permit,
- Changing clean water supply from runoff to existing water potentials.

2.3. Control of Water Destructive Power

Control of water destructive power can be categorized as follows:

a) Emergency Management of Flood Infrastructures

Figure 17: Emergency Management

Emergency management is carried out for work that is not or has not been programmed in the Budget Implementation List (DIPA) or that is urgent in nature, such as repairing damages caused by flooding or protecting against the threat of flooding.

Emergency management works that have been carried out include:

- Rehabilitation of collapsed embankments (965 meters in length)
- Repair of critical embankments (16.600 meters in length)

b) Permanent Management of Flood Infrastructures

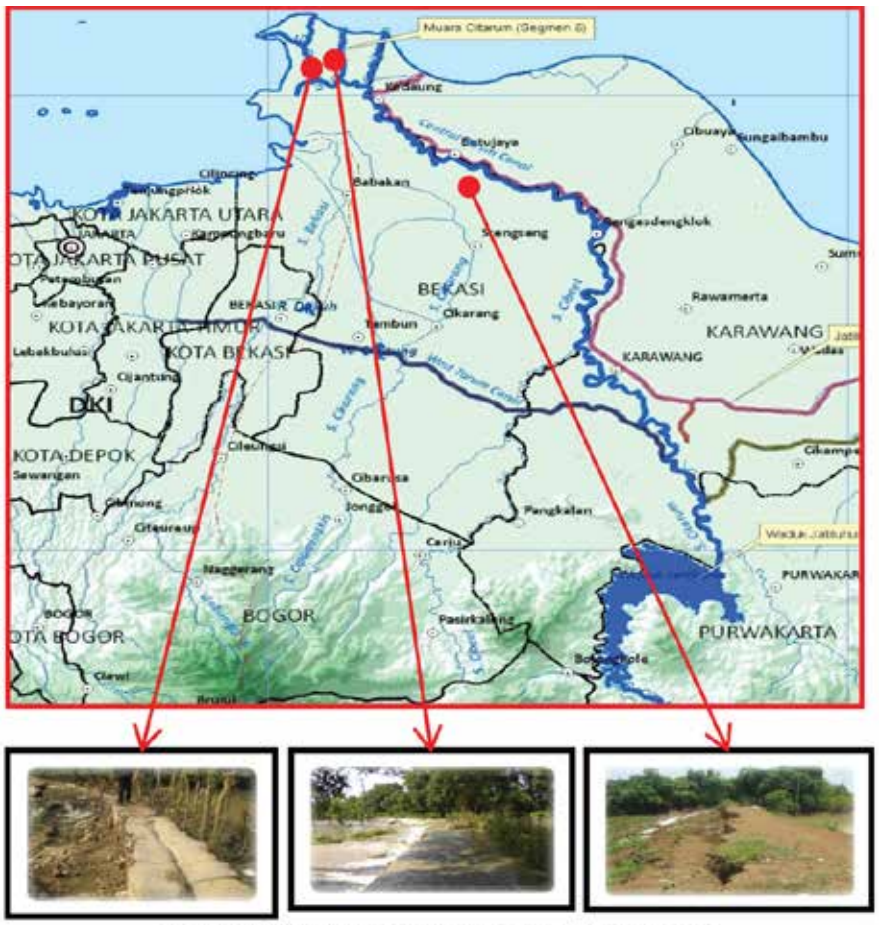


Figure 18: Permanent Management

- Embankment:
    - Embankment rehabilitation from Bojong Village to Gembong Estuary (154 km long)
    - Construction of new embankment between Walahar and Bojong Village
    - Construction of embankment and check dam in Cibeet River

- Dredging or normalization of Upper Citarum River and Bungin River

c) Protection against Coastal Abrasion

Protection against coastal abrasion is done by using vegetative and structural methods. Protection by vegetative method is carried out by maintaining mangrove forests and replanting mangrove for coastal protection. Protection by structural method is carried out by building coastal protection and reinforcement constructions, such as wave breakers, sea walls, gabions, etc..

Figure 19: Management of abrasion in Indramayu Beach and PondokPutri Beach, Subang Regency

d) Landslide Management

- Vegetative Efforts
    - Dryland farming
    - Reforestation by using types of trees which roots can strengthen the resistance to landslides
    - Covering of open slope surfaces with grass

- Structural Efforts
    - Construction of drainage ditches to reduce water infiltration and slope erosion,
    - Slope reinforcement by covering the surface with pavement layer or river stone masonry
    - Construction of bench terraces

- Non-structural Efforts
    - Provision of educative information for the community on landslide/potential landslide locations and regulation concerning the restriction of constructions around landslide-prone areas.

Figure 20: Landslide Management by Vegetative, Structural, and Non-Structural Methods

2.4. Water Resources Information System

Information and secondary data on Citarum River's water resources that are managed by BBWS Citarum can be found and downloaded from the following websites:

http://bbwscitarum.pdsda.net/ or http://www.citarum.org

Information and data from Citarum's hydrological stations are managed by various parties according to their usage, such as PJT II for the management of Jatiluhur Reservoir, PT PLN for the management of Cirata Reservoir and Saguling Reservoir, Center for Water Resources Research and Development, Office of Water Resources Management, etc..

The information is also utilized for flood alertness.

Several Water Resources Information System (SISDA)-related matters found in the Citarum River Basin include:

- Databases in Water Resources Information System network are not yet integrated;
- Some SOPs for the updating of the Water Resources Information System, monitoring and evaluation have been compiled, but the implementation has not been optimal and still need to be completed;
- The Water Resources Information System has not been used as a tool in planning and budgeting.

2.5. 2.5. Community Empowerment and Participation

Community empowerment, monitoring and involvement in Citarum River Basin's water resources management are carried out through several forums such as the Water Resources Management Coordination Team (TKPSDA), National Movement for Water Safeguard Partnership (GNKPA), Movement for Forest and Land Rehabilitation (GNRHL) and so on.

Several physical activities that have been carried out by the GNKPA include rehabilitation, operation and maintenance as well as conservation in Situ Jungkur, Cikalong, Nagrog, Sukamelang, Kumpay, Cibogo, etc., which are widely spread as shoen in the figure below.

Several matters related to the empowerment and participation increase of the community and the business sector which are found in 1 Ci River Basin:

- The performance of the institutions in charge of water resources management is still not maximized, and there is overlapping as well as unequal assignment of roles and responsibilities;
- Stakeholders have not been playing an active role and therefore still require support from the Government;
- The potentials of community roles and women roles in water resources management need to be strengthened.

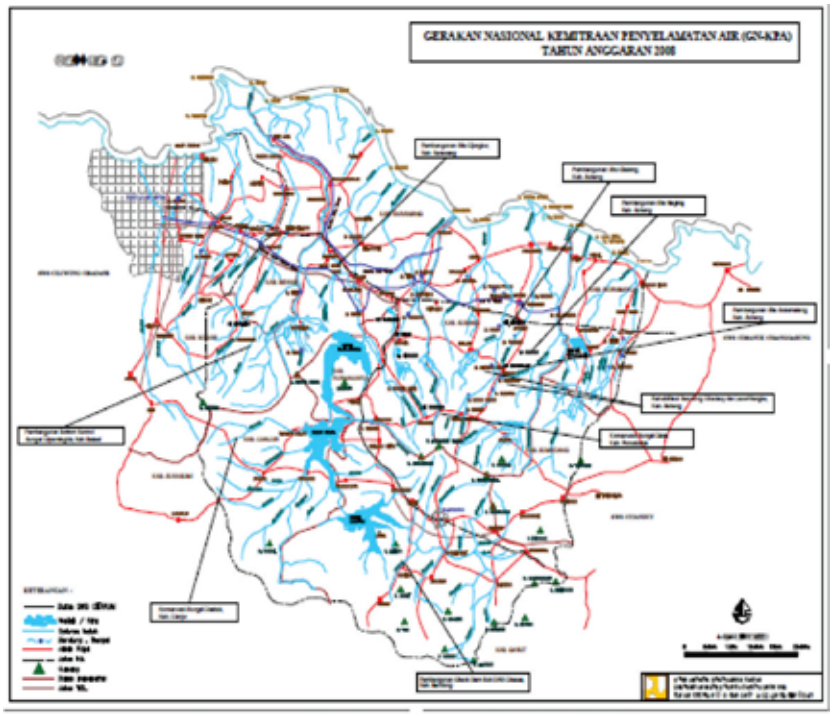


Figure 21: GNKPA Activities in 2008

3. WATER RESOURCES MANAGEMENT IN THE FUTURE

3.1. Comprehensive Management

The Citarum River Basin is considered as a national strategic river basin due to several reasons, such as because there has been a great amount of investment by the state for the river basin and there are many national interests that come from the area such as electrical energy and even drinking water for Jakarta mostly still relies on the water of Citarum. On the other hand, the population pressure in Citarum River Basin is also very great, which brings impacts on the water resources management aspect.

In order to overcome the many problems caused by the high population pressure, it is necessary to conduct spatial planning (zonation) and distribution of activity centers so that there is no overload in certain regions only.

3.2. Comprehensive Management

Considering the strategic value of Citarum River Basin for the national interest, all of its issues have been studied intensively through various activities such as:

- Integrated Citarum Water Resources Management Project (ICWRMP)
- Integrated Citarum Water Resources Management Investment Project (ICWRMIP) or also known as the Citarum Roadmap & Investment Program.

Based on the results of those studies, the BBWS has established the Strategic Plan of 2009-2014 which includes 5 programs, namely:

a) Development, management and conservation of rivers, lakes, and other water sources;

b) Development and management of irrigation networks, swamps, and other irrigation networks;

c) Flood control and coastal protection;

d) Raw water provision and management;

e) Implementation of state government leadership.

At present, studies are being prepared as part of the compilation of the Citarum River Basin Management Plan through an activity supported by ADB and the Government of the Netherlands, namely the Institutional Strengthening for Integrated Water Resources Management (IWRM) in the 6 Ci's River Basin Territory.

In order for water resources management to be optimal, the water resources information system needs to be integrated, which concerns hydrological database that includes rainfall, flow condition, sediment content, water level, and flow in extreme conditions such as flood and drought, hydro-meteorological database as well as database and information on groundwater potentials and aquifer conditions.

The development of hydrological database needs to be improved to real time in selected locations which will significantly affect water resources management by adding automatic equipment networks such as AWLL and ARL. The development of geo-hydrological information system network in every groundwater basin should be integrated with the hydrological information of surface water.

The hydrological and geo-hydrological database can facilitate the planning of utilization in every water regency, while water resources information through the system that is going to be built will be able to provide warning on drought and flood and the tendencies for drought or flood.

Potential development of water resources information system includes the technology and addition of equipment, preparation of human resources in the three elements as well as the development of an integrated water resources information system management institution.

3.3. Implementation Strategy

At present, the Institutional Strengthening for Integrated Water Resources Management (IWRM) in the 6 Ci's River Basin Territory has prepared a matrix for the Operational Policies for Water Resources Management in Citarum River Basin.

In the Matrix, the following have been put in details:

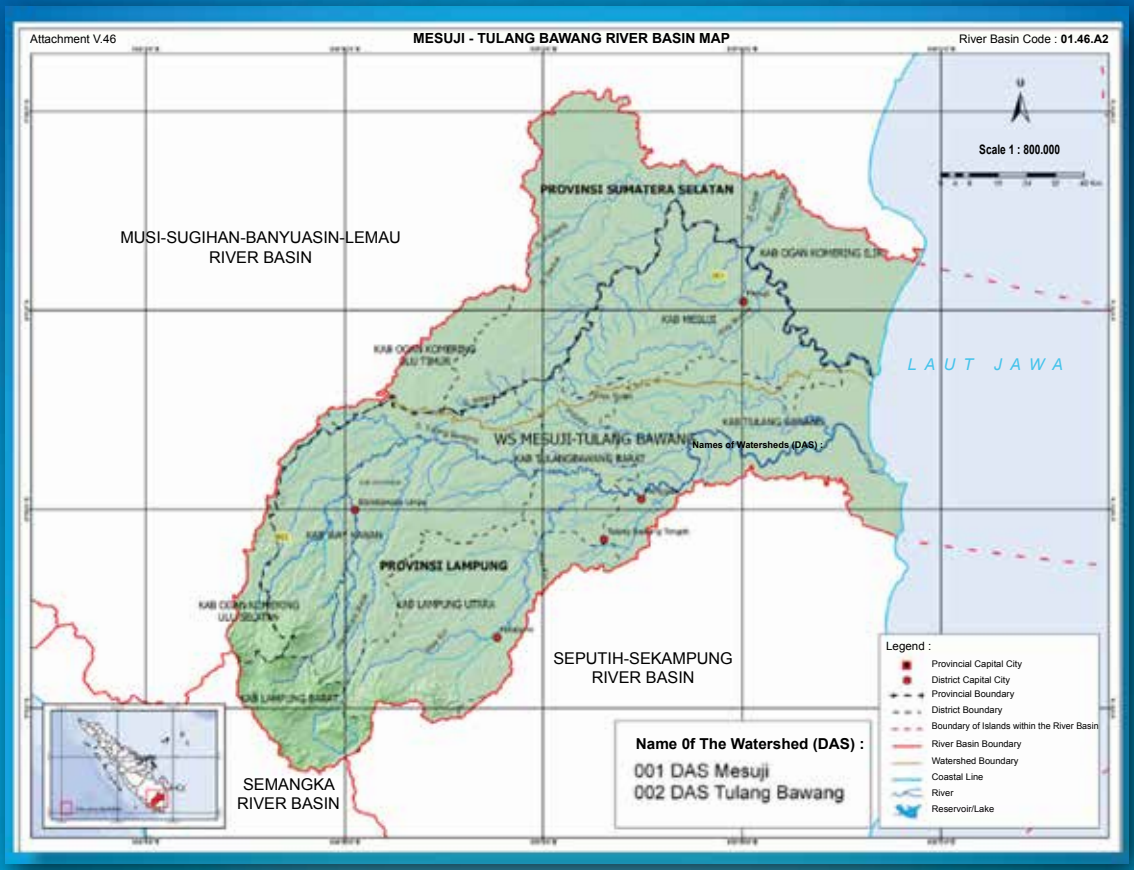
- Short-term Strategy (2011-2015);
- Medium-term Strategy (2011-2020) and
- Long-term Strategy (2011-2030).

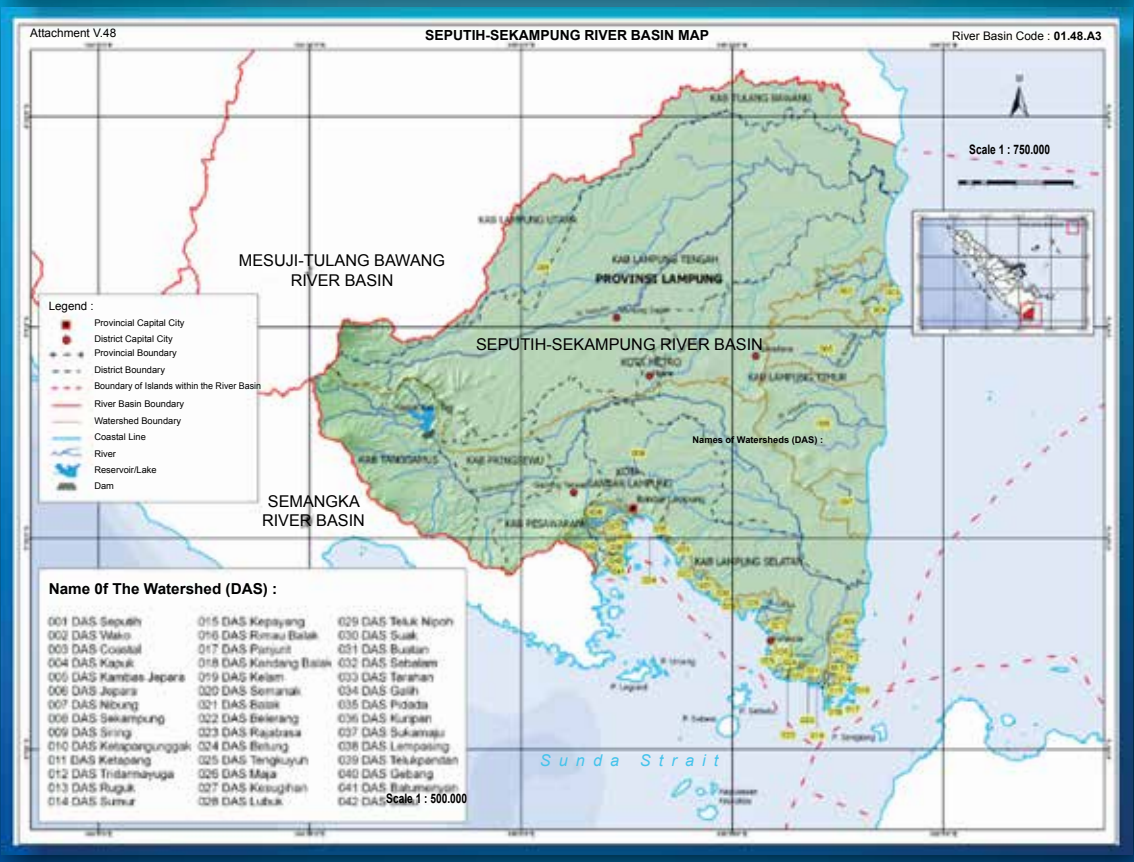
The Operational Policies for Water Resources Management in Citarum River Basin cover 5 (five) aspects, namely:

- Water Resources Conservation
- Water Resources Utilization
- Control of Water Destructive Power
- Water Resources Information System
- Community and Business Sector Empowerment and Participation Improvement

Other than the five aspects, the spatial planning and institutional aspects are also included in the discussion.

A8. LARGE RIVER BASIN ORGANIZATION OF MESUJI-SEKAMPUNG





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1. DESCRIPTION OF ORGANIZATION

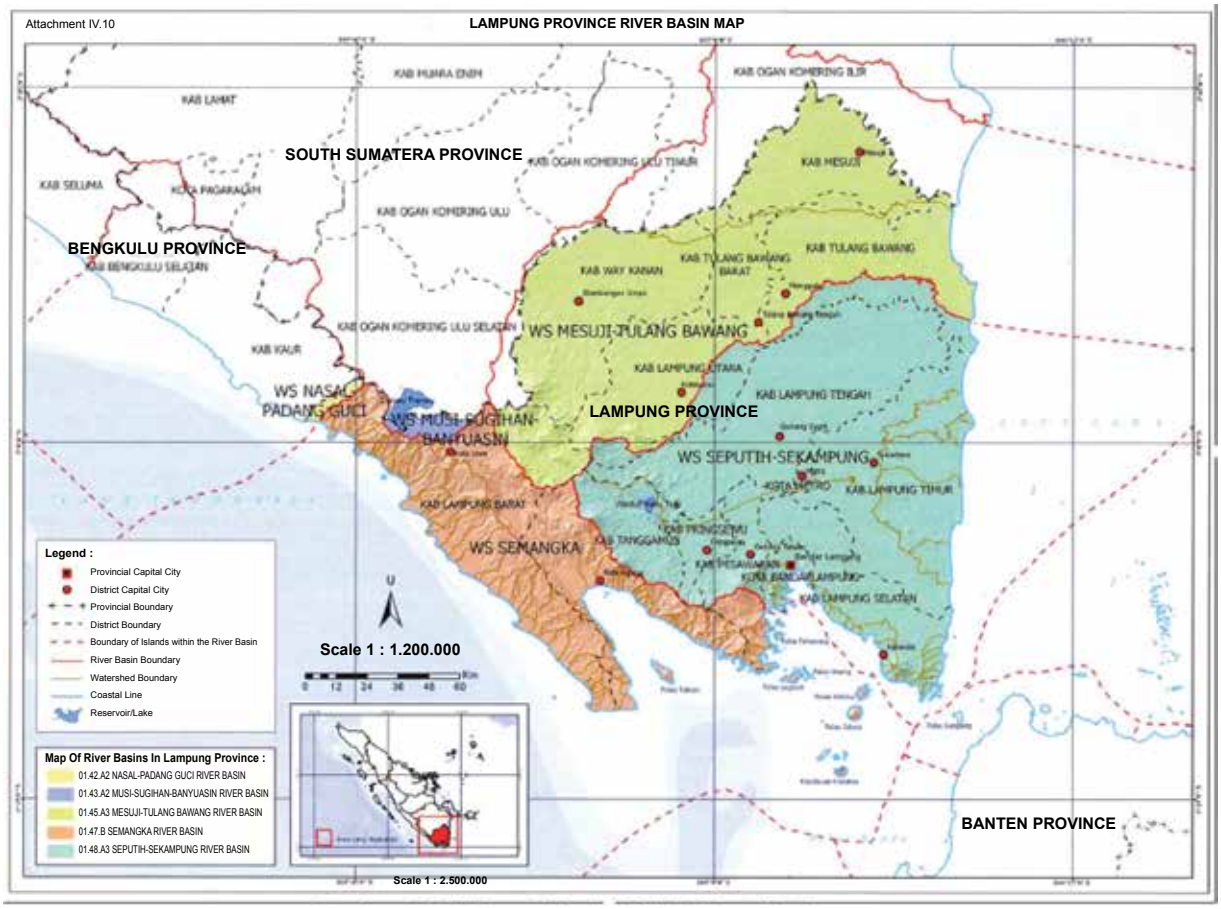


Figure 1: Work Area of BBWS Mesuji-Sekampung

1.1. General Information

Name	:	Balai Besar Wilayah Sungai Mesuji-Sekampung
Address	:	Jl. GatotSubroto No. 57, Garuntang
Municipality	:	Bandar Lampung - 35401
Telephone	:	(0721) 482 478
Facsimile	:	(0721) 482 478
Website	:	http://www.bbes-mesujisekampung.com
E-mail	:	
Legal Basis	:	Regulation of Minister of Public Works Number 23/ PRT/M/2008 jo Number 28/PRT/M/2008
Work Area	:	Mesuji-TulangBawangRiver Basin
River Basin Code	:	01.46.A2, Cross-provincial

Seputih-Sekampung River Basin, River Basin Code: 01.48.A3, National Strategic River Basin

1.2. Brief History

BBWS Mesuji-Sekampung is the Department of Public Works' technical implementation unit in the Province of Lampung which task is to ensure the implementation of water resources management from the upstream to the downstream of river basins in a comprehensive, integrated, sustainable and environmentally sound manner.

Before the establishment of BBWS Mesuji-Sekampung (as mandated in Law Number 7 of 2004 regarding Water Resources), the Department of Public Works, in particular the Directorate General of Water Resources, had work units which function was to carry out construction work as

well as non-construction work in each province.

Specifically in Lampung Province, the work units which manage water resources consist of several Non-Vertical Work Units for Particular Purpose (SNVT), including:

- SNVT for the Mainstay Irrigations and Swamps of Lampung;
- SNVT for Raw Water Management; and
- SNVT for the Main Implementer of Way Seputih-Way Sekampung River Basin

Development, which supervises the following:

  - SNVT for Water Resources Development and Conservation;
  - SNVT for Flood Control and Coastal Protection; and
  - SNVT for Way Seputih-Way Sekampung Floods

Each of these Non-Vertical Work Units for Particular Purpose (SNVT) coordinates with the relevant directorate within the Directorate General of Water Resources, Department of Public Works, according to the area managed.

1.3. Organizational Structure

The Large River Basin Organization of Mesuji-Sekampungis categorized as a type-B large river basin organization with an organizational structure that consists of:

1) Administration Department
2) Program and General Planning Division
3) Implementation Division
4) Water Resources Operation and Maintenance Division

The implementation of the activity budget is carried out by 3 work units, namely:

1) Work Unit of BBWS Mesuji-Sekampung, consisting of 4 Contract Executive Officers:

   a) Contract Executive Officer for Administration
   b) Contract Executive Officer for Planning and Program
   c) Contract Executive Officer for Water Resources Operation and Maintenance I
   d) Contract Executive Officer for Water Resources Operation and Maintenance II

2) Non-Vertical Work Units for Particular Purpose (SNVT) for the Implementation of Water Source Network of BBWS Mesuji-Sekampung, consisting of 3 Contract Executive Officers:

   a) Contract Executive Officer for Rivers and Beaches I
   b) Contract Executive Officer for Rivers and Beaches II
   c) Contract Executive Officer for Water Resources Conservation Utilization

3) Non-Vertical Work Units for Particular Purpose (SNVT) for the Implementation of Water Utilization Network of BBWS Mesuji-Sekampung, consisting of 4 Contract Executive Officers:

   a) Contract Executive Officer for Swamp Irrigation I
   b) Contract Executive Officer for Swamp Irrigation II
   c) Contract Executive Officer for Swamp Irrigation II
   d) Contract Executive Officer for Raw Water

1.4. Human Resources

The total number of employees in BBWS Mesuji-Sekampung is 487 people, consisting of 164 technical employees and 323 non-technical employees, with details as shown in the following Table 1:

Table 1: Human Resources in BBWS Mesuji Sekampung

No	Education	Civil Servant						Total
		Central		DPB Daerah		DPB Dinas&Kab.		
		Technical	Non-Technical	Technical	Non-Technical	Technical	Non-Technical	
1	S 2 (Master's Degree)	31	7	0	0	0	0	38
2	S 1 / D IV (Bachelor's Degree / 4-year Associate Degree)	35	48	8	9	0	0	100
3	D 3 (3-year Associate Degree)	5	6	6	1	1	0	19
4	Senior High School	46	116	25	74	7	28	296
5	Junior High School	0	12	0	7	0	6	25
6	Elementary School	0	2	0	3	0	4	9
Total		**117**	**191**	**39**	**94**	**8**	**38**	**487**

1.5. General Condition of Work Area

The western region of Lampung Provinceis a mountainous area as a series of Bukit Barisan. There are three mountains with heights over 2000 meters above the sea level, namely Mount Pesagiin West Lampung Regency with a height of 2,239m, Mount Tanggamus in Tanggamus Regency with a height of 2,102m and Mount Tebak in North Lampung Regency with a height of 2,315m.

The population growth of Lampung Province in the period of 1990-2000 reached 1,01% (Central Bureau of Statistics/Statistics Indonesia, 2004). This population growth was supported with improved public health rate, birth rate and decreased mortality rate. The composition of the population and the area of the Lampung Province are shown in Table 2 below.

Table 2: Number of Population in BBWS Mesuji Sekampung

No	Regency/Municipality	Area	Male	Female	Total
1	West Lampung	495,040	204,641	183,472	388,113
2	Tanggamus	335,661	415,766	385,843	801,609
3	South Lampung	318,078	616,066	576,230	1,192,296
4	East Lampung	433,789	459,954	430,344	890,298
5	Central Lampung	478,982	556,395	526,099	1,082,494
6	North Lampung	272,563	282,810	272,289	555,099
7	Way Kanan	392,163	184,592	175,252	359,844
8	TulangBawang	777,084	385,331	348,189	733,520
9	Bandar Lampung	19,296	395,514	393,423	788,937
10	Metro	6,179	62,244	61,496	123,740
Total		**3,528,835**	**3,563,313**	**3,352,637**	**6,915,950**

Source: Lampung DalamAngka (Lampung in Numbers) 2004/2005 (Pesawaran Regency is included in South Lampung Regency)

1.5.1. Mesuji-TulangBawang River Basin

Figure 2: Mesuji-TulangBawang River Basin

The Mesuji-Tulang Bawang River Basin is located between 4° 22' South Latitude to 5° 22' South Latitude and 104° 32' East Longitude to 105° 54' East Longitude with an area of 16,625 km² (41.5% of the total area of Lampung Province), and consists of 3 watersheds, namely Mesuji Watershed which covers an area of ± 6,760 km² and Tulang Bawang Watershed which covers an area of ± 9,865 km².

Water resource potentials in Mesuji-Tulang Bawang River Basin include:

- Surface water availability potential amounts to 20.2 billion m³/year;
- Groundwater potential amounts to 251.4 million m³/year.

