Table 4-2. River Basin Study Result

	Observation	Risk/ Problem	Mitigate Measures
River Basin : - Cidurian and Cimanceuri - Cisadane - Ciliwung - Pesanggrahan - Cipinang - Cikarang	**Development in River Basin :** Settlement and industrial development : • High-density settlement without preservation structure (BCR ≥50%) more than 60 properties were developed in Bopuncur. Growing demands of residents in Jakarta for second home. Demands from upper class (1985) to middle class (1995 - present) continue supplying property, which conflicts to building regulations *(Ciliwung and Cisadane upstream)*. • Large clustered land allocation for future such as: township, residential and industrial development along Jagorawi (12,500 Ha) in *Cikeas and Citeureup upstream.* • Clustered development and large land allocation for township development and industrial estate along Jakarta – Merak and Jakarta – Cikampek tollway (more than 22,000 Ha). Less integrated city infrastructure provided in smaller development areas *(downstream of Cimanceuri, Cisadane and Cengkareng)*. **Land use Change:** • Land use change and conversion into settlement and industry. Potential large-scale conversion from tea plantation or agriculture area to residential settlement. *(Cikarang and Ciliwung upstream, Cisadane midstream)*. Area of many lakes and basins decrease and	• High building coverage ratio caused increase of flood discharge from excessive run off and low infiltration. • Significant future change of surface drainage pattern without structural prevention (retention lake or pond) resulting risk of high peak flow. • Potentially large volume of run off will secure in un-integrated water management (lack of detention areas). Improper drainage and infrastructure in fringe areas makes local inundation from rainstorm water. • Environmental degradation : - Erosion and sedimentation - Low infiltration and percolation • Flooding due to insufficient capacity of river/ canal caused by :	**Structural Improvement :** a) Countermeasure for retention wells, pond or elevated house and grass pavement to store water in upstream property development area. A longer-term larger dam may propose to store increase upstream discharge; Dam Cidurian and Genteng as proposed by Niken, 1997 (Ciliwung, Cisadane). b) Propose retention facility detention pond to be made for future development by property developer along Jagorawi toll road (Cikeas and Citeureup). c) Analysis the existing and proposed drainage plan in new development area along East – West toll road and Jagorawi in relation with existing flood control management and facilities. d) Normalization of rivers, canal and reservoir and urban drainage improvement in fringe areas (Cisadane and Cengkareng). **Non-Structural:** Institutional: a) Establish a uniform vision of river basin development and water resource management in DKI Jakarta, Bogor, Tangerang and Bekasi facilitate by Central Government. b) Revitalize the existing law and regulation on river and water management under

	Observation	Risk/ Problem	Mitigate Measures
	used for development area, reduce retention capacity *(Pesanggrahan and Cisadane midstream)*. **Institution and Regulation :** • Poor coordination in landuse and infrastructures planning for upstream and downstream river basin, under autonomy mechanism (Central Government and related district or municipal). • Development can be seen in restricted zone of river area and low-lying coastal areas of North Jakarta *(downstream Cisadane, Ciliwung, Angke and Cipinang)*. • River or canal used as disposal areas, while limited solid waste facilities provided in particular areas *(Ciliwung, Cisadane, Angke downstream)*. • Evidence of gradual land subsidence from excessive extraction of *groundwater (Kapuk, Mernya, Kuningan)*.	- Sedimentation (particularly in lower flood plain) - Illegal structures in river area - High discharge from decrement of natural retarding and detention areas • Weak legislation for land use and water management leads to uncontrolled development in river basin. • Ineffective regulation and legislation for development in river area could increase the flood risk to the settler. • Backwater flooding caused by accumulation of garbage in river, canal and floodgates.	regional autonomy framework (Central Government). Obtain consistent and coordinated management from upstream to downstream (*Central Government to facilitate province and related District/ Municipals*). c) Develop coordinating database (GIS), which annually updating and open access the database to user and stakeholder. d) Coordinative of land use and spatial planning in Jabodetabek and Puncak Cianjur considering regulation of river and water conservation. Central government facilitate for provincial/ district or municipality. e) Solid waste management system should accommodate communicate participation and private sector. **Regulation :** a) Land and water conservation: ANDAL assessment is required for development larger than 20 ha in upstream and 100 ha in lower areas. b) Zonal and building regulation in flood plain area. c) Land use planning and building regulation in conservation area (upstream). d) Public dissemination of building regulation in areas required land and water conservation (Bopuncur). e) Legal instrument and low enforcement f) Prevention excessive groundwater with conservation for more than 40 m extraction.