The Mesuji-TulangBawang River Basin covers several regencies/municipalities, namely:

a) West Lampung Regency
b) Way Kanan Regency
c) North Lampung Regency
d) Central Lampung Regency
e) TulangBawang Regency
f) Some of the regencies in South Sumatera Province

1.5.2. Seputih-Sekampung River Basin

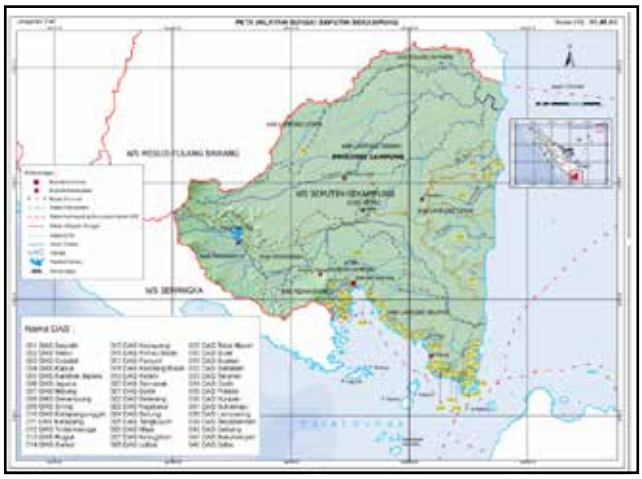


Figure 3 Seputih-Sekampung River Basin

The Seputih-Sekampung River Basin is located between 4° 37' South Latitude to 5° 55' South Latitude and 104° 30' East Longitude to 105° 52' East Longitude with an area of 13,225 km² (33% of the total area of Lampung Province), and consists of 42 watersheds.

Among the watersheds, the two large ones are the Seputih Watershed which covers an area of ± 7,550 km² and Sekampung Watershed which covers an area of ± 5,675 km².

Water resource potentials in Seputih-Sekampung River Basin include:

- Water fulfillment potential is 80%, amounting to 14.2 billion m³/year;
    - Run-off potential: 7.4 billion m³
    - Interflow: 6.8 billion m³
- Groundwater potential amounts to 0.293 billion m³/year.

The Seputih-Sekampung River Basin covers several regencies/municipalities, namely:

a) West Lampung Regency
b) Tanggamus Regency
c) Central Lampung Regency
d) Pesawaran Regency
e) East Lampung Regency
f) South Lampung Regency
g) Tulang Bawang Regency
h) Bandar Lampung Municipality
i) Metro Municipality

1.6. Hydrology

The climate in the work area of BBWS Mesuji-Sekampung is influenced by 2 seasons, namely the dry season and the rainy season. The average daytime temperature ranges from 31.20°C to 34.10°C, while temperatures at night range from 21.70°C to 28.40°C.

The average rainfall is 160.90 mm/month. The highest rainfall of this province occurs in December, reaching up to 388.3 mm/month and the lowest is in August at 9.8 mm/month.

- The Mesuji-TulangBawang River Basin's annual rainfall ranges from 2,500 mm/year to 3,100 mm/year with a mean of 2,800 mm/year;
- The Seputih-Sekampung River Basin's annual rainfall ranges from 1,234 mm/year to 2,565 mm/year with a mean of 1,878 mm/year.

In BBWS Mesuji-Sekampung's work area there are 7 Climatological Stations, 118 Rainfall Stations, and 52 Water Observation Stations, as shown in the following Figure 4.

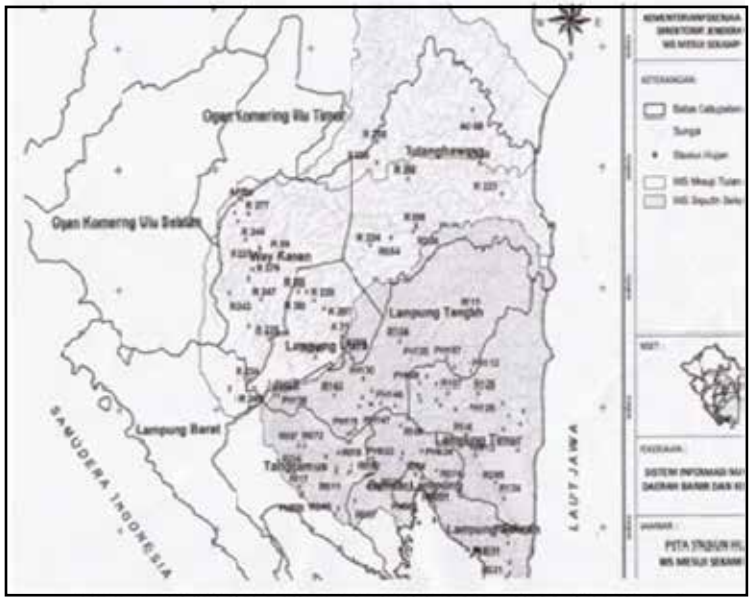


Figure 4: Distribution of Hydrological Stations in BBWS Mesuji-Sekampung

1.7. Budgets of 2011 and 2012

The following Table 3 shows the budget for the Program and General Planning Division, and the data presented in the table shows that there is a Foreign Loan component in addition to the State Budget component. The 2012 budget experienced a decrease compared to the 2011 budget.

Table 3: Budgets of BBWS Mesuji-Sekampung

Fiscal Year	National Budget (APBN)	Foreign Loan	Total
2011	10,620,724	408,000	11,028,724
2012	8,874,350	1,760,000	10,634,350

1.8. Issues

a) Flood and Drought

The declining condition and carrying capacity of watersheds are caused by illegal forest clearing and improper utilization management, which then gives rise to erosion and sedimentation, increased flood intensity during the rainy season, and occurrences of drought in the dry season.

Table 4: Flood Inundation Areas

No	Watershed	Area of Inundation (Ha)	Source of Flood
1	Mesuji	203,700	Mesuji River, Buaya River, Padang River, Menang River
2	TulangBawang	173,070	TulangBawang River, Rarem River, Umpu/ Kanan River

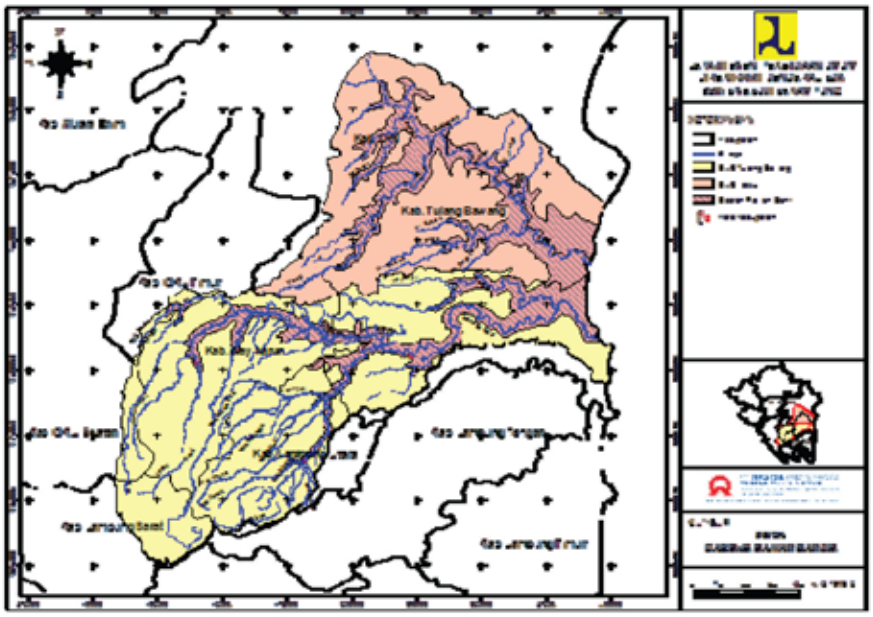


Figure 5: Flood-prone Areas in BBWS Mesuji-Sekampung

Figure 5 above shows that flood-prone areas are mainly found on the right and left sides of the rivers, which is caused by the overflowing of river water. To control this flooding, it is necessary to build embankments with length of approximately 214 km and at least 17 check dams.

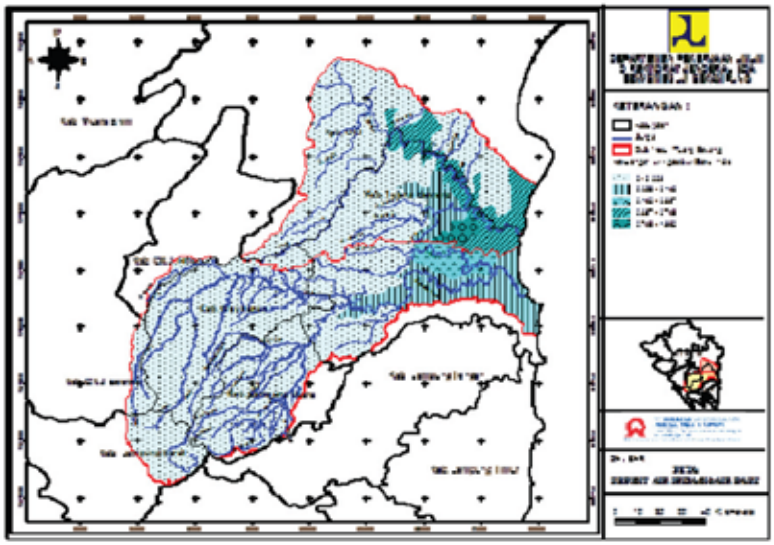


Figure 6: Distribution of Drought-prone Areas

Table 5: Drought-prone Areas

No	Sub-regency	Area (Ha)
1	Menggala	254
2	GedongAji	964
3	TulangBawang Tengah	143
4	Mesuji	630
5	SimpangPematang	602
6	Penawara Tama	242
7	Tanjung Raya	72
Total		**2,907**

In the dry season, there are at least 7 sub-regencies with a total area of 2.907 hectares which are susceptible to drought, as seen in Table 5. In addition, there are 17 irrigation areas with water shortage, which locations are spread all over the Lampung Province.

b) Erosion and Sedimentation

The upper part of BBWS Mesuji-Sekampung's work area, especially the area between Batutegi Dam and Argoguruh Dam, has turned into areas of settlement, plantation and dry-land. This condition causes increased river discharge accompanied by sediment content when it rains. Such condition is worsened by sand mining activities in several river channels, in which these sand mining activities do not comply with the existing rules, such as the requirement to own a permit, selection of location, etc.

Table 6 below shows that most areas experience moderate and high rates oferosion, while Figure 7 shows how areas with potential of erosion are almost equally spread across the river basin.

This condition greatly affects the water resource infrastructures located at the downstream, including Batutegi Dam, Dam Rarem Way, and Way Jepara Dam, as well as the irirrigation networks.

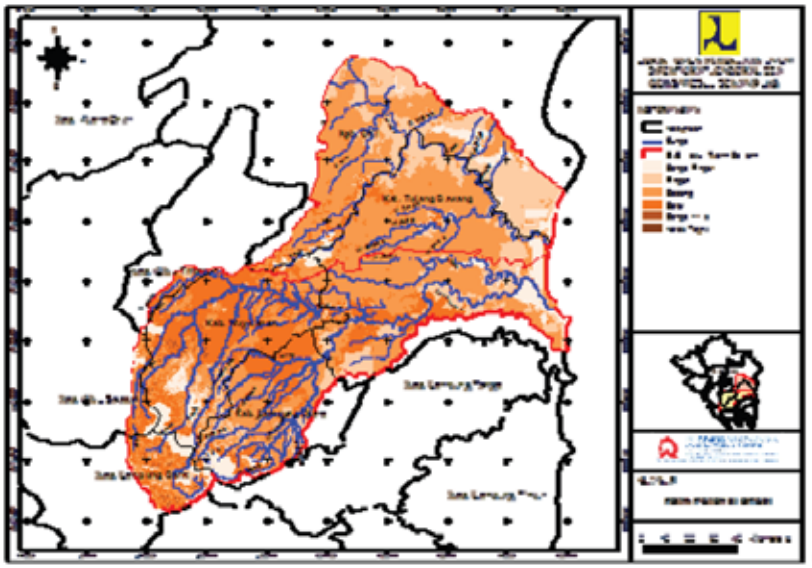


Figure 7: Distribution of Areas with Potential of Erosion

Table 6: Erosion Index

No	Erosion Index	Erosion Rate	Area (Ha)
1	Very Mild	0 - 6,25	128,145.83
2	Mild	6.25 - 62.50	330,445.99
3	Moderate	62.50 - 187.50	801,535.44
4	Heavy	187.50 - 625	376,347.43
5	Very Heavy	625 - 2,500	11,675.03
6	Catastrophic	> 2,500	0.75

c) Coastal Abrasion

Coastal abrasion occurs frequently in several areas such as in Jalan Banding in South Lampung Province, Bandar Lampung Municipality, Way Lunik, Way Sukamaju, Way Penet, Way Sukamaju, Karya Tani village beach, and Karya Makmur in Labuhan Manggarai sub-regency.

d) Limited Facilities and Infrastructures of Water Resources Management

The number and capacities of the existing water storage facilities and infrastructures (reservoirs and traditional reservoirs/embung) are still limited. Therefore, the utilization of water resource potentials and regional potentials is not yet optimal, whereasthefacilities and infrastructuresat the same timecanalsoserve toreduce theintensity offloodsin therainyseasonanddroughtin the dry season.

e) Management of Water Resources Management Infrastructures

Until today, the management of water resources management infrastructures, including the irrigation and Swamp networks, has not been running optimally, and so the utilization also has not been optimal and the area of planting realization is not yet formed as planned.

In the case of Batutegi Dam management, for instance, the multipurpose dam which is used not only to irrigate the Sekampung Irrigation Area but also for a Hydroelectric Power Plant with a capacity of14 MW.

The operational model of Batutegi Damin supplying water to the Sekampung Irrigation Area is guided by the Decree of the Governor of Lampungon Global Plant Layout Plan that is published each year. Given that the main purpose of the Batutegi Damis for irrigation, the operation of the Hydro electric Power Plant then adjusts the water release schedule for the

irrigation. This condition often raises a conflict of interest given that Lampung Province is often constrained in terms of power supply requirements and availability.

Such condition occurs in the management of BatutegiDam, which led to an imbalance of in flow and out flow of BatutegiDam. Since 2005, the water surface elevation has continued to decline. The lowest point of water surface elevation decline occurred in September 2008,which was +226m(48 m below thenormal water level+274m). Out of the total carrying capacity of ±690million m^3, there was only ±95million m^3 at the time. The storage condition changed to almost like the original stream. Large trees that were also submerged seemed to rise to the water surface.

Based on the results of evaluation on the data, it was found that the decline in the availability of water in Batutegi Reservoir was caused not only by the damaged vegetation along the river between the Batutegi Dam and Argoguruh Dam, but also by a lack of coordination between the BatutegiDam operational officers and the Argoguruh Dam guards. When the data were matched, it was seen how frequently overlapping occurred, in which there was water supply when there was already sufficient amount of water in the rice fields. Since that moment, the management of Batutegi Dam restricted the water release for irrigation by increasing coordination in real-time manner, and the water surface elevation in Batutegi Reservoir then started to slowly increase and a spill-out occurred in September 2010.

Figure 8: Batutegi Reservoir at High Water Level and Low Water Level

When water surface elevation declined, the inundation area turned into land and was used for dry-land farming by the people. This was because the water surface decline occurring since 2005 to 2008 made the people living around the inundation believe that the reservoir's water level would never rise again.

When the water surface elevation started to rise, the dry-land area became submerged again. This caused weeds to get carried into the inundation area.

The growth of the weeds that got carried into the inundation area was very fast, which then made 70% of the Batutegi Reservoir's inundation filled with weeds at the end of 2009.

To clear up the inundation area, the Batutegi Dam management attempted to lift the weeds ashore by involving the community around the dam.

Figure 9: Weeds in Batutegi Reservoir

When a spill-out occurred in 2010, the weeds were flushed away through a spillway. But since the spill-out only lasted for 2 months, the weed flushing was not completed and at the end of 2010, approximately 10% of the weeds still remained there.

Given that the weed growth is very fast, the inundation area today is still full of weeds. The lifting of the weeds by involving the community around the dam is still being carried out until this year (2012).

Figure 10: Over flow in Batutegi Reservoir Spillway

2. WATER RESOURCES MANAGEMENT

2.1. Water Resources Conservation

Water resources conservation is aimed to lower the erosion and sedimentation rates in critical areas which are found abundantly in BBWS Mesuji-Sekampung's work area.

- Not Potentially Critical : 594,010 hectares
- Potentially Critical : 834,492 hectares
- Rather Critical : 1,051,507 hectares
- Critical : 310,212 hectares
- Very Critical : 174,647 hectares

The critical levels of the areas are indicated by the size of the river regime coefficients which are far greater than the normal value, which is 1:20.

The river regime coefficients of several rivers are recorded as follows:

- Way Seputih 1 : 80
- Way Sekampung 1 : 125
- Way TulangBawang 1 : 86
- Way Mesuji 1 : 50

The implementation of this activity is carried out together with other agencies such as the Office of Agriculture, Office of Plantation, Office of Forestry, Office of Human Settlement, etc., and also through the GNKPA forum.

These GNKPA activities are started with an agreement to carry out Forest and Land Rehabilitation as well as Water Resources Conservation in TulangBawang Watershed, Way Rarem Sub-watershed and Way Abung Sub-watershed, and also the Community Empowerment of Tulang Bawang Watershed.

Figure 11: GNKPA Activities of Tanggamus Regency

2.2. Water Resources Utilization

In addition to being utilized for clean water, water resources in BBWS Mesuji-Sekampung are also primarily utilized for irrigation. The water is obtained from the utilizationof reservoirs, *embungs*, swamps and groundwater. This has brought success to the agricultural sector and made Lampung Province as one of the national rice barns, with rice production as shown in the following Table 7.

Table 7: Water Resources Utilization in BBWS Mesuji-Sekampung

No	Regency/Municipality	Wetland Rice (Ton)	Dry-land Rice (Ton)	Total (Ton)
1	West Lampung	100,175	3,115	103,290
2	Tanggamus	229,004	6,045	235,049
3	South Lampung	361,593	20,956	382,549
4	East Lampung	329,927	16,911	346,838
5	Central Lampung	385,939	63,330	449,269
6	Lampung Utara	85,276	31,727	117,003
7	Way Kanan	109,396	28,428	137,824
8	TulangBawang	282,009	12,879	294,888
9	Bandar Lampung	7,722	375	8,097
10	Metro	17,149	40	17,189
Total		**1,908,190**	**183,806**	**2,091,996**

Source: Lampung dalamAngka (Lamoung in Numbers) 2004/2005

The table above shows that the amount of rice produced from dry-land faming is relatively large and these areas have a potential to be developed into technical irrigation areas.

The Lampung Province is one of the top national provinces in rice production. There are more than 295,000 hectares of irrigation from 732 Irrigation Areas. Irrigation Areas larger than 3,000 ha extend to 214,150 ha, while Irrigation Areas between 1,000–3,000 ha extend to 24,150 ha and Irrigation Areas smaller than 1,000 ha extend to 56,700 ha. The main Irrigation Areas include Way Sekampung System with potential area of 66,591 ha and Seputih Irrigation Area with potential area of 20,201 ha, covering the Central Lampung Regency, South Lampung Regency, East Lampung Regency and Kota Metro Municipality.

The irrigation development that is currently being conducted in the Mesuji-Tulang Bawang River Basin is the development of Komering Irrigation, which covers an area of 120,000 ha. The Komering Irrigation is a cross-provincial irrigation that includes South Sumatera and Lampung provinces. The area in the South Sumatera province extends to 75,000 ha, while in Lampung, the area extends to 45,000 ha, located in Way Kanan and Tulang Bawang.

a) Dams

Until today, as many as three dams have been built, namely:

Table 8: Dams in BBWS Mesuji-Sekampung

No	Name of Dam	River Basin	Year of Construction	Height (M)	Effective Volume (Million M³)
1	Way Jepara	Seputih - Sekampung	1975 - 1978	16.60	22.25
2	Way Rarem	Mesuji - Tulang Bawang	1980 - 1984	32.00	56.90
3	Batutegi	Seputih - Sekampung	1994 - 2002	122.00	665.00

Figure 12: Batutegi Dam and Way Jepara Dam

b) Traditional Reservoirs (embung)

As many as 66 *embungs* with a total capacity of 20.75 million m³ have been built in the work area of BBWS Mesuji-Sekampung.

Figure 13: Traditional Reservoir (embung)

c) Swamps

The swamp area potentials extending to 128,953 ha consist of non-tidal swamp area extending to 62,300 ha (25,578 ha have been developed), and tidal swamp area extending to 66,653 ha (50,198 ha have been developed). The total areas that have been developed therefore extend to 75,776 ha.

Figure 14: Development of Sragi Swamps

Development of groundwater is intended to irrigate dry areas that are not covered by surface water irrigation network. The potential for groundwater irrigation development extends to 61,600 ha and by 2007, 130 Groundwater Irrigation Networks have been constructed with total areas of 1.380 ha as well as rural raw water infrastructures for 800 families.

Figure 15: Groundwater Development

e) Raw Water

Raw water capacity development potentials amounting to 5,180 l/sec are distributed in 5 regencies, namely South Lampung, North Lampung, East Lampung, West Lampung and TulangBawang. Until 2007, as many as 19 infrastructures and facilities for urban and rural raw water have been built with total discharge of 1,580 l/sec. These infrastructures and facilities provide services for more than 15,760 families.

Figure 16: Raw Water Development

2.3. Control of Water Destructive Power

a) Emergency Management of Flood Infrastructures

Control of water destructive power is carried out to ensure that roads, agricultural areas, industrial zones, settlement and urban areas as well as water resource facilities and infrastructures are able to keep functioning. The Lampung Province requires approximately a 53 km long flood protection, approximately 214 km of embankments and approximately 17 check dams, including design work, namely:

- Way Kandis Flood Management Design Review
- Re-designing of Way Batanghari Flood Management in East Lampung Regency
- Way Seputih/Way Tatayan Flood Management Design Review
- Detail Design and Preparation Studies on the Preparation of Environmental Management

Efforts/Environmental Monitoring Efforts for Minor Rehabilitation of Jepara Dam

- Special Studies for Large-scale Rehabilitation, Dam Security Improvement and Performance Improvement of Batutegi Reservoir
- Re-designing of Way TulangBawang Flood Management

Figure 17: Flood Control Structure and River Improvement

b) Coastal Abrasion Control

Coastal protection work has been started since 2006 as part of the efforts to safeguard and protect public infrastructures against coastal abrasion. In 2007, a 1.000 m long revetment was built at Jalan Banding Beach in South Lampung Regency, and also jetties at Way Kahuripan (239 m), Way Lunik (166 m) in Bandar Lampung Municipality, and at Way Sukamaju (86 m). In 2008, plans were made for the extension of the revetment at Jalan Banding Beach by 200 m, construction of Way Penet Beach revetment (290 m), and construction of jetty at Way Sukamaju (162 m).

Figure 18: Revetment at Way Penet Beach and Jetty at Way Sukamaju

In order to support the implementation, the following design activities were carried out:

- Detail Design for KaryaTani Village Beach Protection in LabuhanMaringgai Sub-regency
- Detail Design for KaryaMakmur Village Beach Protection in LabuhanMaringgaiSub-regency
- Design for Margasari Village Beach Protection in East Lampung Regency
- Design for Ketapang Beach Protection in South Lampung Regency

2.4. Water Resources Information System

The water resources information system is managed by the Water Resources Information System (SISDA) Unit of BBWS Mesuji-Sekampung. As part of the effort to support the implementation of bureaucracy reform acceleration program (quick win) within the Directorate General of Water Resources, especially in conducting data acceleration and water resources data and information provision optimization, BBWS Mesuji-Sekampung organizes Water Resources Data Processing Version 4.0 trainings.

2.5. Community Empowerment and Participation

Community empowerment, monitoring and involvement, especially in terms of a comprehensive water resources management, are carried out through the Water Resources Management Coordination Team (TKPSDA) forum of Mesuji-TulangBawang and the TKPSDA forum of Speutih-Sekampung. Furthermore, in order to support the Government Program Implementation, particularly in Lampung Province as part of the effort to support food self-sufficiency, the BBWS Mesuji-Sekampung, through the Work Unit of BBWS Mesuji-Sekampung for Water Resources Operation and Maintenance II of fiscal year 2011, has organized a Training-of-Trainers (TOT) and Comparative Study program at Ciamis.

Training for Water-Saving Rive Farmers (Application of Water-saving Rice Cultivation in System of Rice Intensification/SRI). The training was held in LPMP Building in Lampung Province from November 8 to November 12, 2011. The training was attended by ± 30 participants from relevant agencies, instructors/resource persons from Aliksa Organic Center, and farmer group from Untoro Village, Trimurjo Sub-regency, Central Lampung Regency.

Figure 19: Workshop, Training and Comparative Study

3. WATER RESOURCES MANAGEMENT IN THE FUTURE

3.1. General

As has been described in the previous chapter, water resources management in the work area of BBWS Mesuji-Sekampung is primarily carried out for irrigation other than for clean water and power generator. The infrastructures are already available, and they are able to be developed (extensification) and optimized in their capacities (intensification) in order to provide more benefits for the stakeholders.

a) Water Resource Development Potentials in Seputih-Sekampung River Basin include:

1) Development/Improvement of Irrigation Networks in an area of 153,334 ha
2) Development/Improvement of Swamp Networks in an area of 12,924 ha
3) Development of Water Resources for Hydroelectric Power Plants with a capacity of 39 MW
4) Development and Management of Raw Water Networks with a capacity of 5,000 l/sec

5) Development of Water Resources for Tourism, namely Batutegi Reservoir and Way Jepara Reservoir
6) Development of Water Resources for Fisheries, namely Batutegi Reservoir and Way Jepara Reservoir

b) Water Resource Development Potentials in Mesuji-TulangBawangRiver Basin include:

1) Development/Improvement of Irrigation Networks in an area of 94,665 ha
2) Development/Improvement of Swamp Networks in an area of 50,000 ha
3) Development of Water Resources for Hydroelectric Power Plants with a capacity of 216 MW
4) Development and Management of Raw Water Networks with a capacity of 4,000 l/sec
5) Development of Water Resource for Tourism, namely Way Rarem Reservoir
6) Development of Water Resource for Fishery, namely Way Rarem Reservoir

In addition to developing the benefits of the existing infrastructures, the work area of BBWS Mesuji-Sekampung has water resource potentials that can still be further developed, such as:

1) Construction of dams in 7 locations spread in Mesuji-TulangBawang River Basin and Seputih-Sekampung River Basin;

2) Development of *embungs*. There are approximately 166 locations and at present, only 66 *embungs* have been constructed.

3) Development of swamp potentials, both non-tidal swamps and tidal swamps, covering a total area of 53,177 hectares as seen in the table below.

Table 9: Swamp Development Potentials

No	Type of Swamp	Total Potential (Ha)	Developed (Ha)	Remaining Potential (Ha)
1	Non-tidal Swamp	62,300	25,578	36,722
2	Tidal Swamp	66,653	50,198	16,455
Total		**128,953**	**75,776**	**53,177**

4) Development of raw water

Raw water development potentials amounting to 3,600 l/sec are spread in 5 regencies, namely South Lampung, North Lampung, East Lampung, West Lampung and TulangBawang. This raw water development needs to be carried out immediately in order to meet the household and industrial development requirements in Lampung.

3.2. Comprehensive Management

By nature, the Lampung Province, including the work area of BBWS Mesuji-Sekampung, has great natural resources. Water resources management is still very possible to be developed for the benefits of all stakeholders.

However, the water resources management should not only prioritize the utilization aspect, but it should also be balanced with the aspects of water preservation and control of water destructive power.

Planning activities should also emphasize not only on the series of implementation, but they should also take into consideration the operation and maintenance afterwards.

The experience gained in the operation of Batutegi Reservoir, for instance, has given a very valuable lesson in conducting water management, which shows that water management should

not only focus on the utilization aspect, but also on the water preservation aspect and control of water destructive power aspect. In addition, water resources management is not monopolized by the water resources sector only, but it is also the responsibility and obligation of other related sectors. In short, it is necessary to create a comprehensive and integrated water resources management.

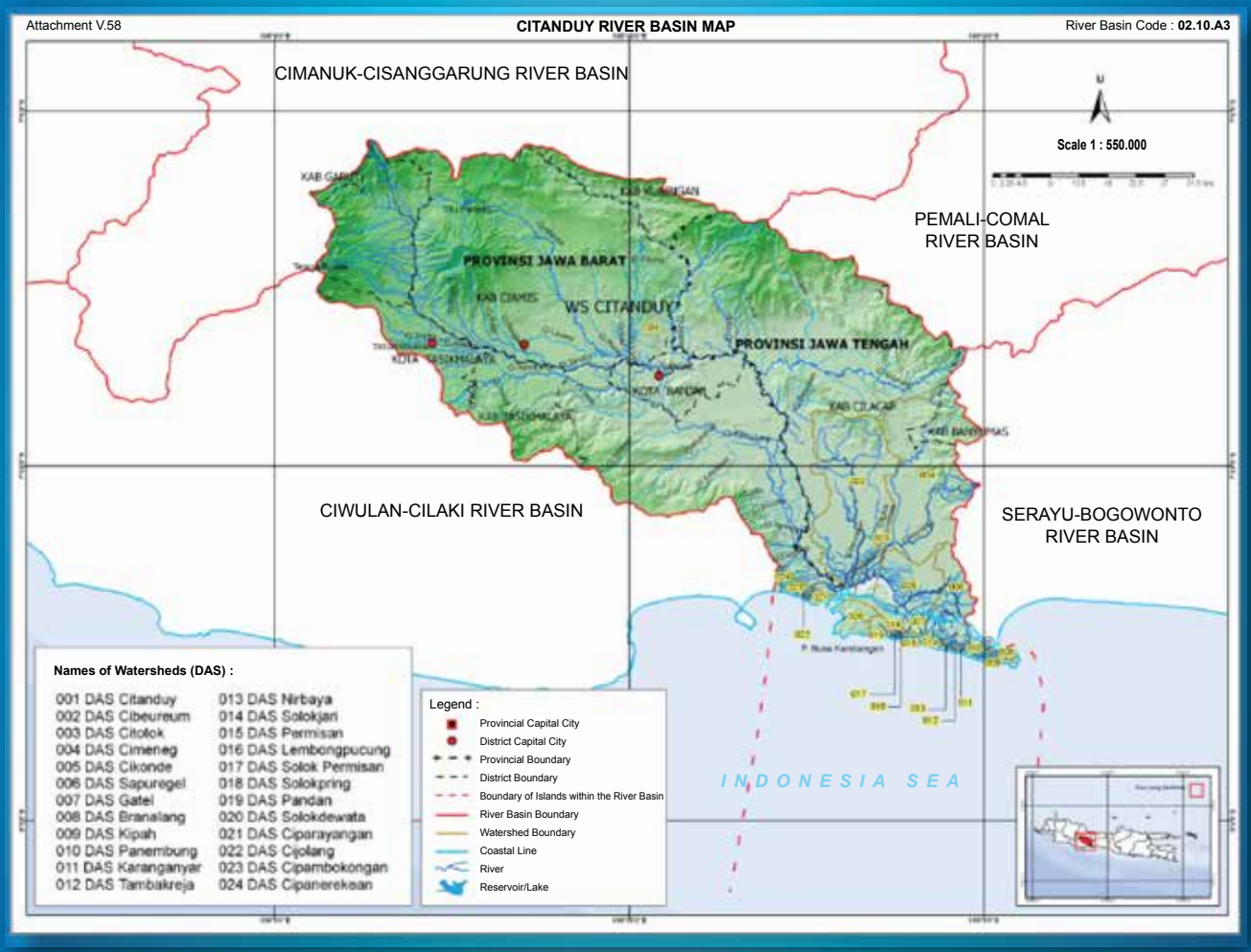
3.3. Implementation Strategy

Water is an absolute necessity for all living things, especially humans. Therefore, water and water resources management always involve the interests of all people and sectors they represent.Water resource infrastructures development should no longer consider only the economic benefits, but it should also consider the social and environmental factors.

Due to this, the development of water resource infrastructures becomes more expensive. Meanwhile, the availability of development funds is very limited. Therefore, it requires an appropriate implementation strategy, which is by conducting a prioritization based on the criteria that are acceptable to all stakeholders.

In addition, the implementation of water resource management infrastructures development is not only the responsibility ofthe water resources sector. Therefore,other sectors can also provide their contributions to the funding and implementation, including the private sector and the public, through the procedures as stipulated in existing regulations. The mechanism for the implementation has also been set up in accordance with the regulations, which is, among others, through the TKPSDA forum.

B1. LARGE RIVER BASIN ORGANIZATION OF CITANDUY



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1. DESCRIPTION OF ORGANIZATION

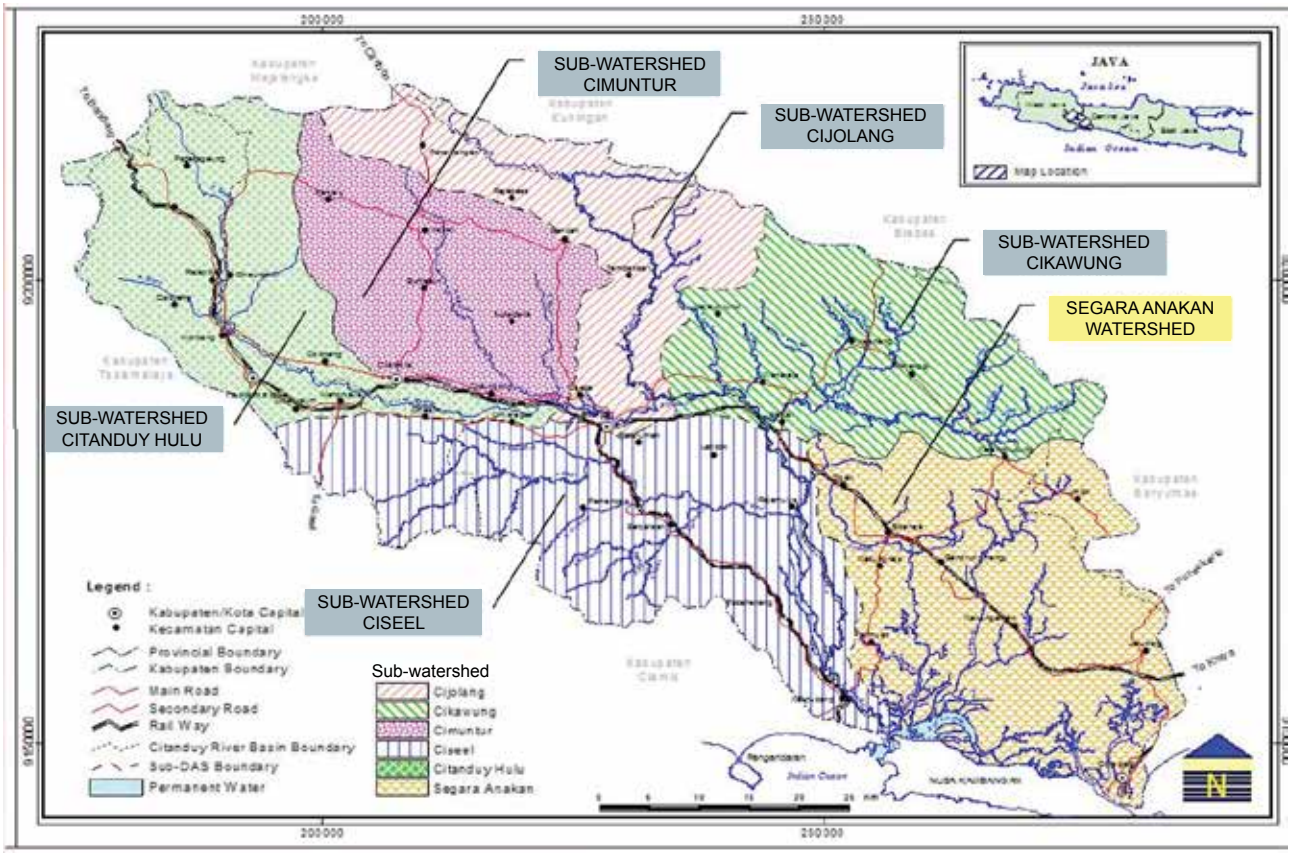


Figure 1: Citanduy River Basin

1.1. General Information

Name	:	Balai Besar Wilayah Sungai Citanduy
Address	:	Jl. Prof. DR. Ir. H. Sutami No. 1
Municipality	:	Banjar, West Java - 46300
Telephone	:	(0265) 741051, 741219
Facsimile	:	(0265) 741302
Website	:	http://www.bbwscitanduy.com
E-mail	:	
Legal Basis	:	Regulation of Minister of Public Works Number 23/ PRT/M/2008
Work Area	:	CitanduyRiver Basin, River Code: A2-13
River Basin Classification	:	Cross-Provincial River Basin (West Java Province–Central Java Province)

1.2. Brief History

1970	:	Citanduy-Ciwulan River Basin Development Project
1980	:	Citanduy-Ciwulan River Basin Development Master Project
1990	:	Balai Besar Wilayah Sungai Citanduy
2008	:	Citanduy Project

1.3. Organization Structure

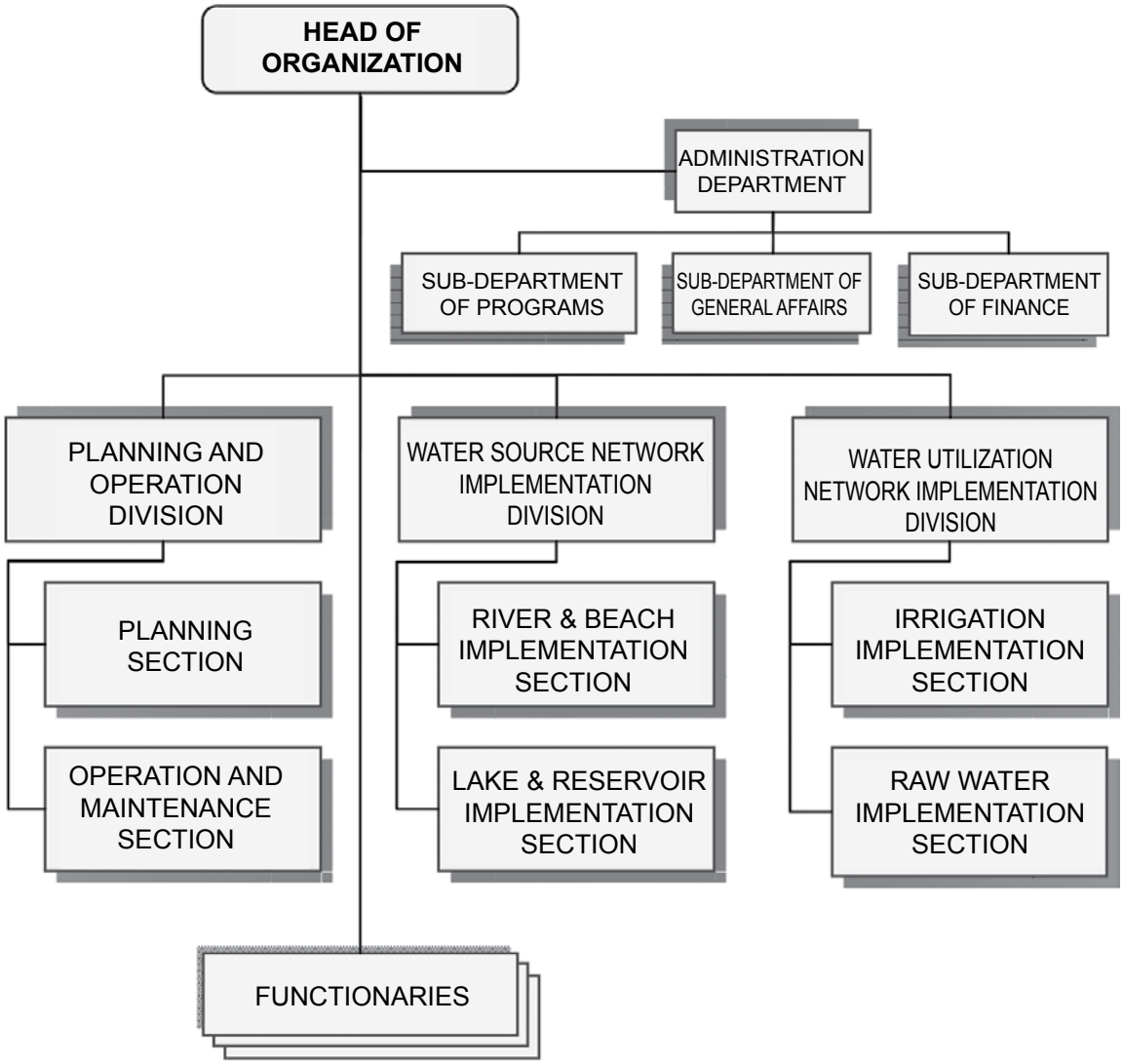


Figure 2: Organizational Chart of BBWS Citanduy

The organizational structure of Balai Besar Wilayah Sungai (BBWS) Citanduy or the Large River Basin Organization of Citanduy was established by the Regulation of Minister of Public Works Number 23/PRT/M/2008, and in accordance with its category as a type-B Large River Basin Organization, the BBWS Citanduy as seen in the figure above is a structural organization led by a second-echelon Head of Organization who is assisted by three third-echelon Heads of Divisions, as shown in the organizational structure above.

In addition to the structural organization, the BBWS Citanduy is also equipped with three functionary organizations, namely:

1) BBWS Work Unit

2) Non-Vertical Work Unit for Particular Purpose (SNVT) for Water Utilization Network Implementation

3) Non-Vertical Work Unit for Particular Purpose (SNVT) for Water Source Network Implementation

1.4. General Condition of Work Area

Figure 3: Work Area of BBWS Citanduy

Geographically, the work area of BBWS Citanduyis located at 108°04'East Longitude to 109°30' East Longitude and 7°03' South Latitude to 7°52'South Latitude.Administratively, the area is located in six regencies and two municipalities in West Java Province and Central java Province. This work area extends to 455,000 hectares, as shown in the following Table 1.

Table 1: Extent of BBWS Citanduy's Work Area

No	Regency/Municipality	Area of Regency/ Municipality (Ha)	Citanduy River Basin	
			Area of Water-shed (Ha)	%
West Java Province				
1	Ciamis Regency + Banjar Municipality	255,371	150,000	32.97
2	Tasikmalaya Regency & Municipality	268,048	68,000	14.95
3	Kuningan Regency	111,700	27,200	5.98
4	Majalengka Regency	120,424	18,400	4.04
Central Java Province				
5	Cilacap Regency + Banyumas Regency	214,257	191,400	42.07
Total			**455,000**	**100.00**

Table 2: Population Growth Projection

No	Regency / Municipality	Population Projection				
		2006	2011	2016	2021	2026
1	Tasikmalaya Regency	435,419	457,630	480,974	505,509	531,295
2	Majalengka Regency *)	17,736	18,696	19,708	20,775	21,900
3	Kuningan Regency *)	32,015	34,831	37,894	41,226	44,852
4	Cilacap Regency *)	1,238,223	1,310,429	1,386,846	1,467,720	1,553,309
5	Tasikmalaya Municipality	350,124	368,530	387,905	408,297	429,762
6	Banyumas Regency *)	47,660	55,763	65,243	76,334	89,312
7	Ciamis Regency	1,172,956	1,178,833	1,184,739	1,190,674	1,196,640
8	Banjar Municipality	164,335	173,488	183,152	193,354	204,124
Total		**3,458,468**	**3,598,200**	**3,746,461**	**3,903,889**	**4,071,194**
Average		**432,309**	**449,775**	**468,308**	**487,986**	**508,899**

Based on Table 2 above, it can be seen that work area of BBWS Citanduy is inhabited by around 3,5 million people (based on the calculation in 2006) and the population is projected to be 4 million people in 2026. Within twenty years there will be a population growth of ± 18% or less than 1% per year. This indicates that urbanization does not or has not yet happened into the work area of BBWS Citanduy, but the concern is that there will be urbanization from the Citanduy river basin.

1.5. Hydrology

The climate in Citanduy River Basin is influenced by 2 (two) seasons, namely dry season and rainy season. Temperatures range from 24°C to 31°C, with average rainfall of 3,000 mm/year.

There are 18 (eighteen) rainfall monitoring stations in Citanduy River Basin distributed as shown in Figure 4 below.

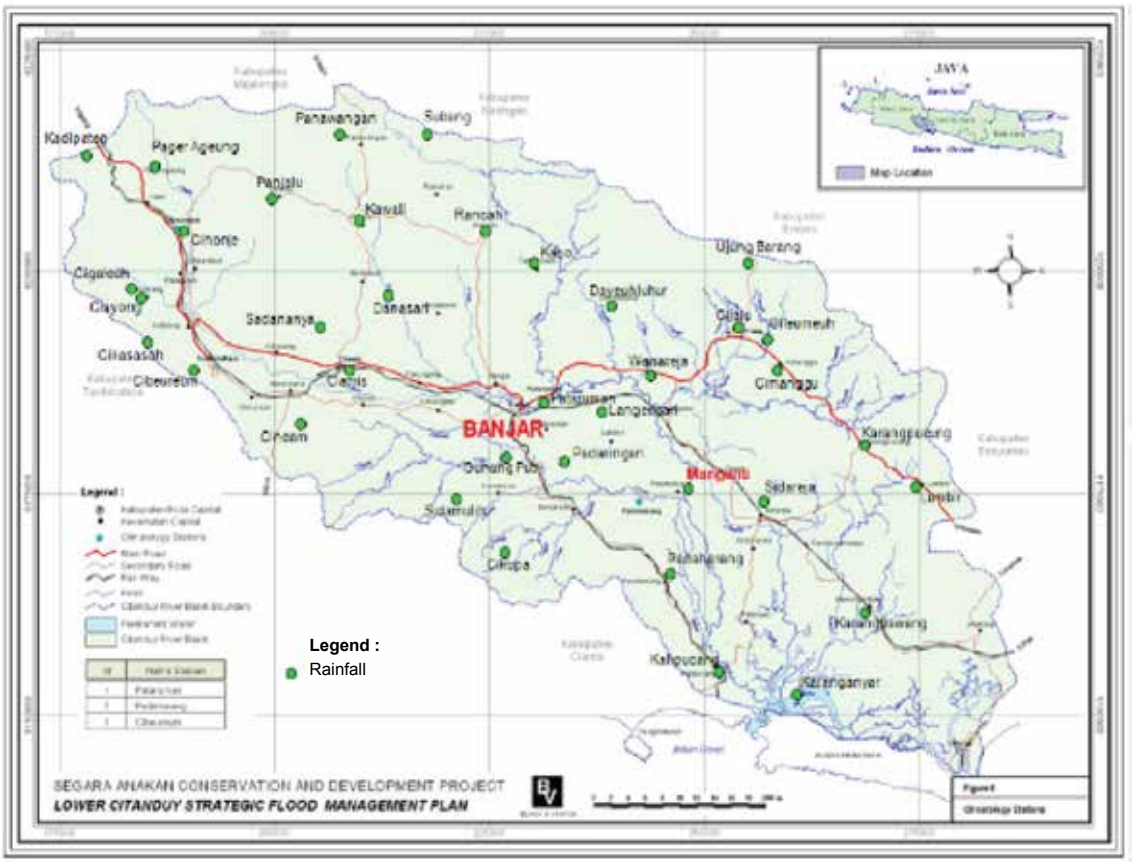


Figure 4 Location Map of Rain Monitoring Stations

Information from the rainfall monitoring stations have been recorded well until 2009. The information, including rainfall data for the periods of 2007, 2008 and 2009, can be found and obtained from the Water Resources Information System (SISDA) managed by the Organization, and they can be found and downloaded from the website of BBWS Citanduy.

In addition, there are also 21 (twenty one) water observation stations distributed in Banjar Municipality, Tasikmalaya Regency, Ciamis Regency and Cilacap Regency, as shown in Figure 5 below.

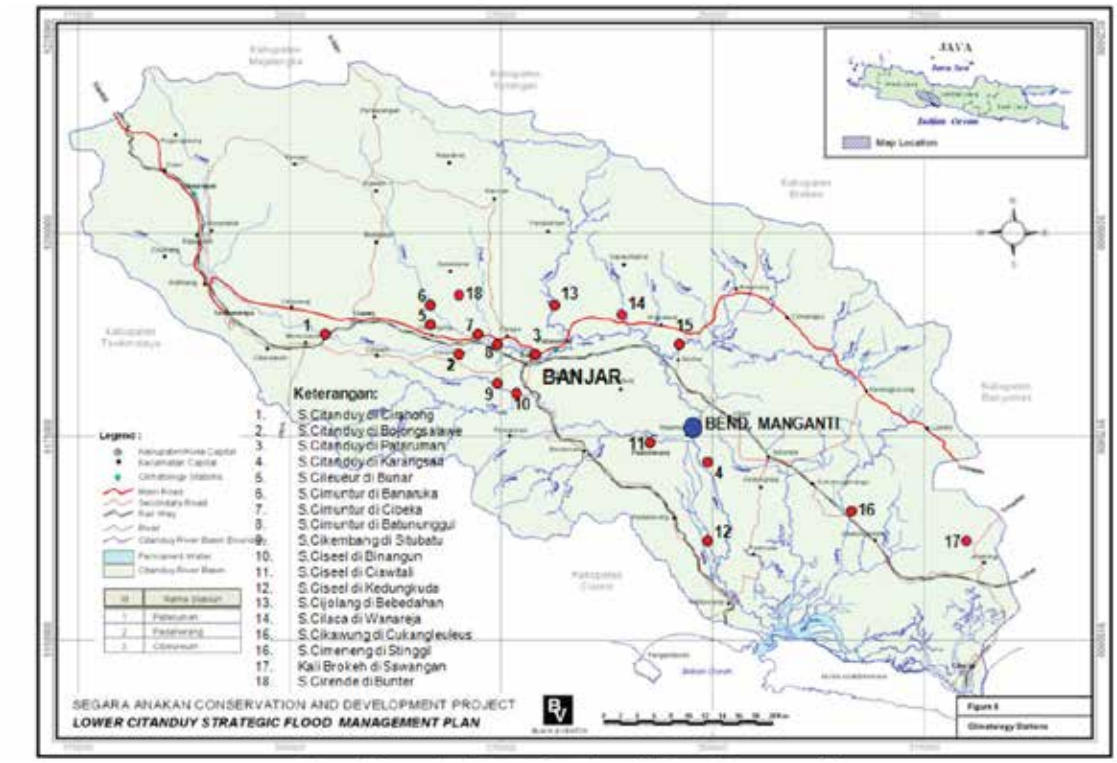


Figure 5: Location Map of Water Observation Stations

Information from the water observation stations have been recorded well for the periods of 2007, 2008 and 2009. The information, including water level data, can be found and obtained from the Water Resources Information System (SISDA) managed by the Organization, and they can be found and downloaded from the website of BBWS Citanduy.

1.6. Watersheds, Rivers and Tributaries

The BBWS Citanduy consists of two watersheds and five sub-watersheds, as shown in Table 3 below.

Table 3: Watersheds in Citanduy River Basin

No	Watershed	Sub-Watershed	Area (Ha)	Total Area (Ha)
1	Citanduy Watershed			350.000
		UpperCitanduySub-watershed	74,000	
		Cimuntur Sub-watershed	60,000	
		Cijolang Sub-watershed	48,000	
		Cikawung Sub-watershed	70,000	
		Ciseel Sub-watershed	98,000	
2	SegaraAnakan Watershed			105,000
Total				**455,000**

The two watersheds consist of 175 tributaries, ranging from the first order to the fifth order, with total lengths of more than 777 kilometers and total watershed areas extending to 4,400 hectares, as shown in Table 4 below.

Table 4: River Orders, River Lengths and Watershed Areas

No	River Order	Total	Length (KM)	Watershed Area (Ha)
1	1	1	175.00	3,500
2	2	52	345.12	980
3	3	75	183.25	n.a
4	4	38	68.25	n.a
5	5	8	n.a	n.a
Total		**174**	**771.62**	**4,480**

According to the Regulation of Minister of Public Works Number 11A/2006, the Citanduy River Basin consists of 8 watersheds, namely Cimeneng, Kadalmeteng, CiputraPinggan, Sapuregel, Kawungeten, Cikonde, Cikembulan and Cihaur.

Meanwhile, the Presidential Decree Number 12 of 2012 states that the Citanduy River Basin consists of 24 watersheds as shown on the map on the cover page.

Table 5: Artificial Lakes (situ)

No	Name of Artificial Lake (Situ)	Area (Ha)	Regency
1	Lengkong	50.00	Ciamis
2	Ciater	3.00	Ciamis
3	Cibubuhan	3.00	Ciamis
4	Cilembu	2.40	Tasikmalaya
5	Sadewata	1.50	Ciamis
6	Wangi	5.00	Ciamis
7	Rancamaya	2.00	Ciamis
8	Mustika	1.00	Kota Banjar
9	Cisaladah	7.00	Tasikmalaya
10	Cibeureum	7.00	Kota Tasikmalaya
11	Cipajaran	3.50	Tasikmalaya
12	Malingping	3.00	Tasikmalaya
13	Rusdi	0.15	Kota Tasikmalaya
14	Bojong	1.80	Tasikmalaya
15	RawaBendungan	300.00	Cilacap
16	Hiyang	10.00	Ciamis
17	Golempang	1.50	Ciamis
18	RancaBojongmengger	2.00	Ciamis
19	Kadupandak	2.00	Ciamis
20	Padahurip	3.50	Ciamis
21	Cimari	3.00	Ciamis
22	Kaso	1.50	Ciamis
Total		**408.20**	

In Citanduy River Basin, there are 22 (twenty two) artificial lakes with a total area of 408.20 ha, as shown in Table 5 above. The artificial lakes are located in many regencies and are managed by the local communities, villages, offices and some of them are managed by the Department of Forestry.

Other than that, there are also 43 traditional reservoirs (embung) spread in Cilacap Regency (12), Ciamis Regency (22), Kuningan Regency (1) and Tasikmalaya Regency (8).

1.7. Issues

A variety of issues are faced by the water resources management in Citanduy River Basin, such as:

a) Critical Lands

The following table on critical lands shows that there are three Citanduy sub-watersheds which critical levels are more than 10 percent, namely Cikawung, Ciseel and Segara Anakan.

Table 6: Critical Lands in Citanduy Watershed

No	Sub-Watershed	UNCRITICAL		MILDLY CRITICAL		CRITICAL	
		Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
1	Upper Citanduy	57,994.83	79.57	8,851.50	12.14	3,914.10	5.37
2	Cijolang	45,197.46	82.50	4,025.07	7.35	3,876.12	7.08
3	Cimuntur	51,804.00	84.16	6,183.09	10.05	1,988.10	3.23
4	Cikawung	53,337.51	76.21	6,033.42	8.62	8,018.82	11.46
5	Ciseel	78,009.03	78.39	7,584.84	7.62	10,989.00	11.04
6	SegaraAnakan	76,536.18	66.60	10,079.91	8.77	17,851.68	15.53

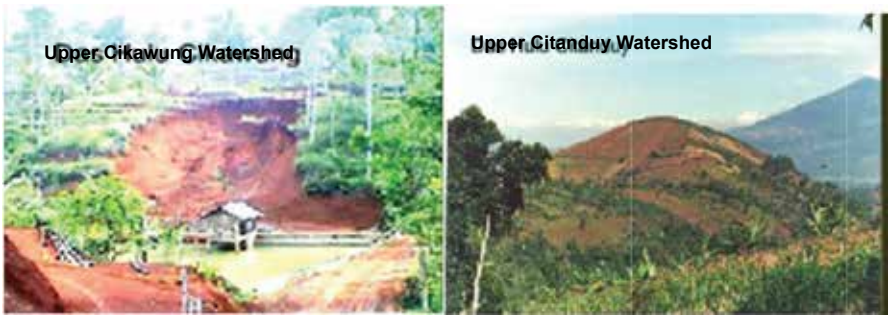


Figure 6: Critical Lands in Citanduy Watershed

b) River Regime Coefficients

The hydrological condition of critical watersheds, especially in the second-order river of Cimeneng, is indicated by the high river regime coefficients, as shown in Table 7 below.