	Observation	Risk/ Problem	Mitigate Measures
	Community Development : • Small numbers of land and river conservation are still on progress in upstream through community (local people) participation (*upstream Ciliwung*). • Community participation in flood protection/ river maintenance and wastewater management (*Penas Tanggul, Cipinang*) in Cipinang downstream. Residential community prefers to live with flood risks instead of relocation.	• Conservation without direct economic benefit may not be attractive for communities. • Sustainability of community commitment to development participation. - Worsen flood risks in certain land subsided areas.	**Community Development :** • Develop the awareness of land and water conservation in upstream to the community (NGO and District Forestry Agency) through promotion of high value perennial crops in critical areas and seasonal crops in flat/ lowland areas (District, Dinas and NGO). • Facilitate community organization/ forum to increase risk awareness of flood in the community (DKI and related districts/ municipal). Public campaign should establish as community-to-community media, not government to community. • Municipality facilitate for community participation project through LPM community empowerment or community forum: - Maintaining clean river and drainage (under solid waste management of DKI and municipal). - Develop minor protection system (dyke, dredging) with facilitate LPM in village level

Table 4-3. Inventory of River Condition

No	Location Spot (Region)	River / River System	Dimension of Canal / River (m)				Fact finding	Condition of flood 2002	
			Wr	Wb	t	h		Flood depth (cm)	Duration
1	Sawangan / Depok Municipality	Pesanggrahan	6.00	6.00	4.00	0.50	- AWLR is provided and in good condition. - Dyke is too low. - High velocity of river with boulders and stone river bed. - The river is meander, risk of erosion and land slide local community provide gabion to protect river bank.	-	-
2	Kel. Kedoya Utara / Central Jakarta	Angke / Pesanggrahan	15.00	13.00	2.00	1.00	- Dyke are lower than flood level, to much garbage in the water course. - Sedimentation reduce flow capacity of the river. - Wide and straight river. - Slow river flow, dirty and polluted and use for liquid waste.	150	14 days
3	Kel.Kapuk Muara / Central Jakarta	Cengkareng Drain / Pesanggrahan	17.00	15.00	3.00	1.00	- Low riverbank, garbage disposal in riverside and river course. - Illegal temporary / semi permanent houses built in the riverbank. - Slow river flow, turbid and polluted make dark colour of the river. - Wide, straight and shallow.	100	3 days
4	Komp.IKPN Bintaro / Tangerang District	Pesanggrahan	11.00	10.00	4.00	1.50	- Meandering river. - Faster river flow with turbid water. - Land slide and erosion in riverbank. - Many teributaries. - Bridge structure is good but low elevation. - Settlement located in lower river plain areas.	300	30 days
5	Perum. Bukit Cengkeh II (Kali Laya) / Bogor District	Cipinang	4.50	4.50	1.00	0.60	- Elevation of settlement Bukit Cengkeh is below river bed. - Dyke is too low and broken in some area. - River flow is faster, but river capacity is limited. - High density settlement developed in meandering river. - Garbage accumulated in the river course.	100	3 days
6	Perum. Lembah Hijau / Bogor District	Cipinang	6.00	5.00	1.50	0.50	- Final garbage disposal located in the riverbank. - River use as disposal area by population in high density settlement. - Urban drainage not in function by debris accumulation. - Meandering river with lower bank elevation. - Right of bank is higher as plantation area. - Flow of the river is faster.	50	1-2 hours