Table 7: River Regime Coefficients

No	Name of River, Location of AWLR	River Order	Annual Qmax	Annual Qmin	Qmax/ Qmin
1	Citanduy in Pataruman	1	846	5.63	150
2	Citanduy in Manganti	1	927	5.86	158
3	Cimuntur in Batununggal	2	323	4.43	67.63
4	Cijolang in Bedebahan	2	323	4.37	73.9
5	Cikawung in Cukangleuleus	2	300.04	11.34	26.44
6	Ciseel in Ciawitali	2	285	2.43	117.2
7	Cimeneng in Stinggil	2	143.88	0.05	2,877.60

b) Erosions and Sedimentations

From the erosion phenomena shown in the following table, it can be seen that the Cijolang Sub-watershed, Cikawung Sub-watershed and Segara Anakan Sub-watershed are categorized as sub-watersheds with heavy level of erosion.

Table 8: Erosion and Sedimentation

No	Sub-Watershed	Area (Ha)	Actual Erosion (t/ha/year)	Potential Erosion (t/ha/ year)	Sediment (mm/ year)	Level of Erosion
1	Upper Citanduy	74,800	131.24	596.56	1.40	Moderate
2	Cimuntur	60,500	88.55	245.96	0.91	Mild
3	Cijolang	48,030	408.24	1,570.16	4.88	Heavy
4	Ciseel	96,500	73.95	528.20	0.74	Mild
5	Cikawung	72,250	268.36	1,490.87	3.08	Heavy
6	Segara Anakan	110,000	181.88	1,653.46	2.00	Heavy

The critical land condition and erosion phenomena led to sedimentation in the downstream area, which then gave rise to siltation and the narrowing of Segara Anakan Lagoon's area, as shown in the following Figure 7 (Study by ECI, 1994).

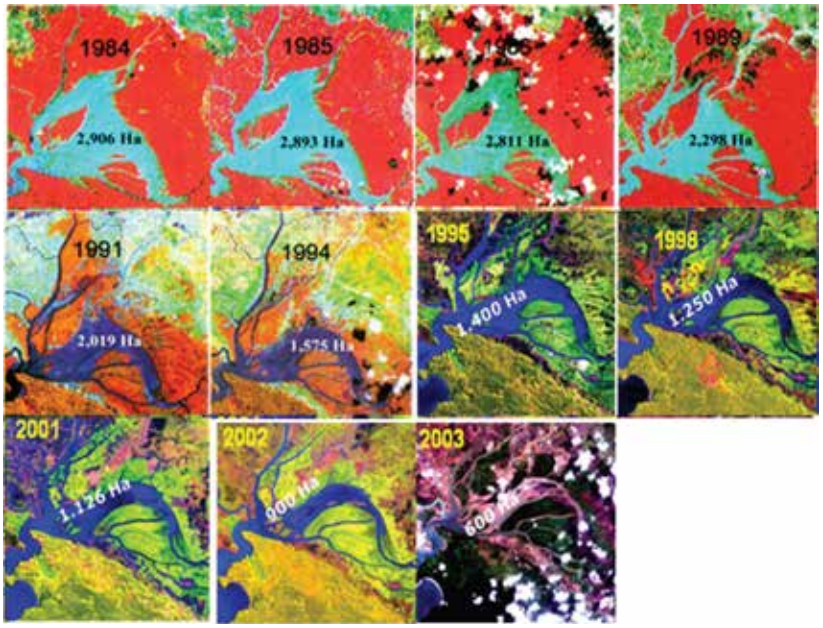


Figure 7: Sedimentation in Lagoon

Table 9: Lagoon Area'sRate of Decline

Year	Area (Ha)	Year	Area (Ha)
1984	2,906	1992	1,800
1985	2,893	1994	1,575
1986	2,811	2000	1,200
1989	2,298	2001	800
1991	2,019	2003	600
1992	1,800	2005	834

The total sedimentation that entered into SegaraAnakan is 5,000,000 m³/year and the amount deposited in the SegaraAnakan Lagoon is 1,000,000 m³/year.

The sedimentation not only causes siltation, but also reduces the lagoon's surface area. The emergence of a new land due to the sedimentation also led to conflicts of interest related to its utilization.

Figure 8: Sedimentation in Cikonde River Mouth

d) Floods and Droughts

The critical hydrological condition of Citanduy Watershed results in high coefficient of river regime or high maximum discharge-minimum discharge ratio. The direct impacts are “excess” of water in the rainy season and “lack” of water in the dry season, or in other words, floods and droughts.

Areas with potential of flooding are spread in Kuningan Regency, Majalengka Regency, Tasikmalaya Regency & Municipality, Ciamis Regency and Banjar Municipality (in West Java Province), Cilacap Regency and Banyumas Regency (in Central Java Province), covering a total area of 73,350 hectares, as shown in the following Figure 9.

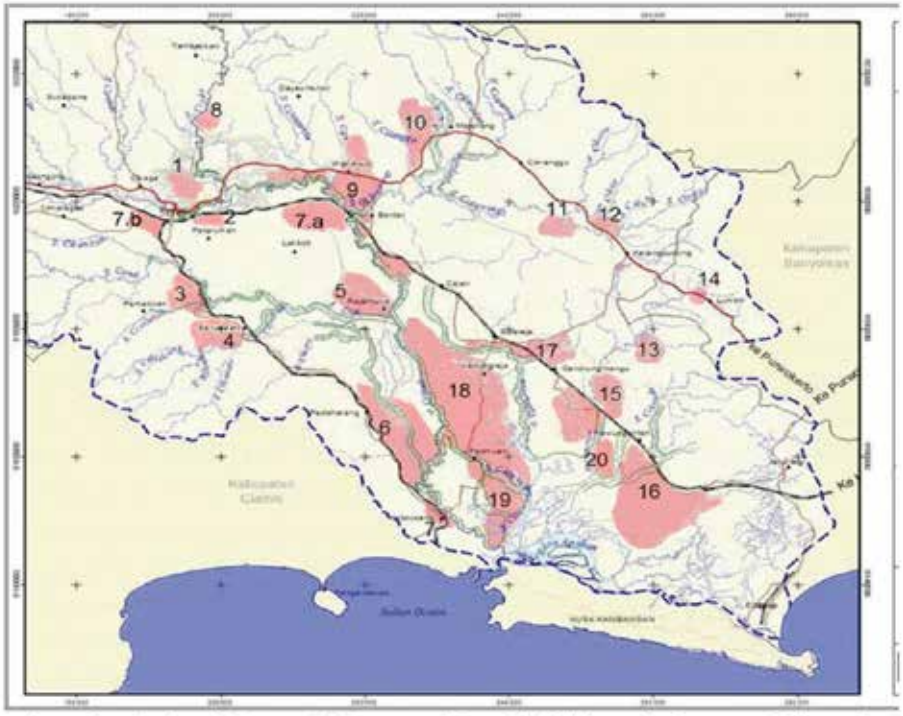


Figure 9: Locations of Flood Potential Areas in Citanduy River Basin

Table 10: Dry Irrigation Areas

No	Name of Irrigation Area	Sub-regency	Regency/Municipality	Area (Ha)
1	Cikunten II	Manonjaya	Kab. Tasikmalaya	45
2	Cikunten II	Cibeureum	Kota Tasikmalaya	323
3	South Lakbok	Padaherang	Kab. Ciamis	821
4	North Lakbok	Lakbok	Kab. Ciamis	26
5	North Lakbok	Purwadadi	Kab. Ciamis	109
6	RawaOnom	Cisaga	Kab. Ciamis	19
7	RawaOnom	Purwaharja	Kota Banjar	52
8	North Lakbok	Langensari	Kota Banjar	53
Total				**1,448**

Source: Inventorying Study of Areas Susceptible to Flood, Landslide and Drought in Citanduy River Basin by PT. SAE CITRA INDAH Consultant, FY 2008

Areas that experience drought are irrigation areas located in various sub-regencies in Ciamis Regency, Tasikmalaya Regency & Municipality and Banjar Regency & Municipality. In total, Irrigation Areas that experience drought extend to 1,448 hectares, as presented in the details of Table 10 above.

Figure 10: Citanduy River at the Upper Part of Pataruman Weir

Areas that experience shortage of raw water include 21 sub-regencies spread in 4 regencies, as shown in the following table.

Table 11: Droughted Irrigation Areas

No	Regency	Sub-regency
1	Ciamis Regency	Kawali, Panawangan, Kalipucang, Banjarsari
2	Cilacap Regency	KampungLaut, Kawunganten, Bantarsari, Patimuan, Kedungreja
3	Tasikmalaya Regency	Singaparna, Mangunjaya
4	Tasikmalaya Municipality	Tawang, Cibeureum, Kawalu Tamansari, Purbaratu

e) Landslides

In Citanduy River Basin, there are at least 13 villages in 4 regencies which are prone to landslides. The names and locations of those villages can be seen in the following Table 12.

Table 12: Landslide-prone Areas in Citanduy River Basin

No	Province	Regency	Sub-regency	Village
1	West Java	Tasikmalaya	Pagarageung	Guranteng
		Ciamis	Rancah	Rancah
			Tambaksari	Kadupandak
				Kaso
			Panawangan	Sadapaingan
				Cinyasang
				Indragiri
2	Central Java	Cilacap	Wanareja	Cukangleuleus
				Malabar
			Majenang	Bener
				Boja
		Banyumas	Lumbir	Lumbir
				Parungkamal

Figure 11: Riverbank Landslide

Landslides also occurred in several riverbanks and this increased the amount of sediment that led to siltationin the downstream.

2. WATER RESOURCES MANAGEMENT

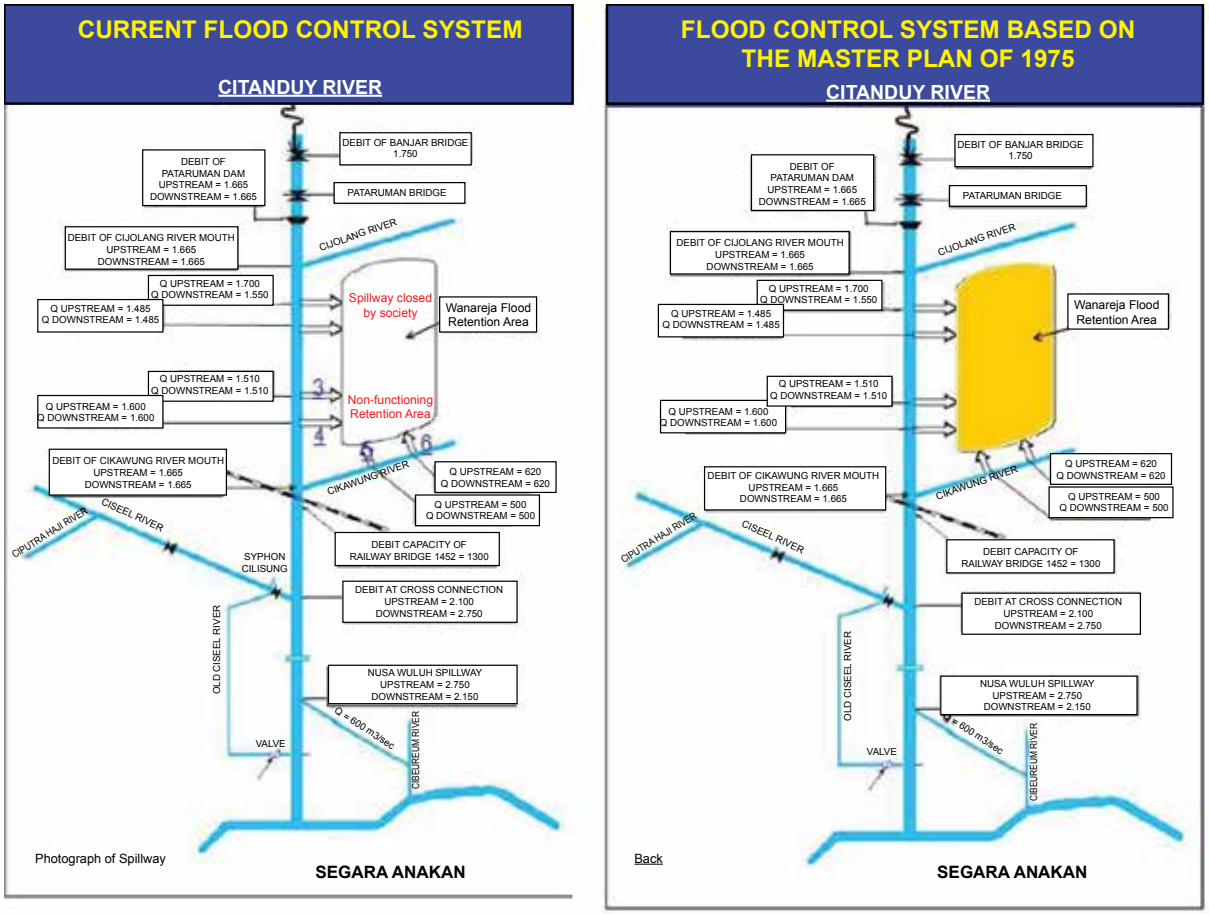


Figure 12: Flood Control System Based on the Master Plan of 1975 and the Current

Based on the 1975 Master Plan, the water resources management in Citanduy River Basin was initially carried out as an attempt to control flooding (The Citanduy River Basin Development Project Master Plan, Directorate General of Irrigation, Department of Public Works, 1975).

The 1975 Master Plan was further developed to examine flood prevention efforts through a study on early warning system (The Citanduy River Basin Development Project Flood Warning Study, Directorate General of Irrigation, Department of Public Works, October 1984).

In 2003, attempts to develop raw water potentials were started in order to meet various requirements for water in accordance with results of studies (Raw Water Potential Identification Study in Citanduy-Ciwulan Area, CitanduyCiwulan River Basin Development Master Project, Citanduy-Ciwulan Water Source Development and Management Project, Guidance and Planning Project Division, July 2003).

According to Law Number 7 of 2004 regarding Water Resources, water resources management has to be based on a management model which preparation must involve all stakeholders, including empowering, monitoring and involving the community through the Water Resources Management Coordination Team (TKPSDA).

Therefore, in 2010, the model was prepared by taking into consideration a variety of management aspects and not just flood prevention and irrigation aspects.

Since 2008, the Mount Galunggung Eruption Management Project has been merged as a part of BBWS Citanduy.

Figure 13: Galunggung Crater and Tunnel

In addition, BBWS Citanduy also manages coastal protection activities, especially against abrasion. Some of the coastal locations that have been managed are the Pangandaran Beach, Bojongsalawe Beach, Bagolo Beach and so on.

Figure 14: Bojongsalawe Beach and Pangandaran Beach

2.1. Water Resource Conservation

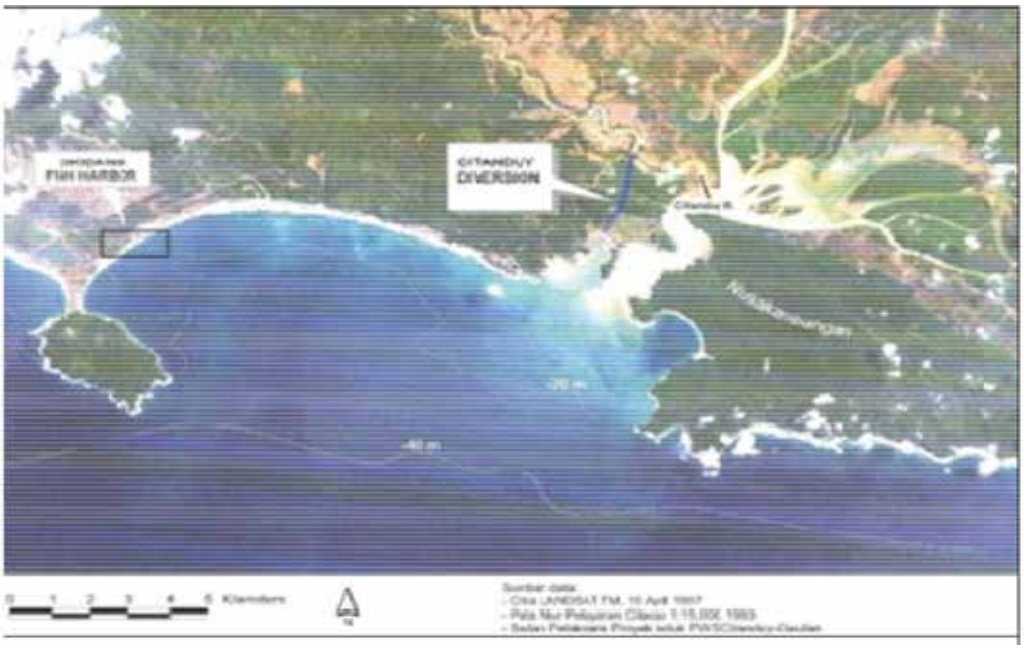


Figure 15 SegaraAnakan

a) Segara Anakan

One of the conservation objects in Citanduy River Basin is SegaraAnakan because it has an important value and the potential to be developed aside from the issues that occur in the area.

Important Value of Segara Anakan:

- Estuarine ecosystem, germplasm, place/habitat for various species of organisms, natural resources of flora and fauna
- Food chain or a place for fish to feed
- Large and small river mouth, which is the Citanduy River

Potentials of SegaraAnakan:

- Mangrove tourism around the waters in the channel between Majingklak (Pangandaran) and Cilacap (Paket Pancimas or Pangandaran-Cilacap Banyumas Tour Package)
- Village Attraction Tourism
- Natural caves in Nusakambangan Island
- Rancababakan Beach, Permisan Beach on the Coast of Nusakambangan Island

Issues:

- Critical watersheds are increasingly expanding
- Erosion and sedimentation
- Lagoon area is decreasing and becomes increasingly shallow
- Conflict of interest in the utilization
- Environmental quality decline, pollution problem (garbage)
- Silting of river channels and estuaries
- Flood and drought

b) Check-dam

Check-dams are built with a primary purpose of preventing excessive sedimentation at the upper part and the mouth of rivers which causes a narrowing and siltation of river channels.

Several check-dams built in Mount Galunggung area function to prevent or reduce disasters caused by debris flow flood.

In several locations, the construction of a check-dam is accompanied with the construction of embankments on the right and left sides of the river channel in order to create a sand pocket.

Figure 16: Goler Check-Dam and Pisitan Check-dam

c) Traditional Reservoir (embung)

In Citanduy River Basin, there are 43 traditional reservoirs (embung) which are mostly utilized for irrigation, raw water and fisheries.

Effort of conservation is also carried out by constructing *embungs* to accommodate excess water during the rainy season, such as EmbungCilentah, EmbungCurugMujan, Embung Kaligombong, etc.

Figure 17: EmbungCurugMujan and EmbungCilentah

d) Artificial Lake (situ)

As many as 22 artificial lakes (situ) in Citanduy River Basin have been utilized for various requirements such as irrigation, fisheries, drinking water, tourism etc, and some are also utilized for water resources conservation, such as Situ Taraju.

Figure 18: Situ Taraju

2.2. Water Resources Utilization

Water resources utilization in Citanduy River Basin is still dominated by the fulfillment of irrigation requirement, which is the irrigation of rice fields in a total area of 42.882 hectares, located in West Java Province as well as in Central Java Province.

Figure 19: Manganti Weir and Cihaur-Sidareja Regulator

This is very reasonable because the value ofagricultural production reaches more than one trillion dollars each year, and agriculture is the main livelihood for more than one million inhabitants, as shown inthe following description.

Based on the management aspect, Irrigation Areas are categorized as follows:

1) Irrigation Areas which are under the authority of the Central Government, covering a total area of 28,464 hectares, located in West Java Province and Central Java Province, namely:

- West Java

i.	Rawa Onom Irrigation Area	:	947 ha
ii.	South Lakbok Irrigation Area	:	4,537 ha

- Central Java

i.	Sidareja Irrigation Area	:	9,188 ha
ii.	Cihaur Irrigation Area	:	13,229 ha
iii.	Panulisan Irrigation Area	:	563 ha

2) Irrigation Areas which operations and maintenance are co-administered by the provincial governments, covering a total area of 14,418 hectares, with details as follows:

i.	Sidareja Irrigation Area	:	9,188 ha
ii.	Cihaur Irrigation Area	:	13,229 ha
iii.	Panulisan Irrigation Area	:	563 ha

3) Irrigation Areas which are under the authority of the provincial, regency and municipality governments, covering a total area of 73,420 hectares.

4) Production Value Estimation

- Cropping patterns:

(a)	Cropping season I	:	Rice
(b)	Cropping season II	:	Rice
(c)	Cropping season III	:	Secondary crops

With cropping patterns as above, the cropping intensity is 175% per year.

- Rice production : 7 [tons/ha]
- Grain price : Rp 3,000,- [per kg]
- Irrigation areas managed directly by the Central Government (BBWS Citanduy): 28,464 ha
  Production value = 28,464 x 7,000 x 175% x Rp 3,000,- = Rp 1,046,052,000,000,-
- Irrigation areas co-administered with Provincial Government: 14,418 ha
  Production value = 14,418 x 7,000 x 175% x Rp 3,000,- = Rp 529,861,500,000,-
  Total Production Value = Rp 1,575,913,500

5) Number of People who receive direct income from irrigation management

- Estimated land ownership: 0.200 ha/farmer
- Estimated number of family members per farmer: husband, wife and three children, total 5 family members.
- Irrigation areas managed directly by the Central Government (BBWS Citanduy): 28,464 ha
  Number of Population = 28,464 ha / 0.20 ha x 5 persons = 711,600 persons
- Irrigation areas co-administered with Provincial Government: 14,418 ha
  Number of Population = 14,418ha / 0.20 ha x 5 persons = 360,450 persons
  Total Population = 1,072,050 persons

2.3. Control of Water Destructive Power

Figure 20: Riverbank Protection in Karangsari

To control water destructive power such as floods, debris flow floods, landslides with their many consequences including riverbank erosion, channel and lagoon siltation, many facilities have been built according to the management plan described in the beginning of chapter 2 above.

Some of the infrastructures that have been built are shown in the following Table 13.

Table 13: Main Infrastructures of Water Resources Management Constructed Until Fiscal Year 2009

No	DESCRIPTION	MASTER PLAN (1975)	REALIZATION
1	Flood Embankment	173 km	325 km
2	Dam	7 locations	0
3	Retarding Basin :		
	- Wanareja (Central Java)	1 location (1.000 Ha)	1 locations
	- Cipanggang (West Java)	1 location (± 600 Ha)	0
4	Flood Spillway	8 units	7 units
5	Valve :		
	- New	15 units	15 units
	- Rehabilitated	19 units	19 units
6	Ciseel - Citanduy Cross Connection	1.85 km	1.85 km
7	Cilisung Siphon	1 unit	1 unit
8	BantarheulangSiphon	1 unit	1 unit
9	Nusawuluh Flood Way	13.50 km	13.50 km
10	Water Resources Conservation		
	- Check Dam	0	50 locations
	- Terracing	1 location	1 location
	- Artificial Lake (situ)Rehabilitation	0	8 locations
	- Traditional Reservoir (embung)	0	11 locations
	- Rural Raw Water	0	20 locations
11	Manganti Barrage	1 unit	1 unit
12	Mount Galunggung Disaster Management /Sand Pocket	0	1 unit
	Check Dam, Tunnel, etc		
13	Irrigation Rehabilitation & Development		
	- Rehabilitation	22,793 Ha	22,793 Ha
	- New	28,493 Ha	30,000 Ha
14	Coastal Protection Structure	0	3 locations

2.4. Water Resource Information System

The Water Resources Information System of Citanduy River Basin is managed by the Water Resources Information System of BBWS Citanduy, which office is located on Jl. Prof. Dr. Ir. Sutami No. 1, Banjar, Telephoneb+62-265-741-302.

The information is stored on the official site of BBWS Citanduyand can be accessed through the following address: www.bbwscitanduy.com.

Some of the information that can be found and downloaded are:

- BBWS Citanduy profile
- Model Plan, 28 September 2010 edition
- Citanduy River Basin Water Resources Model Plan Matrix
- Information of Rainfall Data for 2007, 2008 and 2009
- Information of River Water Level Data for 2007, 2008 and 2009
- Information of Sedimentation for 2007, 2008 and 2009

2.5. Community Empowerment and Participation

Community empowerment, monitoring and involvement in water resources management are carried out through a variety of activities organized by two forums, namely the Water Resource Management Coordination Team (TKPSDA) and the National Movement for Water Safeguard Partnership (GN-KPA).

The Water Resource Management Coordination Team (TKPSDA) of Citanduy River Basin was established based on the Decree of Minister of Public Works Number 255/KPTS/M/2010 dated 2 March 2010 on the Establishment of Water Resource Management Coordination Team (TKPSDA) of Citanduy River Basin.

The Water Resource Management Coordination Team (TKPSDA) of Citanduy River Basin consists of 42 members in which 21 members represent governmental agencies and 21 members represent community organizations or non-governmental organizations.

The Community Participation Improvement Training As Part of the Implementation of the National Movement for Water Safeguard Partnership (GNKPA) has been held in Ciamis Regency, West Java on 12 – 14 October 2011.

GNKPA activities are carried out in 4 regencies and 2 municipalities with priorities set on Ciamis (CitalahabVilale; Karangjaya Sub-regency; Cibubur Village; Citaklakuk Village; Parung Sub-regency; Panteng Sub-regency), Tasikmalaya Regency; Garut and Cilacap, including acitivities in Manganti Weir and in Paruman Weir.

3. WATER RESOURCES MANAGEMENT IN THE FUTURE

3.1. General

The most prominent aspect of water resources management in Citanduy River Basin is the aspect of utilization, specifically for irrigation.

Based on the IWAKO study in 1990, there are ± 94 springs in Ciamis regency with discharge of 1,1 liters/ second in each spring. On the slopes of Mount Sawal, there are large springs (discharge of 10-20 liters/ second) at the height of 400-800 MSL, with average spring discharge of 2 – 3 liter/ second, while for Tasikmalaya regency, there are 1015 springs.

Aside from that, there are also several locations with potential for reservoir construction, such as Matenggeng, Manonjaya, LeuwiKeris, Binangun 1 and Cikembang.

Some artificial lakes and traditional reservoirs also have the potential to be developed for irrigating rainfed rice fields.

3.2. Comprehensive Management

Water resources management in Citanduy River Basin can still be developed comprehensively by referring to various existing legal provisions and laws such as the article 51, 53, etc., of Law Number 7 regarding Water Resources, Law Number 26 of 2007 regarding Spatial Planning, Government Regulation Number 26 of 2008 regarding National Spatial Plan, particularly article 99 and 106 concerning Zero Delta Q Policy, and article 34, 35, 36, and so forth of Government Regulation Number 38 of 2011 regarding Rivers.

3.3. Implementation Strategy

The establishment of the Water Resource Management Coordination Team (TKPSDA) of Citanduy River Basin based on the Decree of Minister of Public Works Number 255/KPTS/M/2010 dated 2 March 2010 is understood as a mandate of Law Number 7 of 2004 regarding Water Resources, and the purpose it to accommodatethe aspirationsofall stakeholderson the management ofwater resources.