Table 4-3. Inventory of River Condition

No	Location Spot (Region)	River / River System	Dimension of Canal / River (m)				Fact finding	Condition of flood 2002	
			Wr	Wb	t	h		Flood depth (cm)	Duration
7	Kel. Cipinang Muara / South Jakarta	Sunter / Cipinang	11.00	9.00	3.00	1.00	- Settlement along the river. - Final garbage disposal located over the dyke with debris to the river. - Meandering of the river. - Erosion and land slide in some of river bank. - Flow of the river is faster.	50	1 day
8	Situ Arman Cimanggis / Bogor District	Jantung / Cipinang	2.50	1.00	0.75	0.50	- River flows faster through settlement area. - Stone and gravel in the river base, with cleareer water.	-	-
9	Kel. Rawa Terate / East Jakarta	Pertukangan / Cipinang	7.00	5.00	1.00	0.50	- Shallow of the river from sedimentation. - River is not flowing and highly industrial polluted. - Illegal temporary and semi permanent settlement along river. - River use as garbage disposal. - Inundation affected by improper local drainage.	50	2 days
10	Kel. Cakung Barat / East Jakarta	Cakung Drain / Cipinang	15.00	12.00	5.00	1.00	- Straight riverway, muddy and dark water from pollution. - No dyke provided in low river plain settlement. - River use as disposal area. - Shallow of river course from sedimentation.	50	2 days
11	Kel. Rawa Terate / East Jakarta	Kali Cakung / Cipinang	15.00	10.00	1.50	0.50	- Accumulated of sediment and debris / garbage, reduce flow capacity of river. - Illegal settlement along the river. - Existing dyke lower than flood level. - River flow very slow, with darker colour from industrial waste. - Local drainage in settlement area is improper. - Bridge has good structure, but low elevated.	50	2 days
12	Kel. Rawa Terate / East Jakarta	Buaran / Cipinang	15.00	12.00	5.00	1.00	- Muddy river, water polluted with its dark colour. - River use as disposal by local settler. - Erosion occure in some riverbank areas. - Bottleneck from sedimentation and unnecssary debris.	50	3 days
13	Kel. Pulogadung / East Jakarta	Sunter / Cipinang	15.00	12.00	3.00	1.00	- Turbid river with straight water course. - Shallow of river bed from sedimentation. - Semi permanent settlement along dyke. - River use as garbage disposal by local people. - Bridge structure is good. - River flow is slow.	-	-
14	Waduk Pulomas / North Jakarta	Sunter / Cipinang	6.00	3.00	1.50	0.50	- Sedimentation and debris accumulated in water course. - Turbid water. - The river flows slower. - The existing dyke too low. - Settlement along the river.	200	7 days

Table 4-3. Inventory of River Condition

No	Location Spot (Region)	River / River System	Dimension of Canal / River (m)				Fact finding	Condition of flood 2002	
			Wr	Wb	t	h		Flood depth (cm)	Duration
15	Kel. Sumur Batu (K.Item) / North Jakarta	K. Item / Cipinang	13.00	10.00	3.00	1.00	- Debris and sediment in clogged river in some area of the river. - New improvement of dyke and slope protection is under progress. - The river flows slower. - Muddy sediment over river.	-	-
16	Kel.Sunter Jaya (W.Sunter Barat) / North Jakarta	Sunter / Cipinang	6.00	3.00	2.00	0.75	- Evidence of sedimentation in sunter reservoir reduce retension capacity.	-	-
17	Kel. Kebon Pala / North Jakarta	Cipinang	10.00	8.00	3.00	1.00	- Meandering of the river. - Stream goes slow and water polluted from industrial waste. - Existing dyke is to low, and temporary covered by sandbags. - Bridge condition is good. - Density settlement along the river.	100	7 days
18	Penas Tanggul / East Jakarta	Cipinang	10.00	7.00	3.00	1.00	- Semi permanent / high density houses along the river. - River is straight. - Dark coloured water from pollution upstream. - Community participation in river environment maintenance.	100	7 days
19	Kel. Cipinang Melayu / East Jakarta	Sunter / Cipinang	8.00	6.00	3.00	1.00	- Meandering of river with mud sediment. - Slow stream flow. - Low river bank without dyke. - High density settlement along the river.	100	30 days
20	Kel.Bukit Duri / East Jakarta	Ciliwung	15.00	12.00	5.00	4.00	- Semi permanent and permanent houses build along the river bank. - No dyke available in low river bank. - River flows faster, with turbid water. - Bridge structure over the river, with normal elevation.	250	30 days
21	Kp.Pulo / East Jakarta	Ciliwung	No data	No data	No data	No data	- Density settlement along the river. - Suffered permanent flooding. - The area its in lower river plain.	300	30 days
22	Kel. Pengadegan / East Jakarta	Ciliwung	6.00	4.00	4.00	3.00	- Steep slope of riverbank, has risk of sliding. - No dyke provided in the lower left side of the bank. - In normal rainy condition water level reach the existing dyke.	200	2 days
23	PerkebunanTeh Ciliwung / Bogor District	Ciliwung	3.00	1.50	0.30	0.20	- Small and fast stream with clear water. Some avocado plantation for conservation of river area by local farmer. - Boulders and stones in the river bed with clear water.	-	-

Table 4-3. Inventory of River Condition

No	Location Spot (Region)	River / River System	Dimension of Canal / River (m)				Fact finding	Condition of flood 2002	
			Wr	Wb	t	h		Flood depth (cm)	Duration
24	Kel. Batulayang / Bogor District	Ciliwung	6.00	4.00	4.00	0.50	- Steep slope with houses development in upper riverbank has risk to land slide. - Meandering river and flows rapidly of clear water. - Stone and boulders dominated river bed. - Bridge structure is appropriate across the river.	-	-
25	Kel. Mekar Jaya / Depok District	Ciliwung	30.00	25.00	7.00	1.00	- Riverbanks with risk of land slide, with gabion structure protect some areas. - Existing bridge in Mekarjaya, equipped with scale measurement of flood level of Ciliwung. - Straight river with rapid flows and more turbid than clear water.	-	-
26	Jagorawi Golf / Bogor District	Cikeas / Cikarang	20.00	16.00	4.00	1.00	- Tree falling down the river and damaged the bridge embankment, remain unrepaired over 2 weeks. - Straight river with rapid flows and turbid river. - Sediment under the bridge from of narrow passage.	-	-
27	River Side G.Putri / Bogor District	Cikeas / Cikarang	2.00	1.50	1.30	0.60	- Higher velocity of river tributary straight to Cikeas river. - Good bridge construction.	-	-
28	Kel.Babelan / Bekasi District	Bekasi / Cikarang	15.00	13.00	5.00	3.00	- Erosion occurred in steep slope of riverbank. - Land slide happened river land area with no slope protection provided. - Higher velocity of river with turbid river. - Large part of dyke removed by developer to fill lower elevation settlement development.	100	4 days
29	Kel. Sukabakti / Bekasi District	Kali Sasak Goban / Cikarang	25.00	-	4.00	4.00	- Flooding when survey, inundation occurred to paddy field. Sedimentation occurred along the river. Existing dyke lower than flood level.	100	3 days
30	Pantai Hurip / Bekasi District	Kali Bekasi / Cikarang	20.00	-	-	3 ~ 5	- Kali Bekasi has different depth from 3 ~ 5 m cause by sedimentation, part the area covered with water weeds planted by local people - Existing dyke lower than flood level. - The river flows slower.	100	3 days
31	Pantai Hurip / Bekasi District	CBL / Cikarang	80.00	70.00	7.50	2.00	- Sedimentation in the river. - Some part of river occorud erosion. - Bridge structure is good condition. - River wide and flows faster.	100	3 days
32	Ds. Cibadak / Tangerang District	Cimanceuri	23.00	15.00	3.00	1.50	- Straight river course with higher flow velocity. - Low riverbank from water survace in normal condition. - Bridge over river in good condition at appropriate height.	100	2 days