Therefore, the water resources management model recommended to the Minister of Public Works for approval should be able to present all aspects of managementin a comprehensive manner, as well as implement the mandates of all existing regulations.The Management Plan, as a detail of the Management Model, should be able to be made as reference for the Large River Basin Organization in preparing the Strategic Plan, as well as a reference for the Regional Government in preparing the Regional Long-term/Medium-term Development Plan (RPJPD/ RPJMD) and the Regional Government Work Plan (RKPD) in order to realize the implementation of the development.

3.4. Artificial Lake (situ) and Traditional Reservoir (embung)Development

Not all of the artificial lakes and traditional reservoirs in Citanduy River have been utilized, and they can still and need to be developed to irrigate rainfed rice fields, meet the raw water requirement, provide water for fisheries as well as tourism.

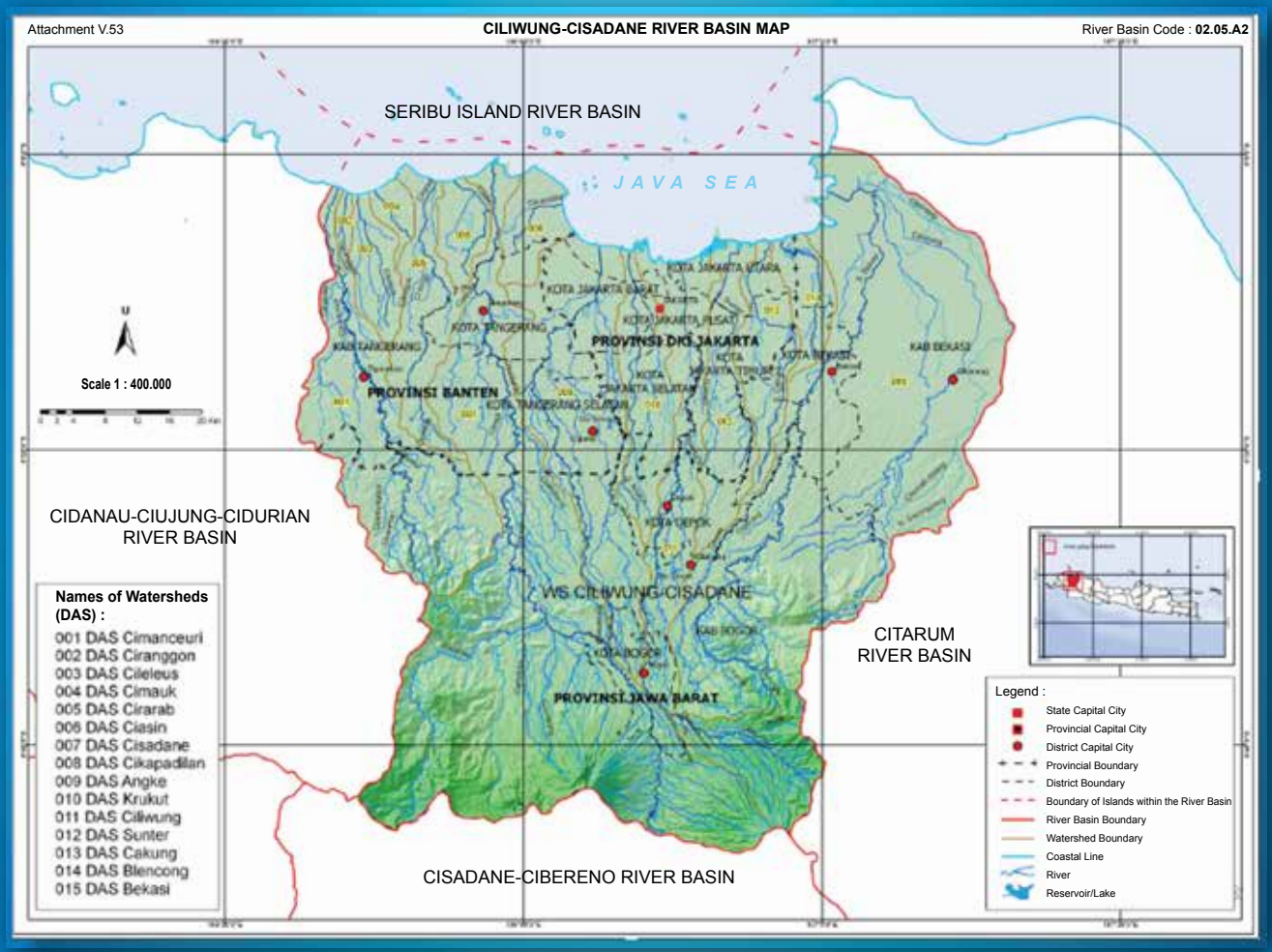
These development efforts should involve all stakeholders and take into account the operational and maintenance aspects in order to gain optimal benefits and to guarantee the sustainability of the functions.

3.5. Erosion and Sedimentation Control

Impacts of erosion in the upstream area can be seen clearly in the sedimentation that occurred in the downstream area, especially in the Segara Anakan lagoon. In general, erosion that occurs in river channels is relatively smaller than the erosion that occurs outside the river channels, including the products resulted from the Mount Galunggung eruption and in crop cultivation areas.

Therefore, efforts of erosion control need to involve various relevant agencies and community. Socialization activities or public awareness campaigns need to be done first on particular occasions or through the GNKPA forum.

B2. LARGE RIVER BASIN ORGANIZATION OF CILIWUNG-CISADANE



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1. DESCRIPTION OF ORGANIZATION

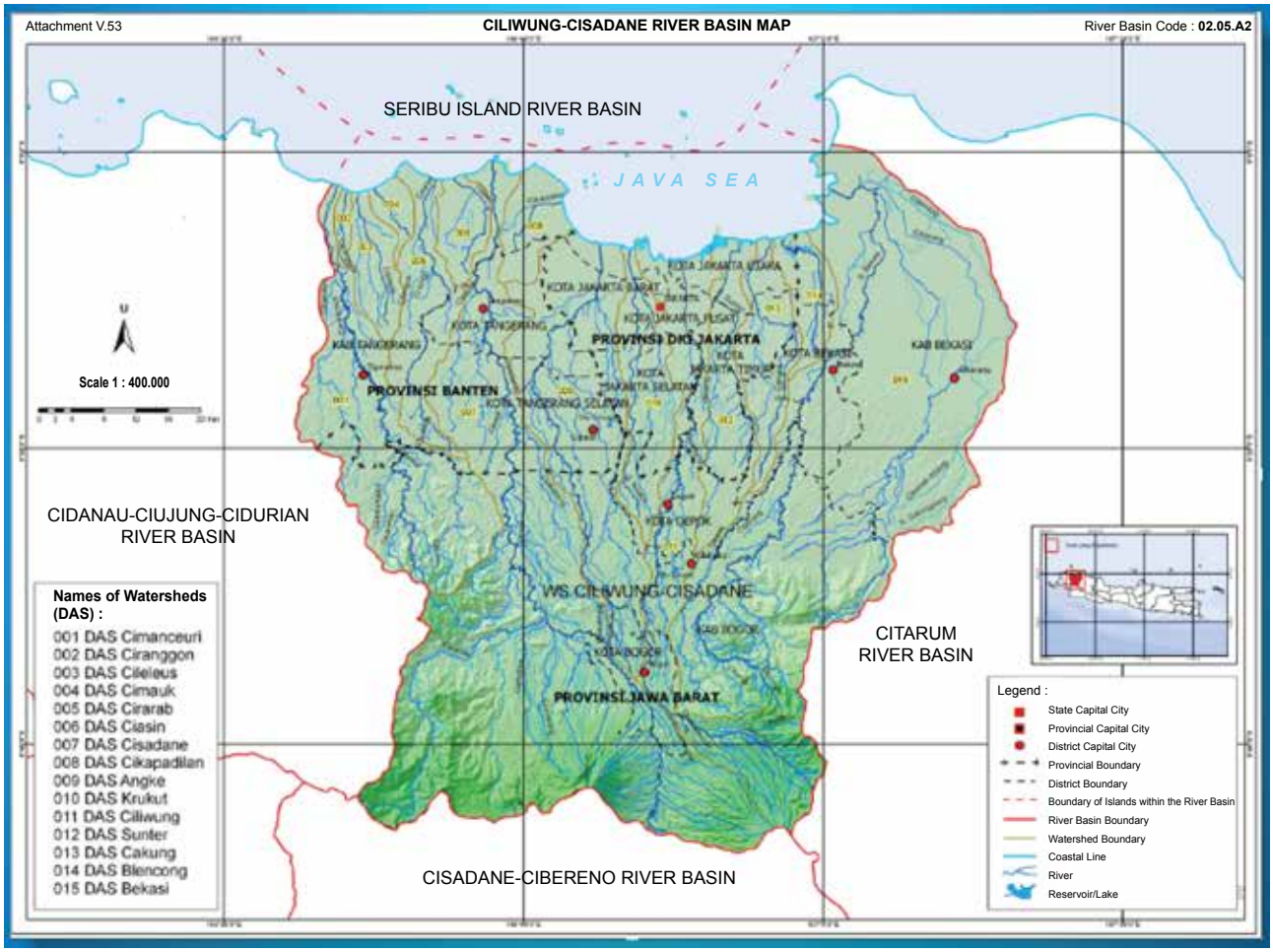


Figure 1: Work Area of BBWS Ciliwung-Cisadane

1.1. General Information

Name	:	Balai Besar Wilayah Sungai Ciliwung-Cisadane
Address	:	Jl. Inspeksi SaluranTarum Barat No. 58
Municipality	:	Jakarta13620
Telephone	:	(021) 8190210; 8190856; 8196945
Facsimile	:	(021) 8196145; 8190856
Website	:	http://.bbwsciliwungcisadane.com
E-mail	:	
Legal Basis	:	Regulation of Minister of Public Works Number 23/ PRT/M/2008
Work Area	:	Ciliwung-CisadaneRiver Basin
River Basin Classification	:	Cross-provincial River Basin
River Basin Code	:	02.10

1.2. Brief History

1965	:	Flood Prevention Project Command (KoproBanjir)
1977	:	Greater Jakarta Flood Management Project
1994	:	Master Project of Ciliwung-Cisadane River Basin Development
2008	:	Balai Besar Wilayah Sungai Ciliwung-Cisadane (Large River Basin Organization of Ciliwung-Cisadane)

The President of the Republic of Indonesia, Ir. Soekarno, issued the Republic of Indonesia Presidential Decree Number 296 of 1965 regarding “Flood Prevention Project Command in the Special Capital Region of Greater Jakarta” dated 11 February 1965. Soon afterwards, the “PROJECT COMMAND” was established. This Project Command was responsible to the President of the Republic of Indonesia c.q. the Minister of Public Works and Electric Power, and appointed as the “PROJECT COMMANDER” was Ir. Sujono Sosrodarsono.

The Balai Besar Wilayah Sungai (BBWS) Ciliwung-Cisadane is a type-B large river basin organization which organizational structure consists of:

1) Administration Department
2) Program and Planning Division
3) Implementation Division
4) Water Resources Operation and Maintenance Division

In addition, BBWS Ciliwung-Cisadane also has functionaries that serve as technical implementation units (UPT).

1.3. Human Resources

BBWS Ciliwung-Cisadane has 89 technical employees and 107 non-technical employees, making a total of 196 employees. These employees are spread in the head office as well as in the field, with details as shown in the following Table 1:

Table 1: Human Resources

Human Resource	Program & Planning Division	Implementation Division	Operation & Maintenance Division	Administration Department	Total
Engineer	?	?	?	-	89
Non Engineer	?	?	?	33	107
Total	**19**	**94**	**50**	**33**	**196**

1.4. General Condition of Work Area

a) Geography

As many as 40% or 24,000 hectares of the Special Capital Region of Jakarta Province’s total area are lowlands, especially in areas such as Muarabaru, Papnggo, Warakas, etc. The elevations range from +0.50 M to +1.20 M of PP (PeilPriok). Normal sea level is around +1.40 M of PP and maximum tidal elevation is around +1.90 M of PP.

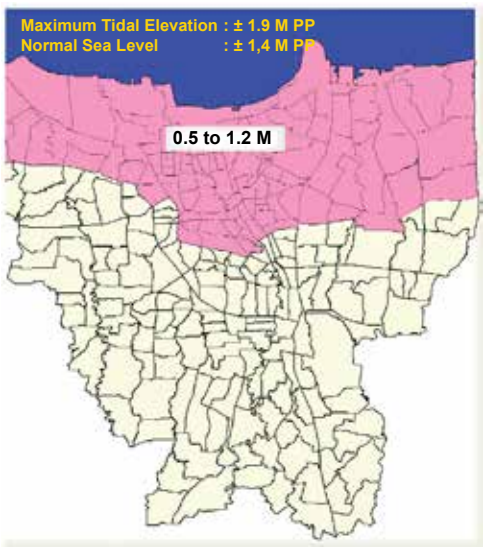


Figure 2: Geography of Jakarta

In the beginning, those areas were always inundated or were in the form of swamps, and today there are still at least 69 locations with the word ‘rawa’ (which means swamp) in their names, such as Rawa Belong, Rawa Mangun, RawaBebek, RawaBuaya, etc. (Gunther W. Holtrof, Jakarta-Jabodetabek Street Atlas).

Some estuaries such as Ciliwung estuary in Marina, PasarIkan, Pluit and Duri, are not always able to drain river water into the sea. In fact, sea water often enters the estuaries, especially at high tide. Due to this, tidal gates are built in those estuaries and in Pluit, a reservoir and pump were built to dispose water into the sea.

The lowlands are very susceptible to inundation because of the entering of sea water into the lands through leaking sea embankment or sea embankment that's overflowed by tides.

b) Land Subsidence

Based on the Bandung Geological Agency study results, land subsidence in the Special Capital Region of Jakarta during the period of 1982-1997 reached 180 cm (Murdohardono, 2010). Meanwhile, according to Abidin et al., land subsidence rates are 1-28 cm per year.

Table 2: Land Subsidence in Jakarta

Method	Period	Subsidence Rates (cm/year)
Leveling surveys	1982 - 1991	1 - 9
	1991 - 1997	1 - 25
GPS surveys	1997 - 2010	1 - 28
InSAR	2006 - 2007	1 - 12

Figure 3: Tidal Flood in North Jakarta on 26 November 2007

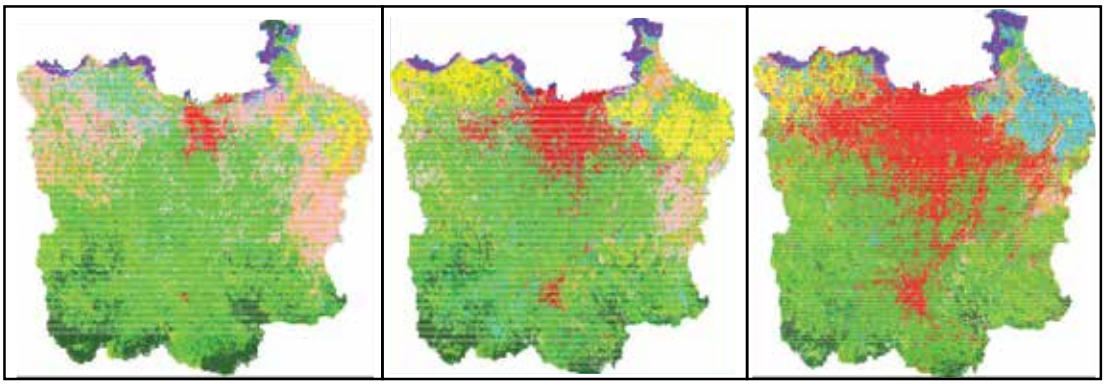
Figure 4: Map of Tidal Flood Locations in North Jakarta

Some opinions state that the occurring land subsidence is an accumulation of cramming from building or settlement loads due to natural consolidation process and land subsidence process. However, there is another opinion that stating that land subsidence is caused by high level of groundwater abstraction by industries, hotels etc., due to lack of clean water supplied by the Regional Drinking Water Company (PDAM) of Jakarta. This is currently being investigated by the Office of Industries and Energy of Jakarta. It should be noted that the clean water supply for Jakarta is only 19.4 m^3/sec, while the real requirement is around 28 m^3/sec. This water deficit is covered by deep groundwater and shallow groundwater.

The Regional Government of Jakarta attempts to slow down the rate of deep groundwater abstraction by making deep groundwater retribution tariff much higher than clean water tariff for businesses, which value is Rp12,500,-/m^3.

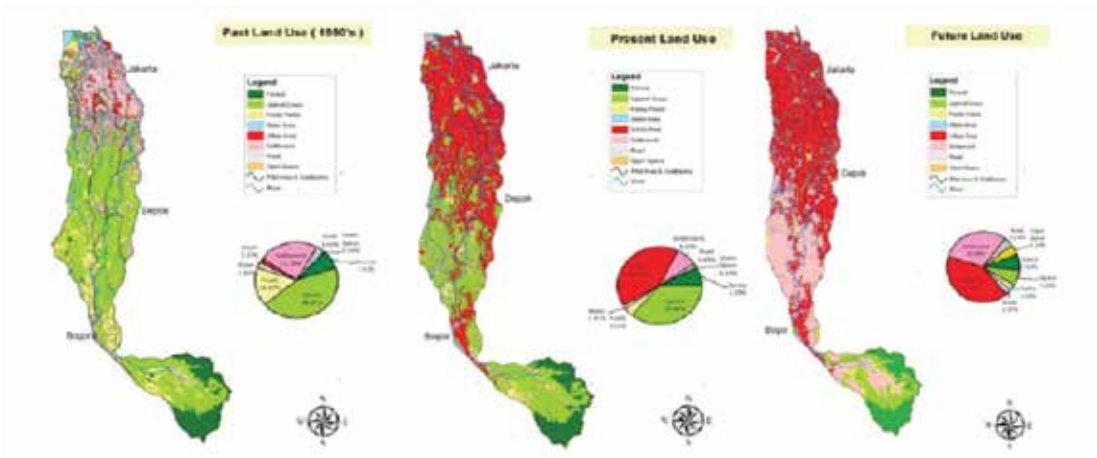
c) Land Use

Land use in Ciliwung-Cisadane River Basin has experienced a lot of changes, especially around urban areas. Many rice fields, dry fields and other open space have changed into residential areas, commercial areas, office areas and other urban infrastructures. A study conducted by the Institutional Revitalization Project for Flood Management in Jabodetabek (2008) revealed that the land-use changes resulted in increased flow coefficient from 0.60 (1980) to 0.66 (2008) and it is estimated to increase to 0.72 (2030) along with the increase of urbanization from 28.8% to 50.8% and 75.8%.



1972 1992 2005, Djakapermana, 2008

Figure 5: Land-Use Changes in Ciliwung-Cisadane River Basin



1980's Urbanization 28.8% Run-off Ratio f=0.6	2008 Urbanization 50.8% Run-off Ratio f=0.66	Future Prospect Urbanization 75.8% Run-off Ratio f=0.72

Figure 6: Land-Use Changes in Ciliwung Watershed

One of the direct impacts brought by the land-use changes is increased run-off coefficient, as shown in the following Table 2.

Table 3: Flow Coefficient Increase

Year	1980	2008	2030
Urbanization	28.80%	50.80%	75.80%
Run-off Coefficient	0.6	0.66	0.72

As a consequence, the Ciliwung River's flood discharge increased by 49% in Depok and 57% in Manggarai.

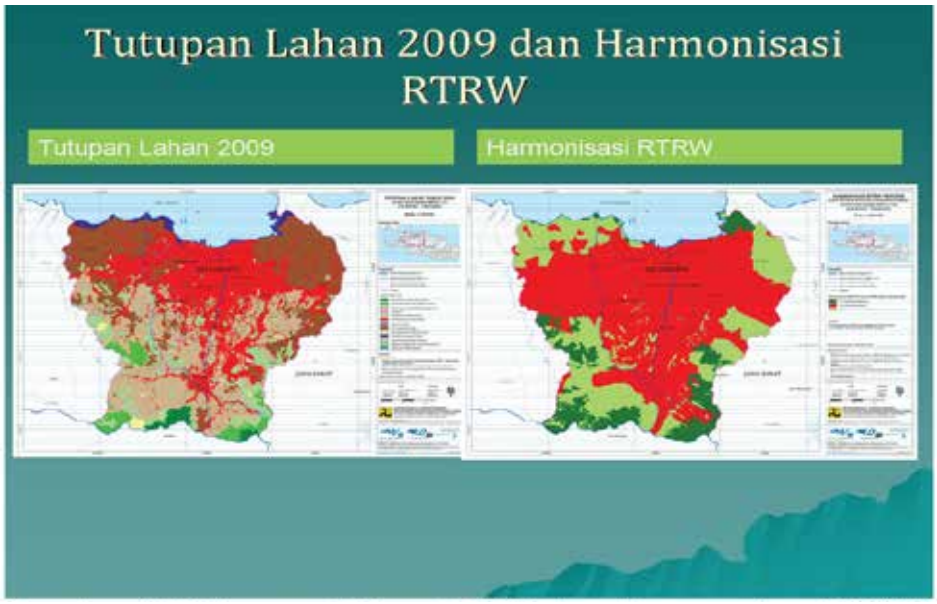


Figure 7: Land Cover in 2009 and Spatial Plan Harmonization

d) Urbanization

Figure 8: Garbage and Settlements in Rivers

Newcomers who cannot afford to occupy a decent residential area eventually set up houses at riverbanks and above river channels in many areas in almost the entire area of the Special Capital Region of Jakarta.

1.5. Hydrology

The climate in Ciliwung-Cisadane River Basin is influenced by 2 (two) seasons, namely dry season and rainy season. Temperatures range from 24°C to 35°C, with average rainfall of 2,500-3,000 mm/year.

AWLR stations, Climatological Stations, AWLR Real-Time stations, ARR Real-Time/Telemetry stations and water quality monitoring points have been built in the work area of BBWS Ciliwung-Cisadane.

1.6. Watersheds, Rivers and Tributaries

The work area of BBWS Ciliwung-Cisadane covers 3 provinces, namely West Java Province, Special Capital Region of Jakarta Province and Banten Province. It is located at 106° 23' East Longitude to 107° 40' East Longitude and 6° 8' South Latitude to 6° 12' South Latitude. There are two main rivers flowing in the Ciliwung-Cisadane area, namely Ciliwung River, which is 126 km in length, and Cisadane River, which is ±170 km in length and each river has watersheds extending to 387 km² and 1248 km² respectively.

The Ciliwung-Cisadane area, which region is called Jabodetabek, extends to 5,367 km² with a population of 22,544,637 persons. The population lives in 6 municipalities and 3 regencies, which are Jakarta Municipality as the State Capital City, Bogor Municipality, Depok Municipality, Tangerang Municipality, Bekasi Municipality, and South Tangerang Municipality, Tangerang Regency, Bogor Regency and Bekasi Regency.

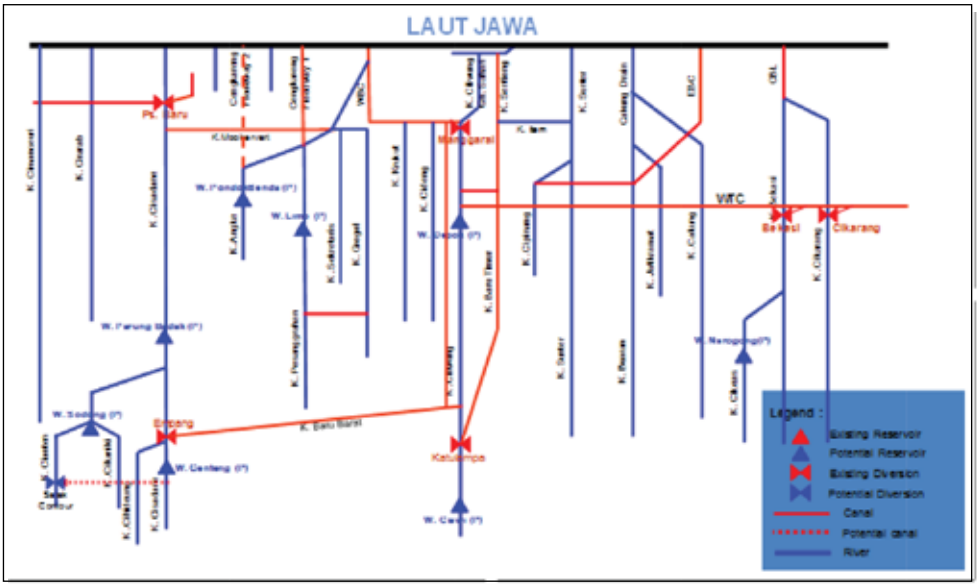


Figure 9: Ciliwung-Cisadane Rivers Scheme

However, based on the Presidential Decree Number 12 of 2012, the Ciliwung-Cisadane River Basin consists of 15 watersheds, as shown in the map on the cover page.

1.7. Budget Allocations of 2010, 2011 and 2012

Table 4: Budget Allocations

No	Year	Amount of Budget [Rp.]	Description
1	2010	232,665,009,000	APBN
2	2011	779,297,124,000	APBN
3	2012	813,064,387,000	APBN

APBN : The National Budget

1.8. Issues

The main issue in Jakarta is flood, which is a classic problem that has been happening since hundreds of years ago.

In the past, flooding occurred only in the northern part of the city, which was inhabited by merchants, laborers, and the Dutch East Indies Government-VOC.

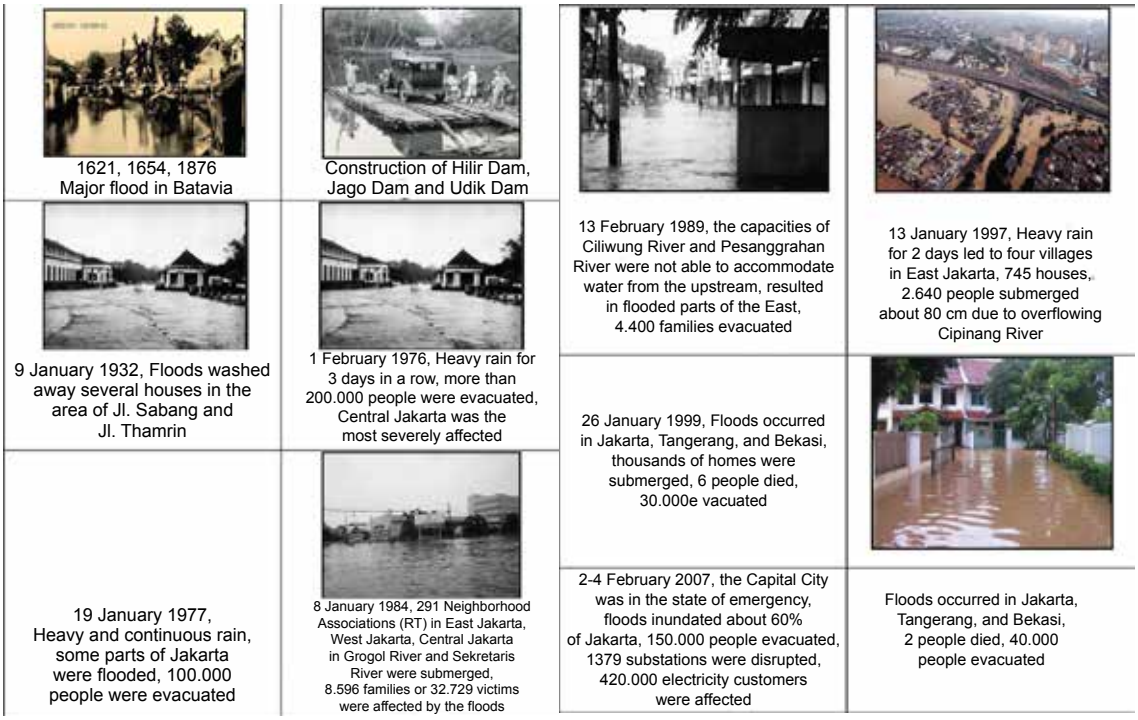


Figure 10: Photo Series of Flood Occurrences in Jakarta

The development of commercial and trading activities has resulted in increased population, and due to this, the city was expanded toward the west, east and especially the south. This increased area of the city has resulted in more and larger locations of flood inundations.