Table 4-3. Inventory of River Condition

No	Location Spot (Region)	River / River System	Dimension of Canal / River (m)				Fact finding	Condition of flood 2002	
			Wr	Wb	t	h		Flood depth (cm)	Duration
33	Jl. Raya Tiga Raksa / Tangerang District	Cimanceuri	22.00	15.00	5.50	2.50	- Steep riverbank with risk of landslide. - Existing bridge with retaining wall narrowing the river width. - Straight and wide river course. - Gifh surface level during survey but not over flowing.	150	2 days
34	Kec.Sukatani (Tambelang) / Bekasi District	Cikarang	15.00	13.00	1.00	1.00	- Local drainage water is not functioned. - Backwater flooding may happen from tidal influence. - No dyke provided along river, which flooded from the river. - Straight and wide river course but shallow. - River use as sanitary outlet (Public Toilet).	100	3 days
35	Kel. Bantar Gebang / Bekasi District	Cileungsi / Cikarang	15.00	13.00	5.00	2.00	- Evidence of small scale sand and gravel quarry. - River bank damaged by land slide from quarry activities. - Straight and wide river with slow velocity and sand sediment.	200	3 days
36	Perum.Kota Wisata / Bekasi District	Cileungsi / Cikarang	17.00	15.00	10.00	2.00	- Sand quarry activities by local settler. - High of riverbank rock confirmation. - Staright river course with turbid water.	-	-
37	Desa Bogor / Tangerang District	Cipangaur / Cimanceuri	26.00	20.00	5.00	1.00	- Sand quarry activities occurred. - Evidence of land slide river bank by quarry activities. - Straight and wide rivercourse with slow velocity of flow.	-	-
38	Kec.Jasinga / Tangerang District	Cidurian / Cimanceuri	50.00	45.00	3.00	1.00	- Local community in voloed in sand quarry activities.	-	-
39	Desa Pasir Ampo / Tangerang District	Cidurian / Cimanceuri	30.00	15.00	3.00	1.00	- Gabion in pasir ampo was broken during flood 2002. - Land slide happened above the gabion damaged the road. - Meandering river.	-	-
40	Kel. Renged / Tangerang District	Cidurian / Cimanceuri	25.00	15.00	3.00	1.00	- Meandering river with risk of erosion of the riverbank.	100	2 days
41	Ds. Gunung Kawi / Tangerang District	Cimanceuri	25.00	20.00	5.00	1.00	- Sedimentation reduced flow capacity of river.	100	2 days
42	Ds. Kelebet / Tangerang District	Cimanceuri	105.00	25.00	4.00	2.50	- Dyke is lower than flood level.	100	10 days
43	Kel.Paledang / Bogor Municipality	Cisadane	20.00	18.00	2.00	1.00	- Development of houses on the steep area of riverbank caused erosion and sedmentation. - Meandering of river aligment. - Land slide evidence in river bank and sediment.	150	3 days
44	Kel. Kebon Pedes / Bogor District	Kali Baru / Cisadane	15.00	10.00	2.50	1.00	- Housing along river. and use the river as disposal area, no solid waste facilities in settlement area. - Sediments and garbages appear in the river, decrease flow capaciry of the river and increase flood area. - Higher velocity of river with turbid water.	75	3 days
45	Tajur K.Cibalok / Bogor Municipality	Cisadane	15.00	10.00	2.00	1.00	- Housing constructed over the river (with foundation reach riverbed). High velocity of river with boulders and stone river bed.	-	-

Table 4-3. Inventory of River Condition

No	Location Spot (Region)	River / River System	Dimension of Canal / River (m)				Fact finding	Condition of flood 2002	
			Wr	Wb	t	h		Flood depth (cm)	Duration
46	Kel.Gudang / Bogor Municipality	Cisadane	14.00	12.00	4.00	0.50	- Left and right dyke constructed with stone masonry - Accumulated of debris and waste in gate.	150	1hour
47	Kel. Periuk Jaya / Tangerang District	Kali Sabi / Cisadane	11.00	7.00	1.30	0.25	- Settlement located in lower river plain areas.	100	1 day
48	Gn.Pasir Gudang / Bogor District	Cisadane	3.00	1.50	1.00	0.50	- Evidence small scale sand quarry around the river. - River bed with stone, gravel and sand.	-	-

Sources : Urgent Inventory Study on Damage of Flood 2002 in Jabodetabek area in Indonesia, PT. Mitrapacific Consulindo International, February 2003

Note :

- Wr = riverwidts
- Wb = widts of riverbed
- t = height from riverbed to dyke
- h = water level height.