The photos of flood occurrences above shows that the issue of flood is a serious issue that disrupts daily activities which eventually bring material loss in the form of damaged things that are submerged in water, social losses due to disconnected traffic, disrupted trading activities, schools cannot operate, public services are also disrupted, etc.

The Government's efforts to overcome flooding have been carried out since a long time ago, which take the form of reducing floods in the city, the Dutch Government diverted the Ciliwung River flow directly into the sea by building water gates and Gunung Sahari canal that led directly to the sea.

In order to protect the city against Ciliwung River's increasing flood discharge due to the conversion of rubber forests in Puncak into tea plantations, in 1920, the Dutch Government built the West Flood Canal from Manggarai toward the sea. By the Presidential Decree issued by President Soekarno, the Greater Jakarta Flood Project Command was established, led by Ir. Soeyono Sosrodarsono (1965-1968).

The efforts carried out included City Drainage improvement, river dredging, and the efforts were continued by the following Officials by compiling the 1973 Jakarta Drainage Master Plan, which served as the starting point of a comprehensive management program.

The 1973 Jakarta Drainage Master Plan recommended the following:

1) Extension of West Flood Canal trace from Karet water gate toward the west through Slipi, Tanjung Duren, and Angke. However, this concept was canceled due to a problem in land clearing, and the fucntion was replaced by the construction of Cengkareng Drain that cut the flows of Pesanggrahan River, Angke River, Speak River and Mookervaart River directly into the sea, and the construction of Siantar Pump in Tomang area to overcome flooding on JalanThamrin.

2) Construction of Cakung Drain to overcome flooding in east of Jakarta.

3) Construction of polders in Pluit, West and East Setiabudi, Tomang, Grogol, Sunter, etc.

4) Construction of East Flood Canal, which realization was implemented in stages, starting in 2003 and completed in 2012.

Table 5: Flood Discharge Increase in Ciliwung River

No	YEAR	DESIGN Discharge (m^3/second)
1	1918	280
2	1973	370
3	1997	570
4	2007	800

In addition, water resources management in Ciliwung-Cisadane River Basin also faces many other issues related to the sustainability of water resources in the upper part of Ciliwung-Cisadane River Basin, namely:

1) Forest areas and conditions continue to decline. The forest damages have brought a wide impact, which is ecosystem damage in river basin arrangement, and this condition is also encouraged by poorly coordinated river basin management between the upstream and the downstream and also the institutions are still weak.

2) Low capacity of forest management, funding, facilities & infrastructures, institutions, and incentives for forest management.

3) The people's awareness in maintaining the environment is still low. This is evidenced by how the areas of forests in Puncak have been decreasing and they have been turned into villas which many of them are said to be owned by Jakarta residents. The Regional Government of Bogor have conducted many efforts, such as issuing the Regional Regulation concerning Restriction on Settlement in Puncak, but many villas still continue to grow sporadically. In fact, new villas have recently emerged on the slopes of Mount Salak and Mount Pangrango. The Regional Government of Bogor has also started controlling the emergence of those villas.

The level of erosion and sedimentation is relatively high, especially in upper Bekasi watershed due to forests being cleared and converted into settlements and farming lands that do not comply with conservation norms. The same condition also occurs in the upper Ciliwung watershed and the upper Cisadane watershed.

Based on the study conducted by the Citarum-Ciliwung Watershed Management Office, the area of very critical watersheds in Ciliwung-Cisadane River Basin extends to 802 ha, critical watersheds 17,219 ha, rather critical watersheds 81,407 ha, and potentially critical watersheds 244,504 ha. The conditions of Ciliwung Watershed and Bekasi Watershed at the midstream and downstream areas are relatively stable and the danger level of erosion and sedimentation is relatively low.

Water Quality

The dominant sources of pollution that pollute the Ciliwung River and Cisadane River are as follows:

- Industrial waste

  In Ciliwung-Cisadane River Basin, there are many industries that dispose their waste directly into rivers without processing it beforehand. Although there is already a regulation that requires every industry to process its liquid waste before disposing it into the river, in reality this regulation is not being adhered to.

- Domestic waste

  Domestic waste (households, hotels, restaurants, etc) is the largest source of pollution.

- Issues in pollution control

  Issues encountered in the efforts of controlling pollution in Ciliwung-Cisadane River Basin include:

  - Since the implementation of the Clean River Program, control has been carried out only on industrial waste. Domestic waste control has not been carried out, when in fact researches show that the load of domestic waste reach 62% of the total loads that enter into rivers.
  - Law enforcement against polluters is still weak since social, economic, work opportunity and other aspects are still taken into consideration.
  - There are many industries which Waste Water Treatment Plant (/IPAL) capacities are lower than the produced waste and therefore the waste disposal does not meet the established quality standards.
  - Water pollution control is a complex issue that requires a large amount of funds and a long time as well as the commitment of all parties concerned.
  - Many settlements are established in riparian areas, resulting in large amounts of garbage and domestic waste that are directly disposed into the river.

2. WATER RESOURCES MANAGEMENT

The water resources management in Ciliwung-Cisadane River Basin was initially carried out primarily as an attempt to control flooding based on the Flood Control Master Plan which consisted of:

- Stage 1: The 1973 Master Plan for Drainage of Jakarta, NEDECO, the flood management plan for Jakarta was focused on West Flood Canal, East Flood Canal, Cakung Drain, city drainage and development of polders in low areas.
- Stage 2: The 1977 Second Master Plan, The Study on Comprehensive River Water Management Plan in JABODETABEK Area, Japan's Nikken Consultant, which was focused on the normalization of 21 rivers in Ciliwung-Cisadane River Basin, located in Tangerang, Jakarta, Bogor and Bekasi, with design discharge between Q25 and Q100 per year.

In accordance with Law Number 7 of 2004 regarding Water Resoruces, the management of water resources must be based on a management model which preparation must involve all stakeholders, including efforts to empower, monitor and involve the community through the Water Resources Management Coordination Team (TKPSDA). Due to this, in 2010, the 6 Ci's River Basins Management Model was prepared based on the Decree of Minister of Public Works Number 11A/06, which combined 3 (three) areas, namely CitarummCiliwung-Cisadane and Ciujung-Cidurian, by taking into consideration the various aspects of management and not only the efforts of flood control and irrigation, but also water resources conservation, water resources information system and community involvement.

However, according to the Presidential Decree Number 12 of 2012, the 6 Ci's River Basins were changed and split into 3 (three) river basins, namely Cidanau-Ciujung-Cidurian River Basin, Ciliwung-Cisadane River Basin and Citarum River Basin.

2.1. Water Resources Conservation

The fact of how the condition of water catchment areas continues to decline with an indication of increased critical lands and forest damages as well as a decline in water quality in Ciliwung-Cisadane River Basin needs to be followed up with activities of conservation, both physical anf non-physical, in order to maintain the sustainability of water resources' existence, carrying capacity, assimilative capacity and functions.

Soil and Water Resources Conservation in Ciliwung-Cisadane River Basin

- Vegetative Conservation, carried out by means of Multiple Cropping and Reforestation.
- Mechanical Conservation, which includes: Soil Tillage According to Contour; Terraces, Infiltration Wells; and Check-dams/Gully Plugs.

Plans related to Ciliwung-Cisadane River Basin Conservation

Forest and Land Rehabilitation will be carried out by the Watershed Management Office and the Regional Government on areas with environmental damages, especially at the upper part of river basin as a water catchment area.

For land and water resources conservation in Ciliwung-Cisadane River Basin, the BBWS Ciliwung-Cisadane have rehabilitated artificial lakes and constructed channel reservoirs. Out of all artificial lakes in Jabodetabek, which amount to around 200 lakes, as many as 50 artificial lakes have been rehabilitated in phases, and around 15 channel reservoirs have also been built.

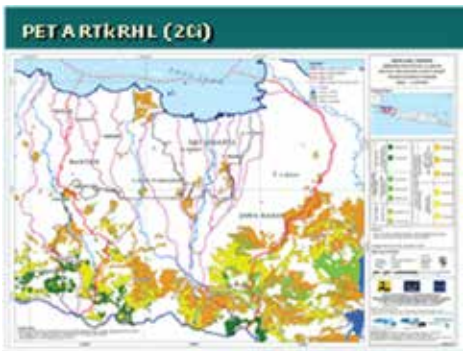


Figure 11: Map of Technical Plan of Forest and Land Rehabilitation of Ciliwung-Cisadane Watershed Management Office

Figure 12: Artificial Lake Before and After Rehabilitation

Figure 13: Small Check-dam

2.2. Water Resources Utilization

2.2.1. Water Resources Use

The resources in Ciliwung-Cisadane River Basin area used for meeting various requirements such as irrigation, raw water for drinking water and industries, as well as flushing. There are many industries that use the water allocation in the Ciliwung-Cisadane River Basin, especially along Cisadane River and Ciliwung River.

The Regional Drinking Water Company (PDAM) processes the CisadaneRiver's water for meeting the drinking water requirement of Jakarta in an amount of 3 m^3/sec, Tangerang Municipality/Regency in an amount of 5.10 m^3/sec and Bogor Municipalityin an amount of 3.80 m^3/second(including water abstraction from the CiliwungRiver).

The Regional Drinking Water Company (PDAM) uses the water from Krukut River in an amount of 0.40 m^3/second.

To meet Jakarta's drinking water requirement, the Regional Drinking Water Company (PDAM) of Jakarta buys raw water from Jatiluhur Reservoir which is channeled through the west Tarum channel in an amount of 16 m^3/second. However, Jakarta still requires more clean water, especially for industries and tourism, and to meet this requirement, they use deep groundwater.

Water Requirement Analysis

- Irrigation Water Requirement

  Based on the current condition, irrigation areas in Ciliwung-Cisadane River Basin, according to data of 2009, extend to 86694 hectares, consisting of Cisadane Irrigation, Jatiluhur Irrigation and Ciliwung Irrigation.

- Domestic and Non-domestic (Household and Urban) Water Requirements

  Water requirement is calculated based on the number of population. The amounts of domestic and non-domestic water requirements are calculated based on the provision set by the Directorate General of Human Settlements. The water requirement for a metropolitan-size city is 190 liter/person/day and for a medium-size city is 130 liter/person/day.

  The ideal domestic and non-domestic water requirements that need to be met in 2030 for the Metropolitan City of Jakarta amount to 41.60 m^3/sec, for Tangerang municipality and regency 19.70 m^3/sec, for Bogor municipality and regency 18.80 m^3/sec, and for Bekasimunicipality and regency 15m^3/sec.

- Industrial Water Requirement

  The calculation of industrial water requirement in Ciliwung-Cisadane River Basin for industries located in BODETABEK (Bogor, Depok, Tangerang, and Bekasi) uses river

water, but industries in Jakarta use deep groundwater because the rivers' water is highly polluted and the amount is very small.

- Fishpond Water Requirement

  Fishponds in Ciliwung-Cisadane River Basin cover a total area of 15,095 hectares (2009), and most of these fishponds are located near coastal areas. The amount of water requirement for fishponds until 2030 is assumed to stay the same, which is 1 liter/second/hectare.

2.2.2. Water Resources Development

In order to meet Jakarta's water requirements that still experience a deficit, attempts have been made for the treatment of river water in Jakarta, which is very dirty, by using the ultra-filtration technology. This will be developed in the West Flood Canal, Jembatan Besi (2 m³/sec) and in Cengkareng Drain (1 m³/sec). In addition, attempts have also been made to develop a technology of sea water treatment by way of desalination, which has been started by Jaya Ancol. The production costs of these two technologies are very high. However, compared to Jakarta's clean water price for industries, which is Rp 12,500,-, the production costs for desalination and ultra-filtration are still cheaper, which are Rp 9,000,- and Rp 5,000,- respectively.

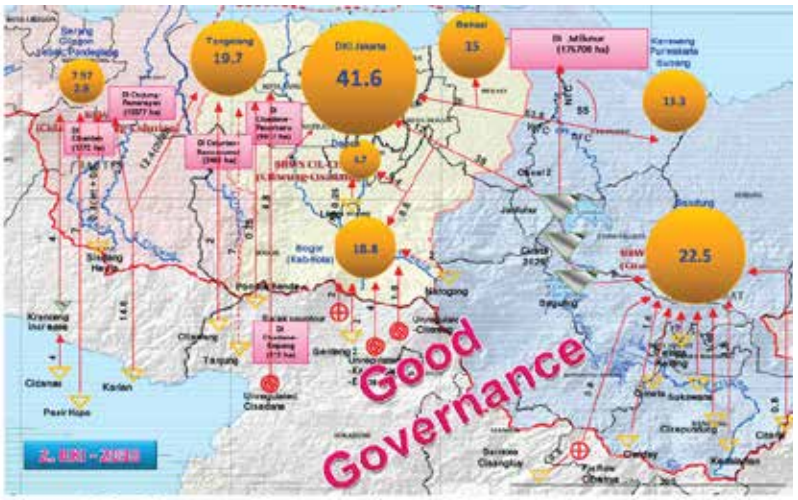


Figure 14: Raw Water Requirement & Fulfillment Scheme of JABODETABEK (Jakarta-Bogor-Depok-Tangerang-Bekasi) in 2030

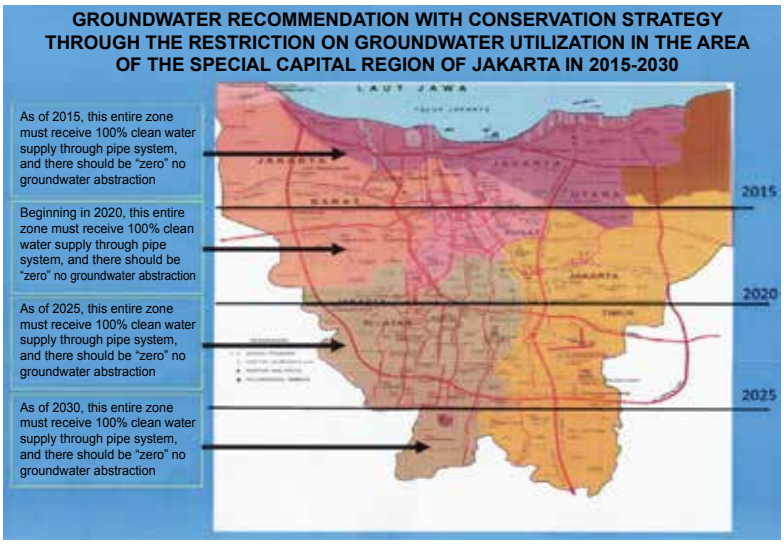


Figure 15: Jakarta Drinking Water Supply Plan

Table 6: Technical Irrigation

No	Irrigation Area	Regency	Area (Ha)	Network Level
Authority of Central Government				
1	Northwest Cisadane	Tangerang	10,379	Technical
2	West Cisadane	Tangerang	9,198	Technical
3	North Cisadane	Tangerang	2,476	Technical
Total			**22,053**	
Authority of Provincial Government				
1	Kranji	Bogor	53	Technical
2	Cibanon	Bogor	456	Technical
3	Sasak	Bogor	1,072	Technical
4	Katulampa	Bogor	333	Technical
5	BantarJati	Bogor	24	Technical
6	Cibalok	Bogor	79	Technical
7	ParakanJati	Bogor	119	Technical
8	Empang	Bogor	1,057	Technical
9	Angke V	Bogor	252	Technical
Total			**3,445**	

2.3. Control of Water Destructive Power

2.3.1. Flood Management Principles

Flood management in Ciliwung-Cisadane River Basin is carried out with a comprehensive management principle, which is the flood from the upstream is channeled to the West Flood Canal and East Flood Canal to be directly disposed into the sea. For rainwater that falls on a city located on a relatively high area, the water, with gravity, is channeled through drainage canal into the river and then into the sea, while rainwater that falls on a low area and cannot be directly disposed into the sea is channeled into reservoirs/ polders and then pumped into the river and channeled into the sea. Such as in Figure 16 that describes the principles of Jakarta Flood Management according to the 1973 Jakarta Flood Management Master Plan.

For instance, the flow of flood in Ciliwung River in Manggarai is diverted into the West Flood Canal straight into the sea.

The same goes for floods in Cipinang River, Sunter River, Buaran River, Jatikramat River and Cakung River, in which the floods in these rivers are channeled into the East Flood Canal and then disposed directly into the sea.

In line with the development of Jakarta, which is accompanied with the development in flood management by constructing flood management infrastructures, the principles for flood management therefore change also, such as shown in Figure 17 where we can see that there are the Cengkareng Drain, East Flood Canal and the Cengkareng Floodway II plan, as well as the management of artificial lakes in the upstream area.

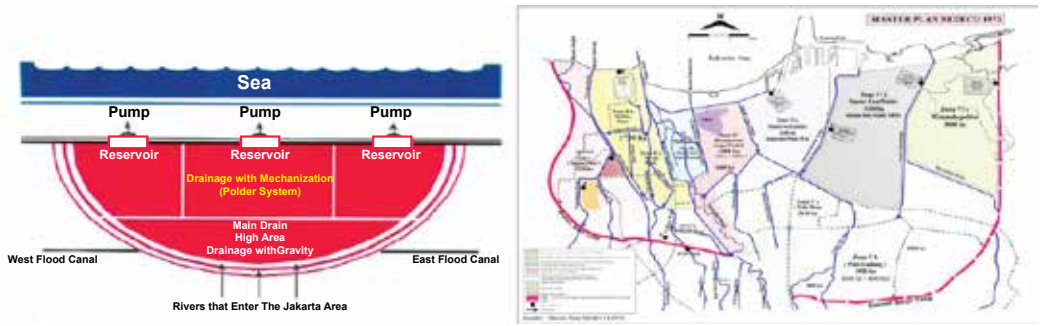


Figure 16: Jakarta Flood Management and Drainage System

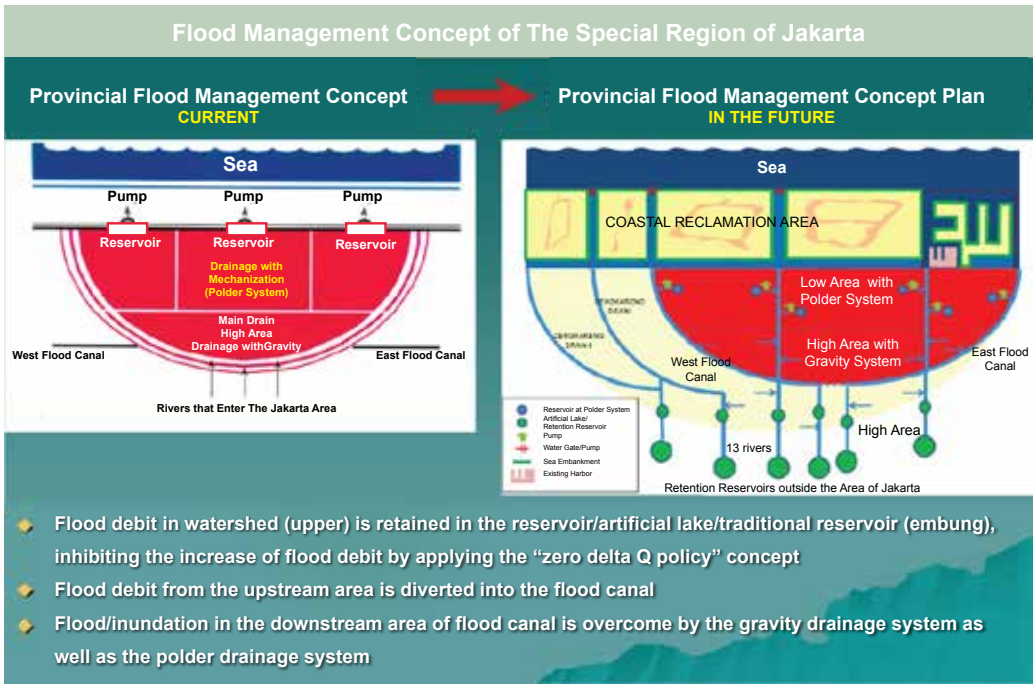


Figure 17: Development of Flood Management Principles

Figure 18: West Flood Canal Normalization

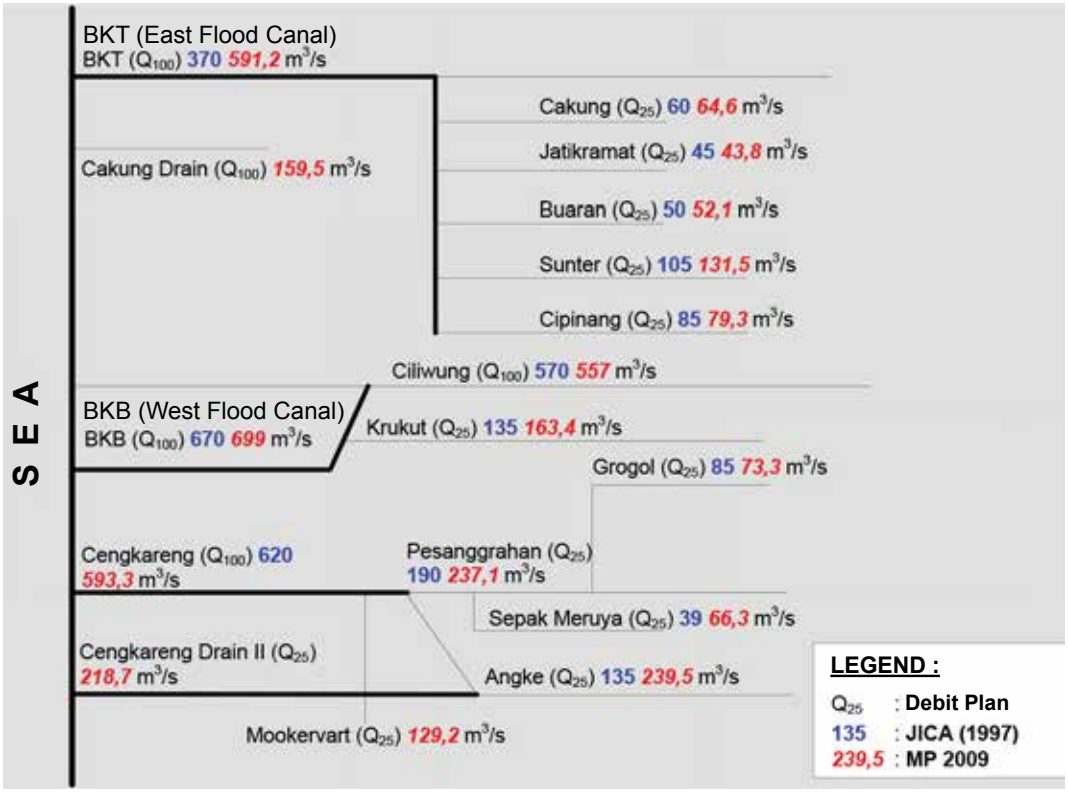


Figure 19: River Design Discharge (MP Review, 2009)

2.3.2. Tidal Flood

In the past few years, there have been occurrences of floods caused by high tides and also land subsidence in the north coast of Jakarta. The worst incidence was in 2007 in Pluit, which knocked down the Pluit Pump's walls and causing floods in Muara Baru and Luar Batang. Areas affected by the tidal flood in North Jakarta were KapukMuara, Kamal Muara, Pluit, Penjaringan, Cilincing and Marunda.

Figure 20: Tidal Rob Management in Jakarta, Tangerang&Bekasi

2.4. Water Resources Information System

One of the functions of BBWS Ciliwung-Cisadane is hydrological system management. In order to support the function and responsibility, a hydrological system needs to be implemented which consists of hydrological system facilities and infrastructures as well as their management units. The hydrological system is under the Operation and Maintenance Division of the Large River Basin Organization of Ciliwung-Cisadane. The Operation and Maintenance Division implements the following functions:

a) Operation and maintenance of rivers, lakes, artificial lakes, as well as the facilities and infrastructures

b) Monitoring and evaluation of operational feasibility on facilities and infrastructures

c) Preparation of technical recommendations in the licensing for the provision, allocation, use and exploitation of water resources in river basin

d) Implementation of hydrological and water resources information system

e) Facilitation in Water Resources Management Coordination activities in river basin and community empowerment in water resources management

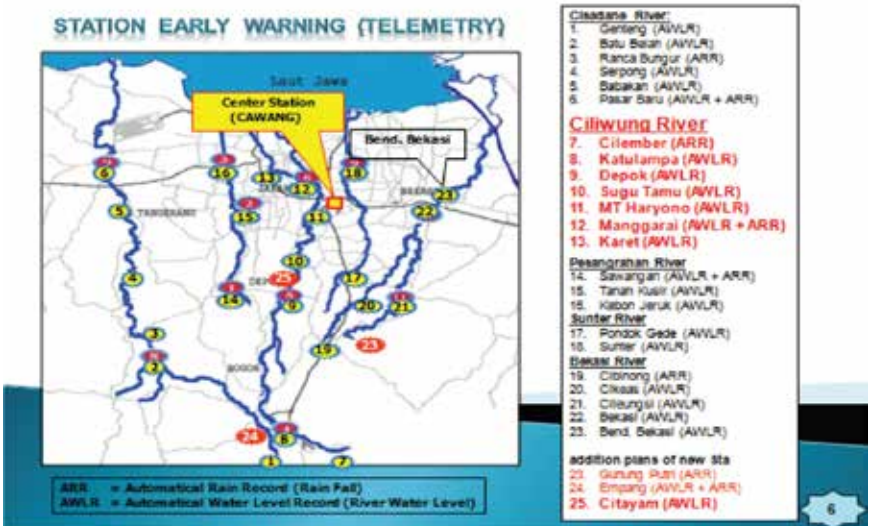


Figure 21: Flood Early Warning Stations Map

The equipment available in Ciliwung-Cisadane, especially automatic rain recorders, automatic water level recorders (AWLR)are installed in certain rivers. In addition, there are flood monitoring stations in strategic water level monitoring locations which data are sent to the Central Command Post in the BBWS Ciliwung-Cisadane Office through the radio or automatically by using the Scada equipment.

2.5. Community Empowerment and Participation

Community empowerment is carried out through:

The Water Resources Management Coordination Team (TKPSDA). The members of TKPSDA consist of:

a) Central Government
b) Provincial Government
c) Regency Government
d) NGOs
e) Professionals
f) Association of Engineering Experts, etc

The membership of TKPSDA is validated by the Minister of Public Works.

3. WATER RESOURCES MANAGEMENT IN THE FUTURE

3.1. Conservation

The rapid development of settlements in JABODETABEK has led to the conversion of many artificial lakes into settlements. Therefore, artificial lakes in JABODETABEK that have not been protected need to be protected immediately and rehabilitation needs to be carried out in order to optimize the artificial lakes' functions.

Critical watershed management should also be immediately carried out by relevant agencies in relation to reforestation in order to prevent land erosion and to enable water to be stored in ground so that peak discharge can be reduced and discharge can be increased in the dry season. Construction of infiltration wells and biopores for water conservation also need to be encouraged.

3.2. Water Resources Utilization Development

3.2.1. Water Resources Development

Water resources development intended for increasing the benefits of water resources' functions in order to meet raw water requirement is planned to be implemented by preparing a master plan for the development and maintenance of water resources in Ciliwung-Cisadane River Basin.

The surface raw water deficit for Jakarta that has been going on for a long time can be overcome immediately by increasing the water discharge of the West Tarum canal from 16 m^3/second to 31 m^3/second. The PDAM of Jakarta will use the ultra-filtration technology for treating dirty water in Jakarta's rivers. The initial step will start in the West Flood Canal and Cengkareng Drain. If it is successful, it can be developed in other rivers, and therefore will increase Jakarta's water sustainability.

In addition, sea water desalination will also be developed. At present, Pembangunan Jaya Ancol has conducted seawater treatment for drinking water and in the near future, this will be developed in industries located near coastal areas.

3.2.2. Water Resources Exploitation

Water resources exploitation is regulated by the issuance of regional regulation that arranges the use of water for industries and the licensing for bottled water industries and water refilling industries with regard to social functions and environmental preservation. Every day there are many trucks carrying water from Bogor and Sukabumi. This certainly needs to be controlled in the future. The abstraction amount should not exceed the amount available in order to prevent over-abstraction which will lead to water shortage for the surrounding community. Aside from that, there is also the danger of land subsidence, which at the moment has already occurred in Bogor.

3.3. Control of Water Destructive Power

Attempts to prevent flood disaster are carried out through an integrated and comprehensive control of water destructive power planning in water resources management model that is implemented by involving the community as follows:

- Flood management by establishing flood-prone zones in the locations experience flooding almost every year. In Jakarta there are 86 inundation-prone locations.
- Restoring the function of riverbanks and riparian areas as conservation areas by limiting development in riverbanks and moving riverbank settlers out of the location.
- Increasing river capacity through river improvement and normalization from the upstream to the estuary in 21 rivers in Jabodetabek, such as in Cimanceuri, Cirarab, Cisadane, Cengkareng Drain, Angke, Pesanggrahan, Sepak, Grogol, Sekretaris, Krukut, Cideng,

Ciliwung, Cipinang, Sunter, Buaran, Jatikramat, Cakung, Blencong, Bekasi, Cikarang, and Cilemahabang.

- Increasing the number of retention basins/polders in Jakarta into 30 locations.
- Normalization of city drainage canal.
- Routine operation and maintenance of rivers and drainage canals.
- Preparing a flood evacuation system and conducting flood simulation once a year.
- Developing an early warning system by installing telemetry station/Flood Forecasting & Warning System (FFWS).
- Aligning conservation efforts in the upstream with utilization in the downstream.
- Maintaining coastlines by constructing abrasion retaining embankments or by planting mangrove on the beaches of Bekasi and Tangerang municipalities.

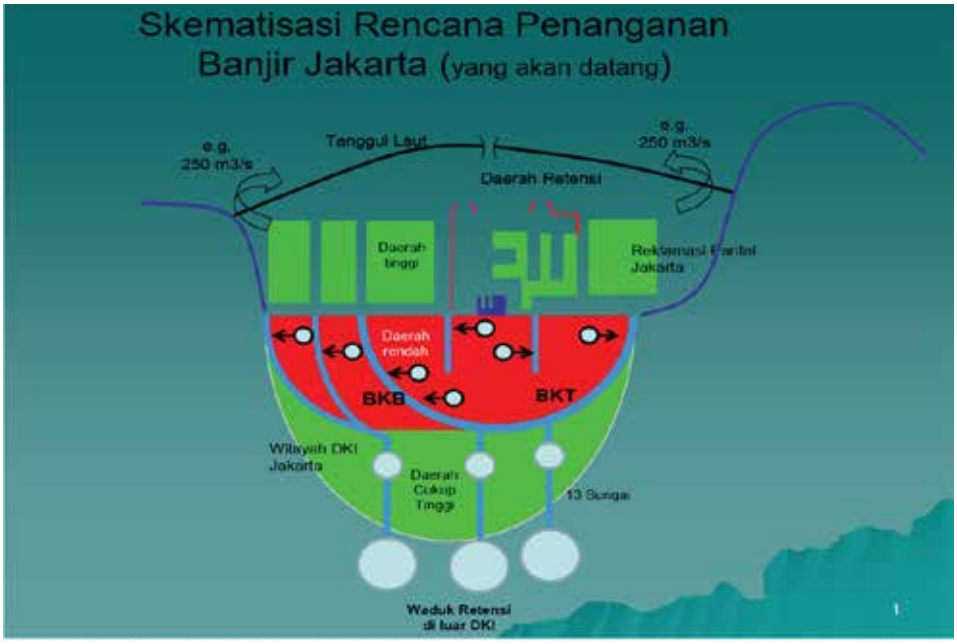


Figure 22: Future Flood Management Scheme

In addition, the Government conducts a study called the Jakarta Coastal Defence Strategy to ancipate tidal flood and land subsidence due to excessive groundwater abstraction.

The principle is to construct a massive sea embankment on the North Coast of Jakarta in order to prevent tides from entering Jakarta.

3.4. Water Resources Information System

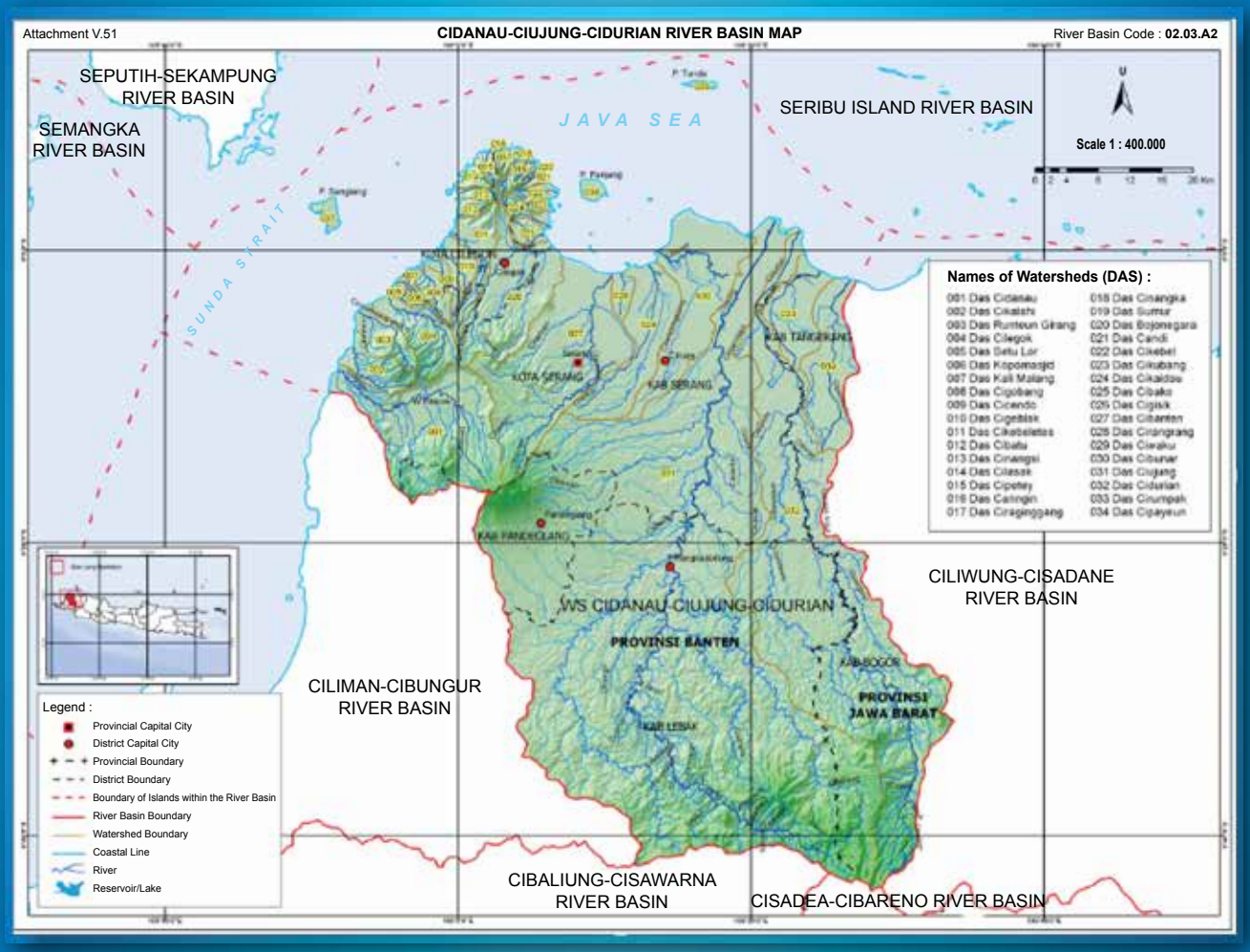
In order to support water resources management, it is necessary to provide accurate, timely, continuous and easy-to-access water resources data and information by developing a provincial or regency/municipal water resources data and information system network for Ciliwung-Cisadane River Basin that is integrated and supported by strong institutions, developing community participation in providing information on water resources as well as managing and developing the Ciliwung-Cisadane River Basin database system.

3.5. Community, Private Sector and Regional Government Empowerment and Participation Improvement

Efforts to empower and increase the participation of the community, private sector and the regional government are carried out by:

- Conducting socialization to increase the community's awareness on water resources management
- Establishing a Water Resources Council
- Enforcing law against illegal mining
- Empowering the community living around forests to participate in maintaining and safeguarding the forests
- Drawing up policies on water usage by arranging policies for overcoming water scarcity
- Increasing community capacity and active participation by increasing the organization's capacity to respond to environmental issues through assistance program provided by the government, empowering the community and the private sector through socializations, trainings, assistance and guidance, in order for them to be concerned, participate, and be responsible in sustainable water resources management.

B3. LARGE RIVER BASIN ORGANIZATION OF CIDANAU-CIUJUNG-CIDURIAN



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1. DESCRIPTION OF ORGANIZATION

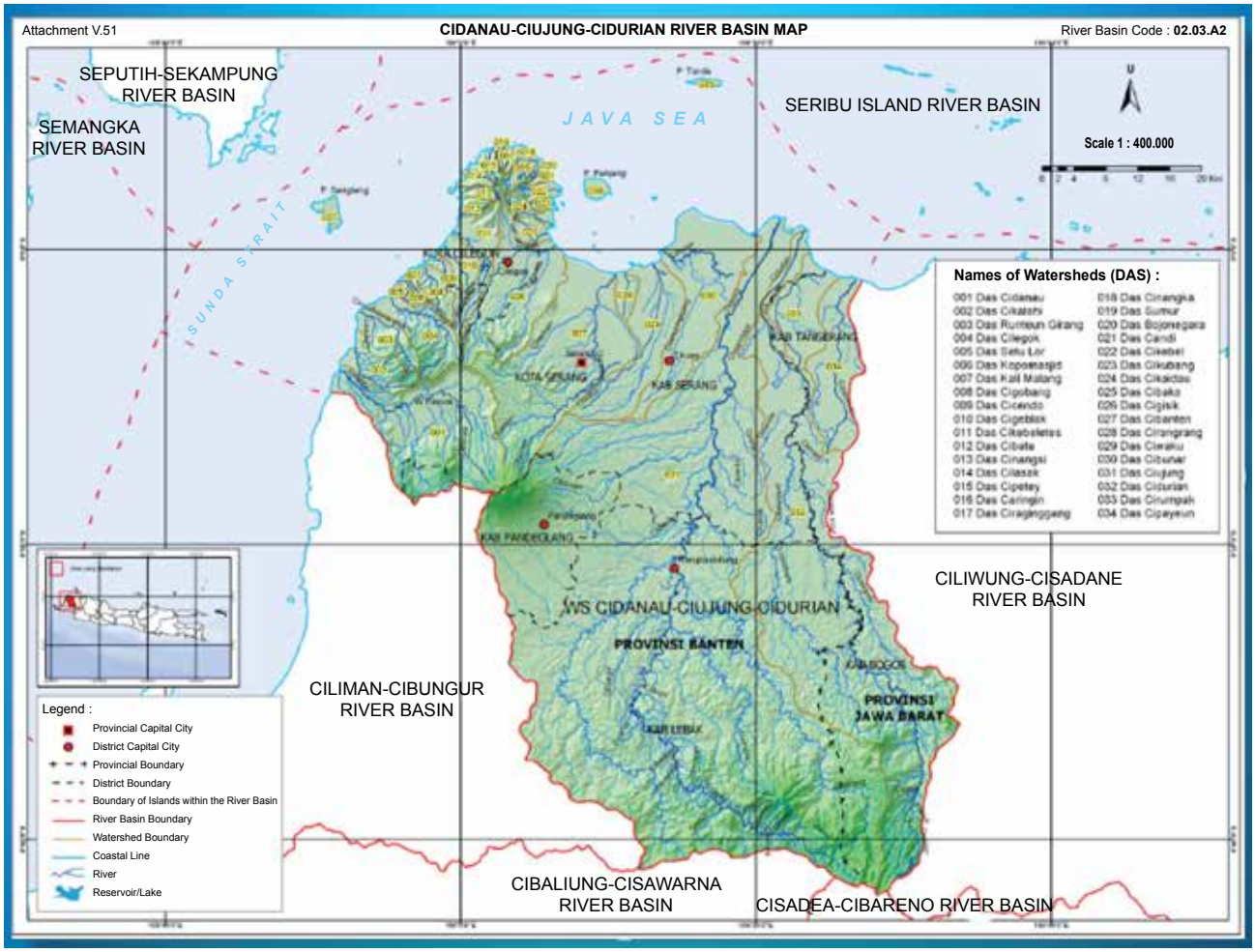


Figure 1: Cidanau-Ciujung-Cidurian River Basin

1.1. General Information

Name	:	Balai Besar Wilayah Sungai Cidanau-Ciujung-Cidurian
Address	:	Jl. Raya Labuhan Km. 3 KotakPos 8
Municipality	:	Pandeglang
Telephone	:	(0253) 201155
Facsimile	:	(0253) 202686, (0254) 206111
Website	:	http://.bbwsc3.com
E-mail	:	
Legal Basis	:	Regulation of Minister of Public Works Number 23/ PRT/M/2008
Work Area	:	Cidanau-Ciujung-Cidurian River Basin
River Basin Code	:	02.03.A2
River Basin Classification	:	Cross-provincial River Basin (West Java Province and Banten Province)

1.2. Brief History

1. 1994: Master Project for Ciujung-Ciliman River Basin Development and Banten Irrigation Work Unit

2. 2006: Balai Besar Wilayah Sungai Cidanau-Ciujung-Cidurian (Large River Basin Organization of Cidanau-Ciujung-Cidurian) in Banten Province and some parts of West Java Province

The establishment of Balai Besar Wilayah Sungai Cidanau-Ciujung-Cidurian was the continuity of the programs carried out by several work units, namely:

- Banten Irrigation Work Unit
- Flood Management and Coastal Improvement Work Unit
- Raw Water Provision Work Unit
- Ciujung-Ciliman Water Sources Development and Management Work Unit

1.3. Human Resources

The organizational structure of Balai Besar Wilayah Sungai (BBWS)Cidanau-Ciujung-Cidurian was established based on the Regulation of Minister of Public Works Number 26/PRT/M/2006, and in accordance with its category as a type-B large river basin organization, BBWS Cidanau-Ciujung-Cidurian is led by an Echelon IIB official as the head of the organization, assisted by three division heads and one department head, each being an Echelon III officials, as follows:

1) Administration Department
2) Maintenance Planning and Operation Division
3) Water Source Network Implementation Division
4) Water Utilization Implementation Division

This BBWS C-3 is supported by 205 employees, consisting of 72 technical workers and 133 non-technical workers, with details as shown in the following Table 1:

Table 1: Human Resources

Human Resource	Planning Division	Implementation Division	Operation & Maintenance Division	Others	Total
Engineer	11	50	9	2	72
Non Engineer	10	77	24	22	133
Total	**21**	**127**	**33**	**24**	**205**

1.4. General Condition of Work Area

The work area of BBWS Cidanau-Ciujung-Cidurian includes some parts of Banten Province, namely Pandeglang Regency, Lebak Regency, Serang Regency, Serang Municipality, Cilegon Municipality, as well as some parts of Tangerang Regency; and some parts of West Java Province, which are some parts of Bogor Regency.

The administrative area of Cidanau-Ciujung-Cidurian River Basin extends to 9.361,80 km². The number of population in Cidanau-Ciujung-Cidurian River Basin is 4.545.407 persons (male: 2.381.782 persons and female: 2.263.735 persons).

The distribution of employment of productive-age population is as follows:

- Agricultural sector 24,38%
- Agricultural sector 20,07%
- Service sector 66,67%

Some of the rivers in the work area of BBWS Cidanau-Ciujung-Cidurian are in polluted condition, as suggested by the Head of Domestic Waste, Toxic and Hazardous Materials, and Toxic and Hazardous Materials Waste Sub-Division of Bantan Province Environmental Agency, who explained in a media that the polluted rivers include the Ciliman River, Cirarap River, Cidurian River, Cimanceri River, Ciujung River, Cibanten River, Cidanau River, Ciujung Kulon River, Cibaliung River, Ciberang River, and Cisadane River. Due to the pollution, the quality of the polluted rivers' water no longer meets the quality standards for drinking water, agriculture, and industries.

The Cidanau-Ciujung-Cidurian River Basin consists of 3 sub-river basins, namely:

1) Cidanau Sub-river basin, with watershed areas extending to 207.7 km²
2) Ciujung Sub-river basin, with watershed areas extending to 1,987 km²
3) Cidurian Sub-river basin, with watershed areas extending to 928 km²

- The Cidanau River is the only river that channels water from Danau Swamp to the sea in Sunda Strait. Danau Swamp is a swamp located on a mountain and it receives its water supply from around 17 rivers and tributaries spread in the administrative area of Serang Regency and Pandeglang Regency. The water catchment area from the rivers, tributaries and lakes extend to 22.620 hectares, consisting of community land and the national forest area that serves as a "conservation forest". The water is highly needed by the Cilegon industrial zone, which puts this river in an important and strategic position in the national industrial sector.

- The Ciujung River is the largest river in Banten Province that passes through 2 regencies, namely Lebak Regency and Serang Regency. The Ciujung Sub-river basin consists of three main tributaries, namely Cisimeut River with sub-watershed area extending to 458 km², Ciberang River with sub-watershed area extending to 304 km², and Upper Ciujung River with sub-watershed area extending to 594 km². Other smaller tributaries are located in the downstream part of Rangkasbitung Municipality, namely Cikambuy River, Cisangu River, Ciasem River, Cibongor River and Ciyapah River.

  The Ciujung River stretches ±142 km in length. There is a weir called Pamarayan Weir which function is to irrigate the Ciujung Irrigation Area. Physical construction of a new irrigation network did not begin until 1905. The main structure of this irrigation is a weir located near the Pamarayan Village in Ciujung River. Since this structure was called the Pamarayan Wier, the irrigation network was then also called the Ciujung Pamarayan irrigation. The new Pamarayan Barrage is located in Serang Regency, Banten Province. The barrage was built in 1992.

  The almost deforested land along the river basin, massive erosion during rain, the silting up of rivers due to sedimentation, and dense settlements in riverbanks are the factors that cause flooding in the Ciujung Watershed, Banten.

  The frequently flooded regencies/municipalities in Banten are Lebak, Pandeglang, Serang, Cilegon and Tangerang. The Jakarta-MerakToll Road is recorded to have been flooded as many as seven times since 1996.

  The Karian Reservoir at the upper part of Ciujung River, which is currently under development, will function to supply clean water in Serang and Jabotabek by using the Karian-Tanjung-Serpong canal, irrigation water for Ciujung, and as Ciujung's flood controller for areas between Rangkasbitung and Pamarayan Weir. The effective carrying capacity is 219 m³ and it is able to generate 5.2 MW electricity.

- The Cidurian River disgorges at the Mount Halimun-Salak National Park. The river is 181,50 km in length and its watersheds cover an area of 928 km². It has 139 tributaries that range from the first order to the fifth order.

Flood often occurs because of broken down dyke, such as the dyke in Kresek Sub-regency, which flooded hundreds of houses including the Jayanti Sub-regency and Tigaraksa Sub-regency.

In addition, the Cidurian River also experienced pollution caused by liquid waste from ten industries located along the river.

1.5. Hydrology

Table 2: Rainfall Recording Stations

No	Name of Watershed	Total
1	Ciujung	23
2	Cidurian	9
3	Cilemer	3
4	Cipasauran	1
5	Cibeber	1
6	Cibanten	1
7	Cimoyan	1
8	Cisata	3
9	Cibama	1
10	Cibungur	1
11	Ciberang	1
12	Cimoyan	1
13	Ciliman	2
14	Cibama	1
15	Citeneng	1
Total		**50**

In general, the average annual rainfall ranges from 2,000 mm for the northern part, which areas are relatively flat, to 4,000 m for the southern part, which areas are mountainous. Rainy season occurs from October to April, while the other months are the dry season. The highest rainfall occurs in January to February, while the lowest in July. In the work area of BBWS 3 Ci, there are 50 Rainfall Recording Stations spread in 15 watersheds as shown in Table 2.

The Cidanau Watershed functions as a water catchment area, especially in the area of Banten Province. According to Munibah (2008), the erosion rate of Cidanau Watershed is 149.7 tons/ hectares/year.

The almost deforested land along the river basin, massive erosion during rain, silting up of rivers due to sedimentation, and dense settlements in riverbanks are the factors that cause flooding in the Ciujung Watershed, Banten. The sedimentation rate of Ciujung River is 2.5 mm per year. The watershed's categorized as poorly conditioned watershed as the sedimentation rate is more than 2 mm per year. The Ciujung Watershed also has a low Permanent Land Conver Index, which is 11 percent. The index is considered poor if it is smaller than 20 percent.

The river regime coefficient, which compares the maximum and minimum discharge of the Ciujung Watershed, is 189, far greater than 80.

The river water discharge's coefficient of variance (CV), which compares the existing discharge and the average discharge, shows a value of 48. This is categorized as poor as it is greater than 30. "These four indicators confirmed that the Ciujung Watershed is already categorized as critical," said Sutopo.

The average annual rainfall ranges from 1,500 mm at the north coast's plains to 2,500 mm in the upstream. Temperatures range from 26°C to 30°C with humidity of 80% and wind speed ranging from 4 to 5 knots or 2.1 m/second.

1.6. Watersheds and Rivers

In accordance with the Presidential Decree Number 12 of 2012 regarding the Establishment of River Basins, the Cidanau-Ciujung-Cidurian River Basin, which consists of three sub-river basins, has 34 watersheds as shown in Table 3 below.

Among the three sub-river basins, the Ciujung Watershed is the first priority in the watershed management, while the Cidanau and Cidurian watersheds are the second priority.

The measurement of Cidanau river flow in Kp. Peusar Station during the period of January 2000 to December 2001 showed a monthly average discharge of 5,421 m³/second.

The measurement of Ciujung river flow in Rangkasbitung Station during the period of 1992 to 1999 showed monthly average discharge ranging from 35.3 m³/second (July) to 105,112 m³/second (January).

Table 3: Watersheds in Cidanau-Ciujung-Cidurian River Basin

No	Code	Name of Watershed	No	Code	Name of Watershed
1	001	Cidanau	18	018	Cinangka
2	002	Cikalahi	19	019	Sumur
3	003	Runteun	20	020	Bojonagara
4	004	Cilegok	21	021	Candi
5	005	SetuLor	22	022	Cikebel
6	006	Kopomasjid	23	023	Cikubang
7	007	Kali Malang	24	024	Cikaidau
8	008	Cigobang	25	025	Cibako
9	009	Cicendo	26	026	Cigisik
10	010	Cigeblak	27	027	Cibanten
11	011	Cikebeletes	28	028	Cirangrang
12	012	Cibatu	29	029	Ciwaku
13	013	Cinangsi	30	030	Cibunar
14	014	Cisalak	31	031	Ciujung
15	015	Cipetey	32	032	Cidurian
16	016	Caringin	33	033	Cirumpak
17	017	Ciraginggang	34	034	Cipayeun

The measurement of Cidurian river flow in Kopomaja Station during the period of 1991 to 1999 showed monthly average discharge ranging from 5.899 m³/second (August) to 25.499 m³/second (January).

The current Safety Level Status of the Cidanau, Ciujung and Cidurian Rivers is Q5.

Development Realization: implemented improvement, rehabilitation and maintenance of flood embankments in Cidanau River, Ciujung River and Cidurian River according to the target set in the Strategic Plan (Renstra) of 2010-2014 as well as the preparation of the Master Plan for Comprehensive Flood Management System in Cidanau River, Ciujung River and Cidurian River, which was a derivative of the Cidanau-Ciujung-Cidurian River Basin Water Resources Management Model in achieving the target of Safety Level Q5 for rural area and Q25 for urban area.

1.7. Budget Allocations of 2010, 2011 and 2012

The budget received from the 2011 Budget Implementation List (DIPA) showed a significant increased compared to the budget of 2010 and it was allocated evenly for all Divisions. The total budget of 2012 shows a slight increase in the Implementation Division and Others. However, there is a decrease in the Planning Division and Operation & Maintenance Division as shown in the following Table 4.

Table 4: Budget Implementation List (DIPA) of BBWS Cidanau-Ciujung-Cidurian [xRp1.000,-]

DIPA	Planning Division	Implementation Division	Operation & Maintenance Division	Others	Total
2010	6,425,000	130,130,000	6,340,000	6,491,824	149,386,824
2011	9,914,216	223,360,205	13,147,281	8,841,023	255,262,725
2012	8,250,000	226,707,189	10,830,765	9,995,735	255,783,689

1.8. Issues

a) Critical Land

The conditions of lands in the Cidanau-Ciujung-Cidurian River Basin are categorized as very critical, critical, rather critical and potentially critical and these lands extend to 340.098 hectares, as shown in the following Table 5.

Table 5: Categories and Areas of Critical Lands

No	Category	Area (Ha)
1	Very Critical	1,024
2	Critical	25,124
3	Rather Critical	94,101
4	Potentially Critical	219,849
Total		**340,098**

The critical lands occurred due to the conversion of lands into settlements, offices, industries, cassava plantations and oil palm plantations, as well as improper land cultivation as shown in Figure 2 below.

Figure 2: Land Conversion and Improper Cultivation

These critical lands led to increased erosion rate, such as the case in Cidanau where the erosion rate is 149,7 tons/ha/year (Munibah), which then resulted in the silting up of Danau Swamp.

The spread of the critical lands can be seen in the following Figure 3.

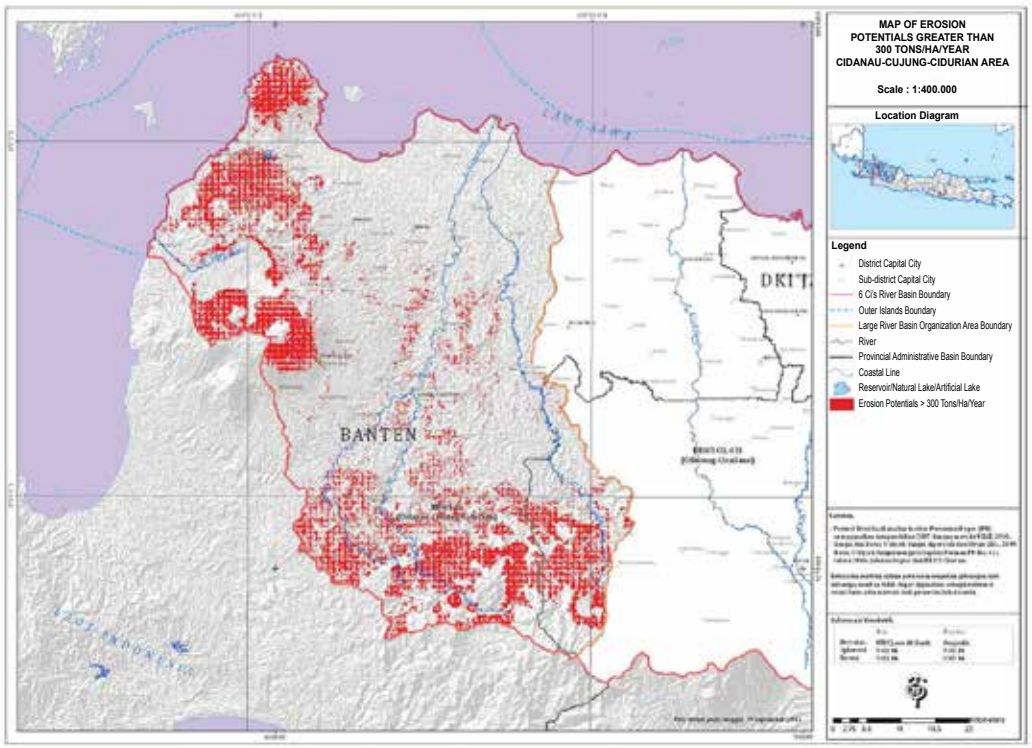


Figure 3: Erosion Potential Map

b) Flood and Drought

Flooding occurs due to the overflowing of several rivers. Among the frequently overflowing rivers are the Ciujung River, Cidurian River, Ciliman River, Cilemer River and Cibinangeun River. On 14-15 January 2012, floods were experienced by at least 10,340 families, including on the Jakarta-MerakToll Road, which was flooded for 3 km long, with depth reaching 1.50 M.