Photo and sketch append in the appendix.

Figure 4-4. Profile of Cisadane River

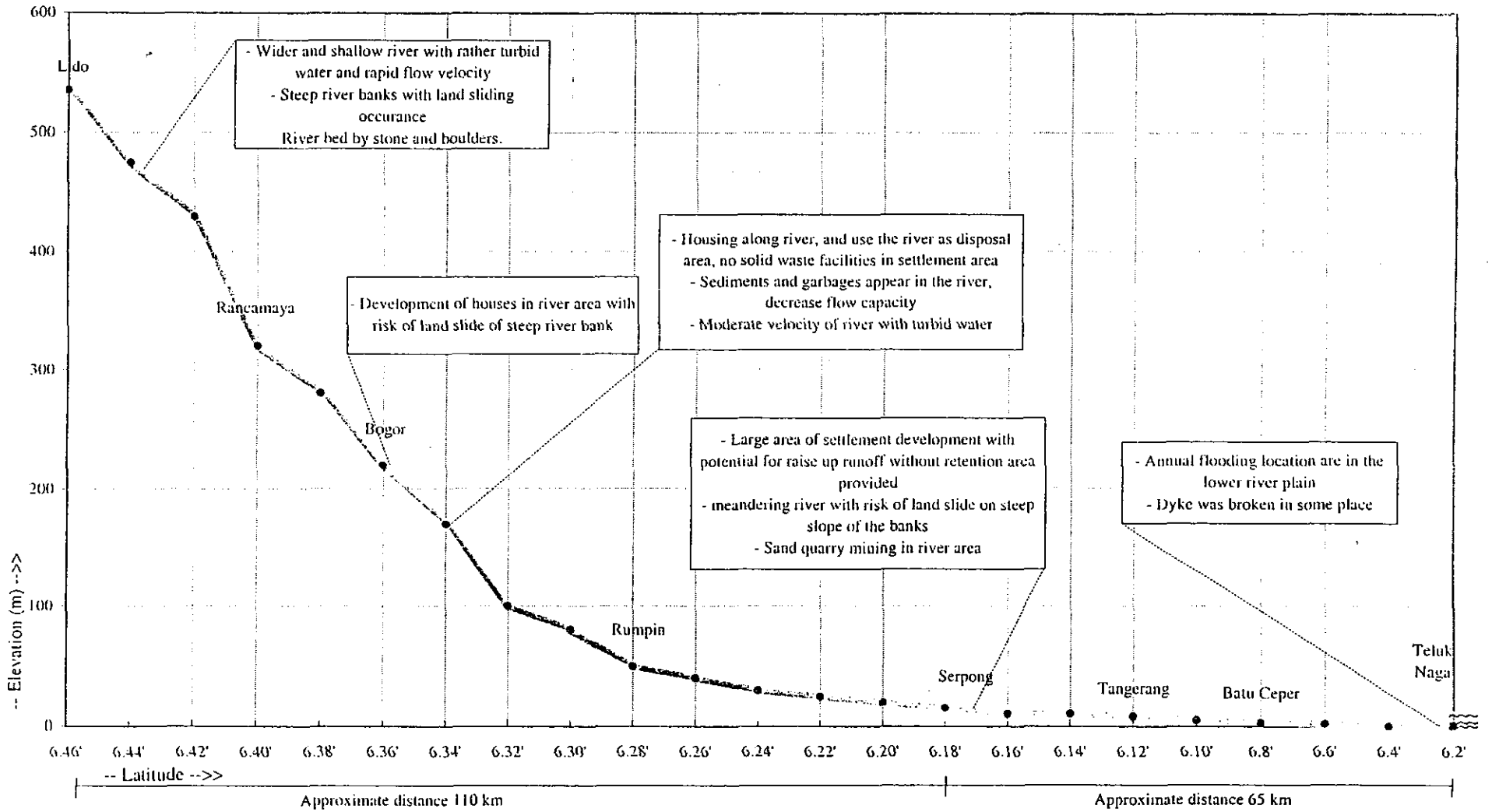


Figure 4-5. Profile of Ciliwung River

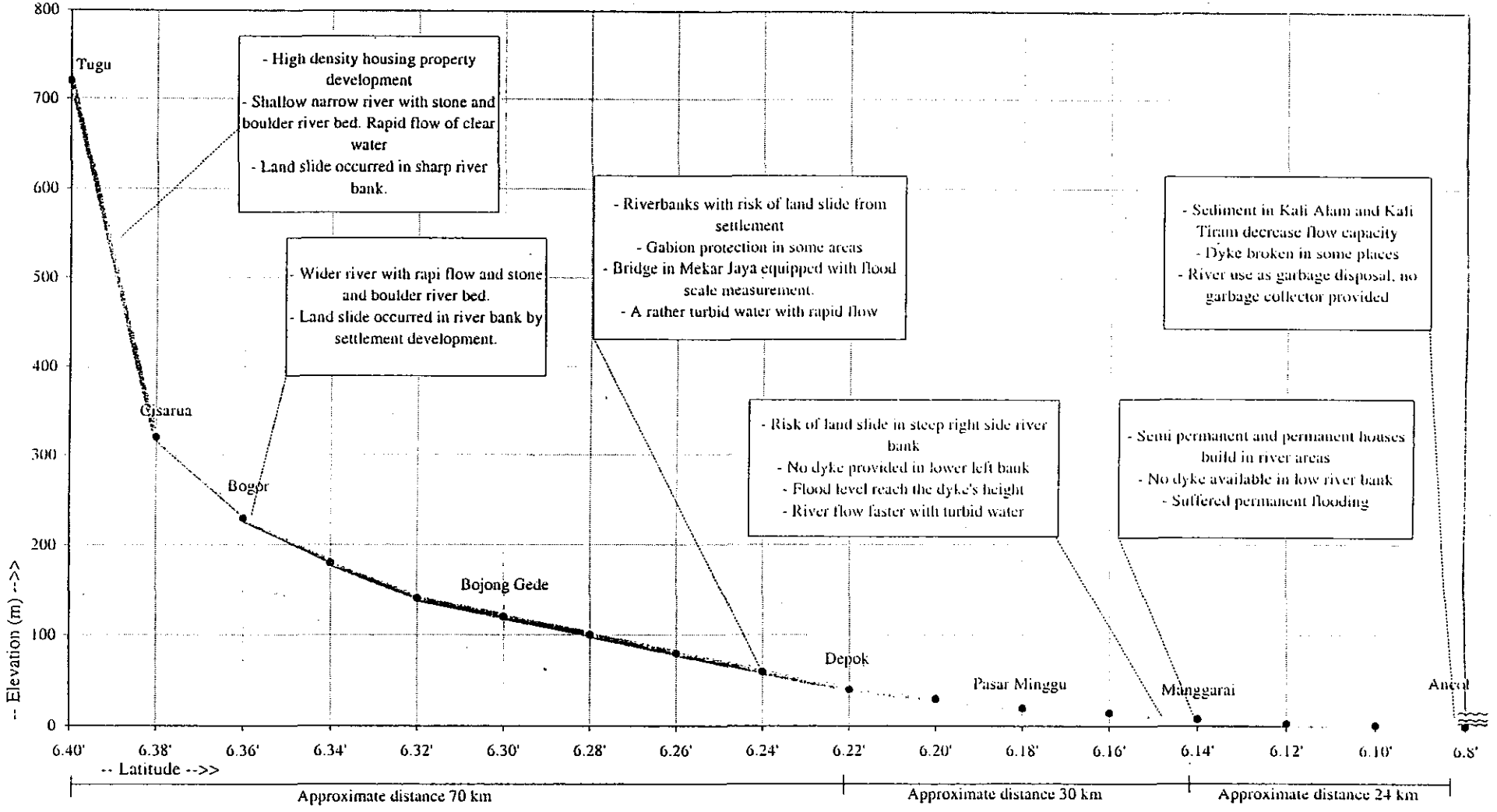