Table 6: Flood Inundations on 14-15 January 2012

No	River	Settlement (family)	Industry	Farm (Ha)
1	Ciujung	4,364	20 factories	-
2	Cidurian	1,950	2 factories	1,100
3	Ciliman	1,312		853
4	Cilemer	1,757		876
5	Cibinuangeun	957		774

For rivers that empty into the Java Sea, flood inundations occurred along the river flow until the coastal area, and in Cidanau, inundations occurred due to the overflowing of Danau Swamp, which is located in the upstream area, shown in blue color in the following Figure 4.

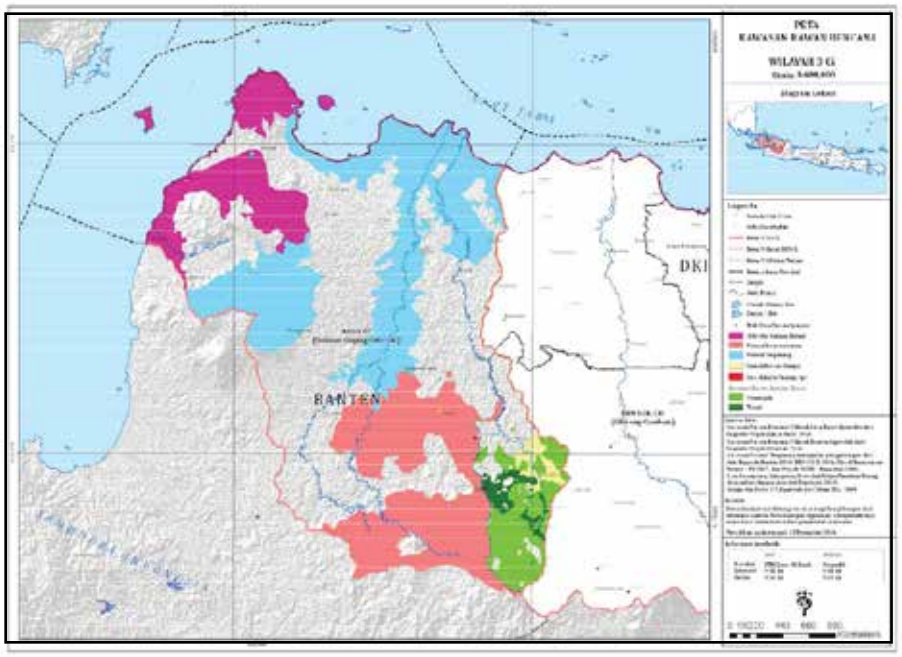


Figure 4: Flood-prone Locations

Heavy rains also cause frequent landslides in the upstream as shown in pink color in the figure above. This also results from the geological condition of the region which is very susceptible to land movement as shown in dark green and light green colors in the figure above.

The losses brought by this flooding were massive, because the floods did not only hit settlement and farming areas but also industrial areas and even the Jakarta-MerakToll Road. Even after the floods receded, the Toll Road was still congested because it was made as a place of evacuation by the residents whose houses were still flooded.

Figure 5: Floods in Residential Areas, Rural Areas, Urban Areas and on the Toll Road

One of the indicators of land damages is the high ratio of maximum discharge and minimum discharge. The maximum discharge in the rainy season leads to floods and the minimum discharge in the dry season leads to droughts.

Droughts cause reduced raw water supply for irrigation, industries and raw water requirements for the Regional Drinking Water Company (PDAM) and others in rural areas. The spread of locations that experience irrigation water supply shortage is shown in the following Figure 6.

Figure 6: Drought in Agricultural Land

c) Pollution

Pollutions that occur in rivers result from the disposal of industrial waste and domestic garbage as shown in the following Figure 7. These pollutions lead to water quality decline which then results in associated impacts on the water users, including agricultural plants which water is polluted.

Figure 7: Pollution by Industrial Waste and Garbage

d) Coastal Abrasion

Coastal abrasion occurs in several locations in 17 sub-regencies and 5 regencies in Banten Province. Other than being caused by waves, abrasion is also caused by human behavior, such as:

- Coastal sand excavation on the mainland. One exampleis what happened at the beach of Karangserang Village, Sukadiri, Tangerang Regency, where a six-foot-high mound of sand was piled on the beach. Some people carry the sand with a cart then lower it down on the side ofthe road to make it easier for the truck that transports it to other areas.

- Sand mining carried out by ships does not only suck up the sand, but also suck up mud that eventually damage the roots of mangrove plants. The impact of sand mining is now expanding into the coastal area of Banten Baywaters. Based on the data obtained, at present there are 30 thousand mangrove trees that died due to sandmining. This coastals and mining has now spread to Panjang Island.

Figure 8: Abrasion in Carita-Anyer and On the Roadside near Planned

Bojonegara Port

- The clearing of mangrove forest to be converted into fishpond area, such as the case in Garapan Ward, Bakau Tinggi Hamlet, Tanjung Pasir Village, Teluk Naga Sub-regency, Tangerang Regency. According to observation, coastal abrasion occurred for one kilometer long, and moreover, huge waves have swallowed 20-100 meters of the beach area in Garapan Ward and threatened 390 families.

The Search and Rescue (SAR) Team Post of the Regional Disaster Management Agency (BPBD) of Serang Regency on the shore of Bandulu Beach, Bandulu Village, Anyer Sub-regency almost collapsed. The post was damaged by the coastal abrasion that occurred in early 2012, as shown in the following Figure 9.

Figure 9: Abraded SAR Post

There is only one breakwater in the location that stretches for about 200 meters, while other larger, unprotected locations make the Karangserang Beach more prone to abrasion. Coastal protection plants such as mangrove no longer exist.

According to observation, coastal abrasion occurs for one kilometer long, and in addition, huge waves have swallowed 20-100 meters of the beach area in Garapan Ward.

In Garapan Ward, a 350 meter-long breakwater has been constructed for the first phase. Another breakwater with a length of 600 meter is currently under construction.

2. WATER RESOURCES MANAGEMENT

2.1. Water Resources Conservation

Efforts of conservation are carried out on critical lands in forest areas and especially on critical lands in the upstream area of dams or reservoirs planned to be constructed. In general, the recommendations for critical land conservation are stated in the following Figure 10.

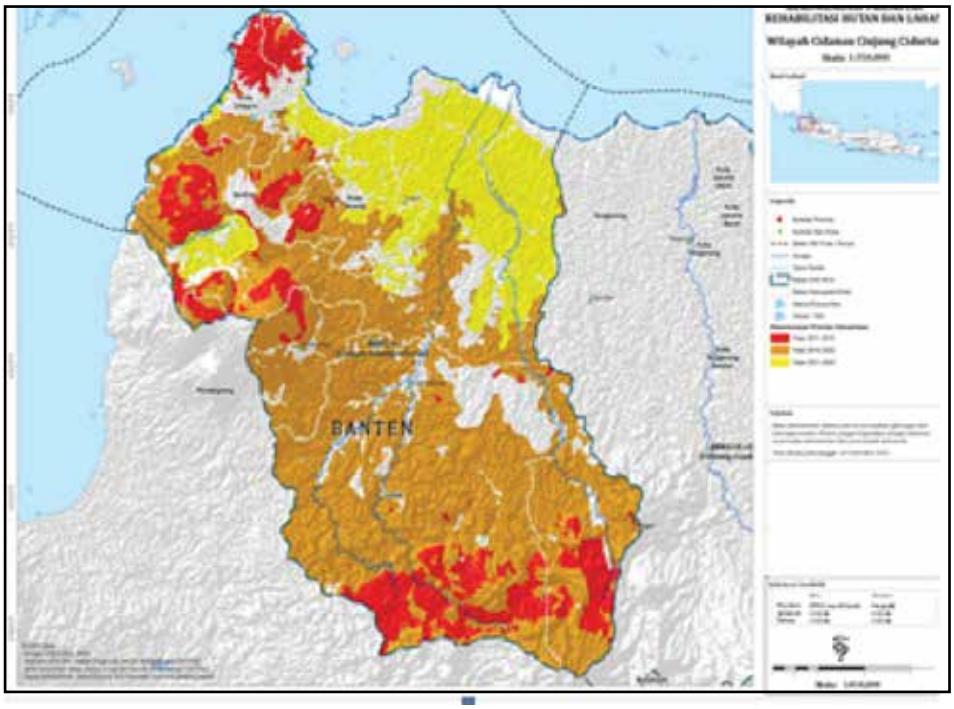


Figure 10: Recommendations for Critical Forest and Land Rehabilitation

The Objectives of Water Resources Conservation are:

a) Conservation on very critical and critical watersheds as well as upper area of reservoirs by:

- Implementing the recommendations provided by the Technical Plan for Forest and Land Rehabilitation – Watershed Management Agency, the Movement for Forest and Land Rehabilitation (Gerhan) and the National Movement for Water Safeguard Partnership (GNKPA),
- Striving for the Technical Plan for Forest and Land Rehabilitation Zonation Map to be included in the Regency/Municipal Regional Spatial Plan,
- Conserving watersheds with a principle of upstream-downstream cooperation, environmental services management,
- Conducting agricultural cultivation according to the conservation norms.

b) Protection of reservoirs, artificial lakes, swamps, springs & retention areas, as well as groundwater conservation by:

- Protecting water body, building water storages,
- Reducing groundwater abstraction permits (Serang-Tangerang Groundwater Basin), accompanied with replacement by providing surface raw water.

c) Realization of increased surface water quality by:

- Controlling the use of industrial Waste Water Treatment Plant (IPAL),
- Improving urban sanitation (dirty drainage & communal IPAL),
- Monitoring river water quality,
- Managing garbage.

d) Water saving through efficiency increase by:

- Applying SRI agriculture system,
- Conducting socialization on domestic and industrial water saving,
- Reducing drinking water pipe leakage.

e) Protection of critical coastal areas and beaches by:

- Protecting eroded beaches (32 locations),
- Protecting coastal cities against seawater level rise,
- Conserving mangrove forests.

Conservation of water resources in the work area of BBWS Cidanau-Ciujung-Cidurian is done by using an approach of physical construction of sediment (debris) retaining structures in erosion-prone rivers.

One of the physical/construction efforts in overcoming river erosion is by constructing the following structures:

- Cisela Consolidation Dam in Giri Raya Village, Cipanas Sub-regency, Lebak Regency,
- Cimaur I Consolidation Dam in Cipanas Sub-regency
- Ciherang I Consolidation Dam in KaduPecang Village, Cipanas Sub-regency.

Figure 11: Locations of Protection against Coastal Abrasion

2.2. Water Resources Utilization

a) Irrigation Water Provision

Provision of irrigation water in the Cidanau-Ciujung-Cidurian River Basin has developed since a long time ago and along with the development of industries and the requirements of residential areas and community settlements, in which some of them have been converted in their functions.

Irrigation water provision is also done through the physical construction of Consolidation Dams (sediment retaining dam) that also function to manage erosion and or to retain sediment. The consolidation dams that have been built in BBWS Cidanau-Ciujung-Cidurian include the physical facilities of Pamarayan Dam, etc.

The irrigation areas in the work area of BBWS Cidanau-Ciujung-Cidurian extend to 45,690 hectares in total, with 20,747 hectares of the total area spread in 13 locations and they are under the authority of the Central Government.

Water amounting to 15.99 m³/sec or 504.09 million m³/year is needed to meet all of the irrigation water requirements.

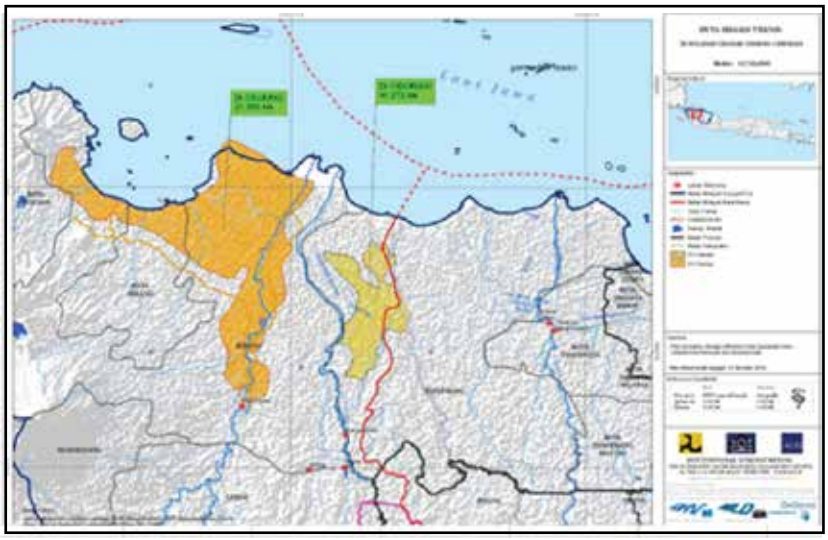


Figure 12: Irrigation Map

This irrigation water is also used for fishery irrigation related to fishponds. Based on their areas, fishponds are divided into the categories of intensive, semi-intensive, and traditional, as well as the cropping pattern/cropping season. In Cidanau-Ciujung-Cidurian River Basin, fishponds are spread in Serang Regency and Tangerang Regency. The total areas of fishponds (based on the regencies included in the northern part of Banten Province) extend to 10,243 hectares.

Figure 13: Pamarayan Dam

b) Raw Water Provision

Provision of raw water is done primarily for meeting the requirements of industries and the Regional Drinking Water Company (PDAM) in serving community needs especially in Serang Municipality. Raw water provision is carried out by:

- Constructing Cisirih Rubber Weir
- Constructing the retention basin of Cisirih Rubber Weir,
- Constructing Ciberung Rubber Weir
- Constructing Cibanten Rubber Weir (Phase I)
- Constructing Cibanten Rubber Weir (Phase II)
- Constructing rural raw water reservoir in Garung Village, Anyer Sub-regency, Serang Regency
- Constructing Krenceng Reservoir

Water requirements for households, urban areas and industries are around 9,508 m³/ second.

2.3. Water's Damaging Ability Control

Damages caused by flooding continue to increase each year because the value of investment on flood-prone areas continues to increase and losses therefore become greater on the same areas

of inundation. The value of damage is obtained by multiplying the level of vulnerability by the number of occurrences. Flooding in an uninhabited area will not cause any losses. When there are people living in the area, and they are not ready for (vulnerable to) flooding, then there will be losses resulted from the flooding.

The control of water's damaging ability in BBWS Cidanau-Ciujung-Cidurian is carried out as part of the efforts to overcome the issue of flooding with the following approach:

1) Flood Risk Management Concept and
2) Objectives of Water's Damaging Ability Control

Objectives of Water's Damaging Ability Control

a) Reduced frequency of flood occurrences

- Conducting watershed conservation
- Reducing clearing of floodplains, retention areas and riverbanks
- Increasing river maintenance and normalization
- Improving flood embankments

b) Reduced impact of losses due to floods

- Applying the regulation on constructions that are resistant to flood
- Conducting socialization on the preparedness against flood

c) Managed danger of seawater flooding

- Increasing the protection in Old Banten Municipality
- Improving sea embankments in coastal cities

d) Reduced losses due to droughts and landslides

- Conducting efficiency on water requirements and cropping pattern planning
- Conducting the mapping and socialization of landslide-prone areas

The constructions of physical infrastructures for water's damaging ability control that have been carried out in the work area of BBWS Cidanau-Ciujung-Cidurian include:

- Riverbank reinforcement of Cimaur River in Lebak Regency
- Construction of Ragas Masigit embankment in Ciujung River, Serang Regency
- Construction of Cibodasembankment in Ciujung River, Serang Regency
- Normalization of Cibenda River in Pandeglang Regency.
- Riverbank reinforcement of Cikalumpang River in Serang Regency
- Riverbank reinforcement of Cidurian River in Serang Regency
- Construction of Cikambuy River and Lempuyang River embankments
- Improvement/completion of embankment and valve in Cidurian River in Serang Regency
- Improvement/completion of embankment in Cigudeg Village, Cidurian River, Bogor Regency

2.4. Water Resources Information System

The information system implemented in BBWS Cidanau-Ciujung-Cidurian is primarily for providing information on rain and flood possibility that needs to be informed immediately to the people as well as flood control and management operations.

The objectives of the water resources information system include:

- Realization of a complete and reliable water resources database
- Availability of human resources and the improvement of their capacities
- Rationalization and procurement of adequate equipment

- Water resources data that are coordinated among related agencies and easy to access by the community
- Funding commitment for an integrated water resources information system (SISDA) by the relevant agencies

In addition, several data such as data on water discharge and water level resulted from observations in several locations in the main rivers can also be obtained from the BBWS Cidanau-Ciujung-Cidurian website.

2.5. Community Empowerment and Participation

The Objectives of Community and Private Sector Empowermentand Participation Improvement are:

1) To improve institutions

- Increasing the capacities of work units and their cooperation
- Meeting the needs of employees and increasing their capacities
- Creating an integrated program and budget preparation among agencies
- Collecting water resources management services
- Establishing a Public Service Agency for Water Resources Management

2) To increase community awareness:

- Conducting socialization on domestic and urban water saving
- Conducting socialization on irrigation water saving
- Conducting socialization on industrial water saving through the 3R system

3) To increase preparedness against flood

4) To increase the awareness on garbage management and environmental sanitation

5) To implement and develop CSR for water resources conservation and environment

3. WATER RESOURCES MANAGEMENT IN THE FUTURE

3.1. General

In implementing water resources management in the future, the National Strategic Issues have been declared, which include the following:

- Millennium Development Goals (MDGs) Program
- Food Sustainability
- Energy Availability
- Global Climate Change
- Good Governance in Water Resources Management
- Implementation of Spatial Planning in Water Resources Management

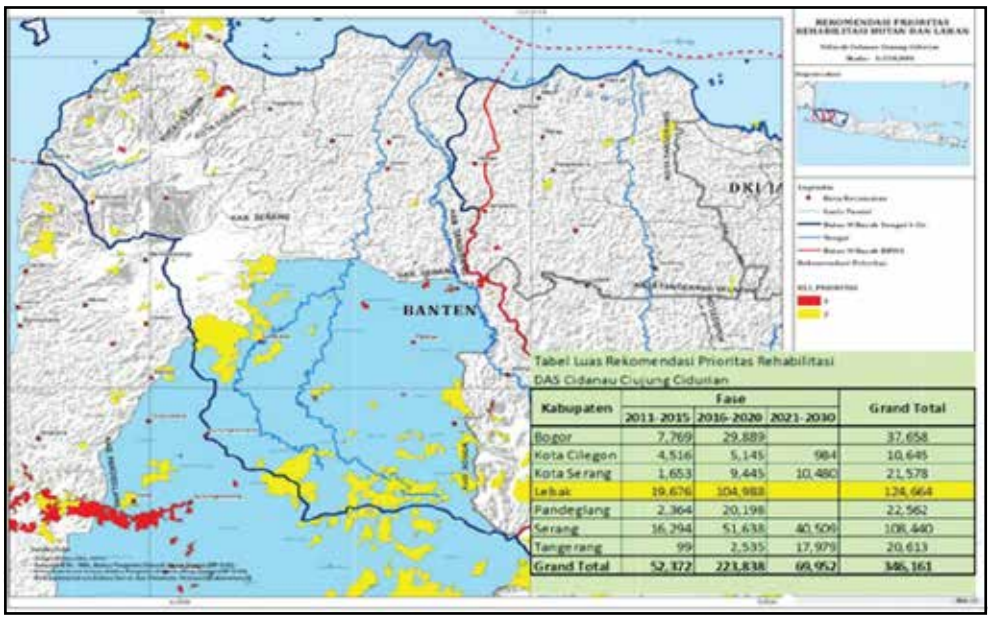
3.2. Comprehensive Management

The comprehensive management referred to here is a management that takes into consideration the water resources management pillars in order to realize the national strategic issues.

The physical construction of strategic water resource infrastructures in BBWS Cidanau-Ciujung-Cidurian is by building multi-function dams that provide great benefits for meeting the community needs.

a) Conservation

Conservation will be carried out according to the Recommendations from the Watershed Management Agency as shown in the Forest and Land Rehabilitation Map in Figure 14 below. The figure shows the Forest and Land Rehabilitation Program until 2030 which covers an area of 346,161 hectares.



Kabupaten	Fase			Grand Total
	2011-2015	2016-2020	2021-2030	
Bogor	7,769	29,889		37,658
Kota Cilegon	4,516	5,145	984	10,645
Kota Serang	1,653	9,445	10,480	21,578
Lebak	19,676	104,988		124,664
Pandeglang	2,364	20,198		22,562
Serang	16,294	51,638	40,509	108,440
Tangerang	99	2,535	17,979	20,613
Grand Total	52,372	223,838	69,952	346,161

Figure 14: Locations of Forest and Land Rehabilitation Program

b) Water Resources Utilization

There are 7 potential locations for dam construction, including the Karian Dam which is currently under construction, as shown in the following Figure 15.

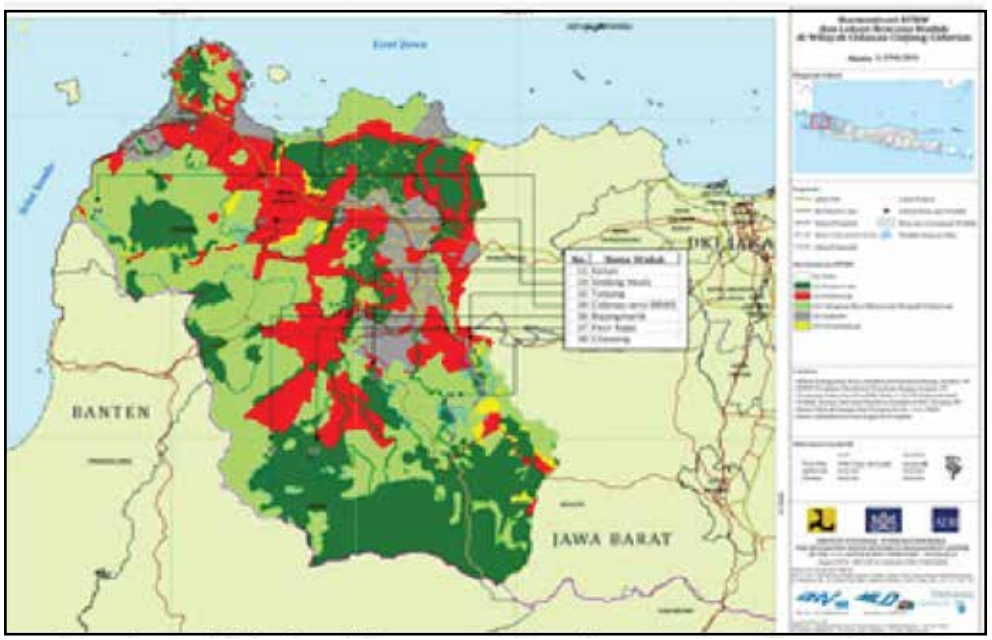


Figure 15:Locations of Dam Construction Plans

The dams planned to be constructed include:

- Cidanau Dam, which will be used for supplying raw water for Cilegon. Cidanau Dam is built by using the Dano Swamp and Cidanau River as the water sources.

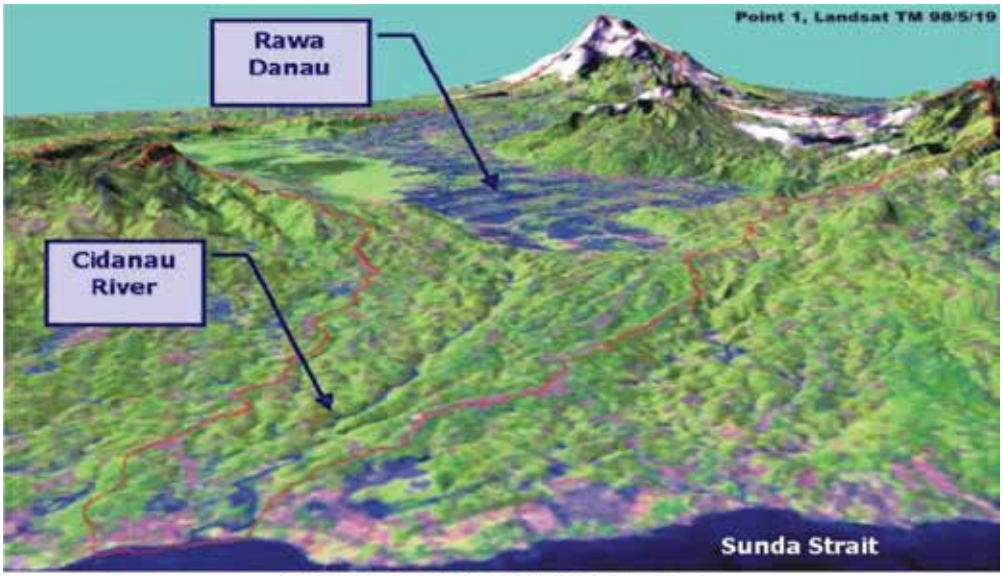


Figure 16: Cidanau Watershed

- Krenceng Dam, which serves as a raw water storage that is used when there is a problem with the Cidanau Pump House I or when the Cidanau River discharge is below the requirements.

  The effective capacity is 2.5 million m³ and the dam has an area extending to 104 hectares. The capacity will be increased to 4.5 million m³ by way of dredging.

- Sindang Heula Dam in Cibanten River

- Karian Dam in Ciherang River, which is a tributary of the Ciujung River. The Karian Dam is able to supply raw water for urban and industrial areas in Tangerang Municipality, Banten, in an amount of 9.1 m³/second, additional raw water for urban and industrial areas in Serang Municipality, Cilegon, and additional irrigation water for the 23-hectare Ciujung Irrigation Area.

3.3. Spatial Planning

Spatial planning is an important matter that will greatly support the realization of water resources management as well as the implementation of Law Number 26 of 2007 on Spatial Planning and related provisions that include:

- Zonation (infiltration area, retention area, etc)
- Recommendation of Sustainable Agricultural Land (technical irrigation)
- Inclusion of socialization on construction supervision (Building Construction Permit/IMB) in the Regional Spatial Plan

This spatial planning issue encountered the conflict of interest on the need of irrigation areas and settlement areas, in which according to the population growth, the need for settlement areas continues to increase, and this led to some irrigation lands being converted into residential, settlement, industrial areas etc.

3.4. Implementation Strategy

The strategy for implementing a comprehensive management in the work area of BBWS Cidanau-Ciujung-Cidurian uses a hydrology and authority-based approach in establishing policies and therefore requires coordination between the Central, Provincial and Regency/Municipal Governments. The measures taken are as follows:

- Conducting the inventorying of hydrological data in a comprehensive and continuous manner for various requirements as part of water resources management in BBWS Cidanau-Ciujung-Cidurian.
- Conducting monitoring and creating a water resources and flood information system, conducting more comprehensive evaluation and studies for future water resources management with regard to climate changes.
- Preparing the Comprehensive Management Plan of BBWS Cidanau-Ciujung-Cidurian by conducting conservation, water resources utilization, water's damaging ability control, debris flow flood control, coastal protection against abrasion, water resources information system implementation, as well as community empowerment, monitoring and involvement.