Figure 4-6. Profile of Kali Bekasi

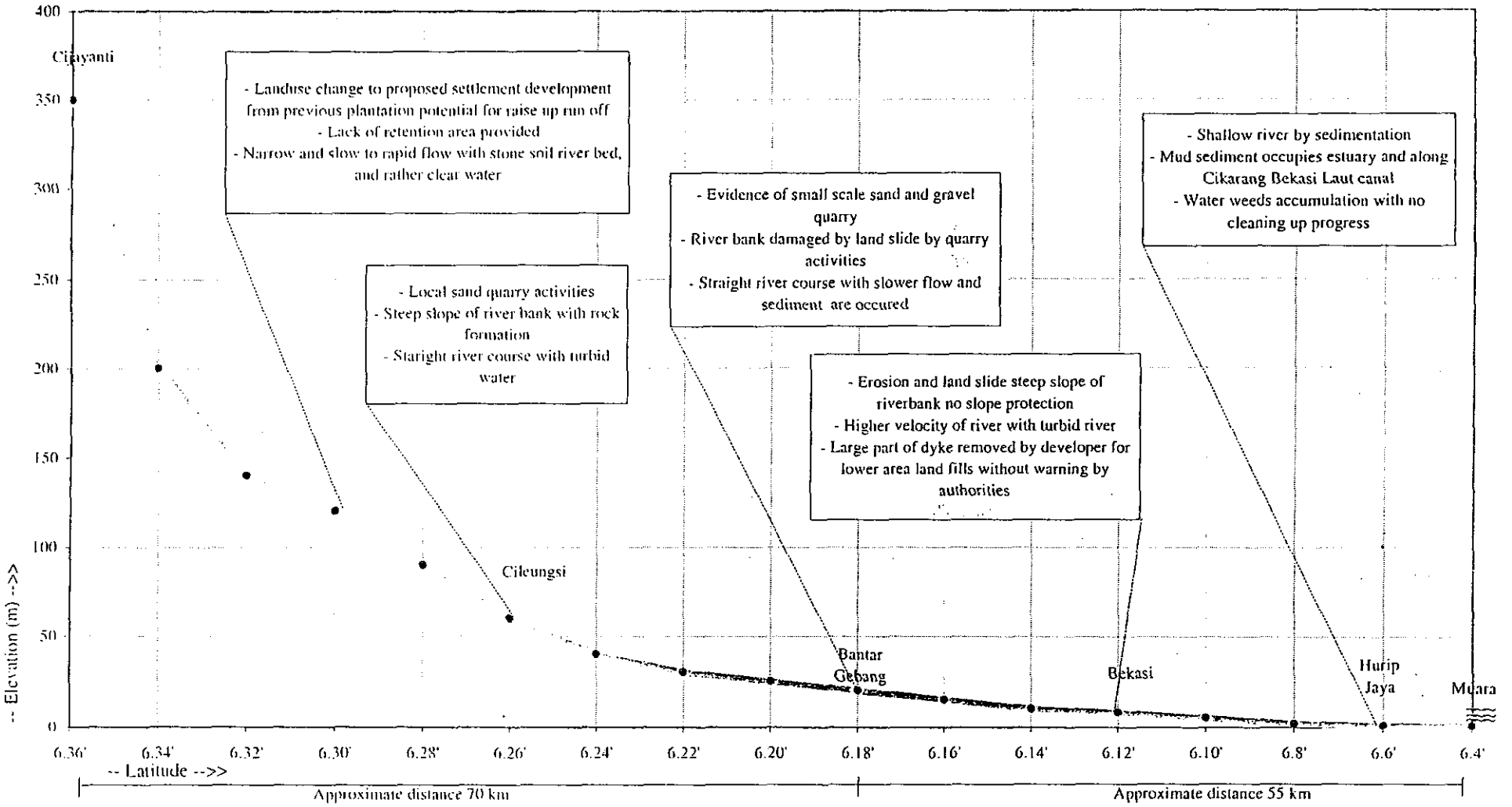
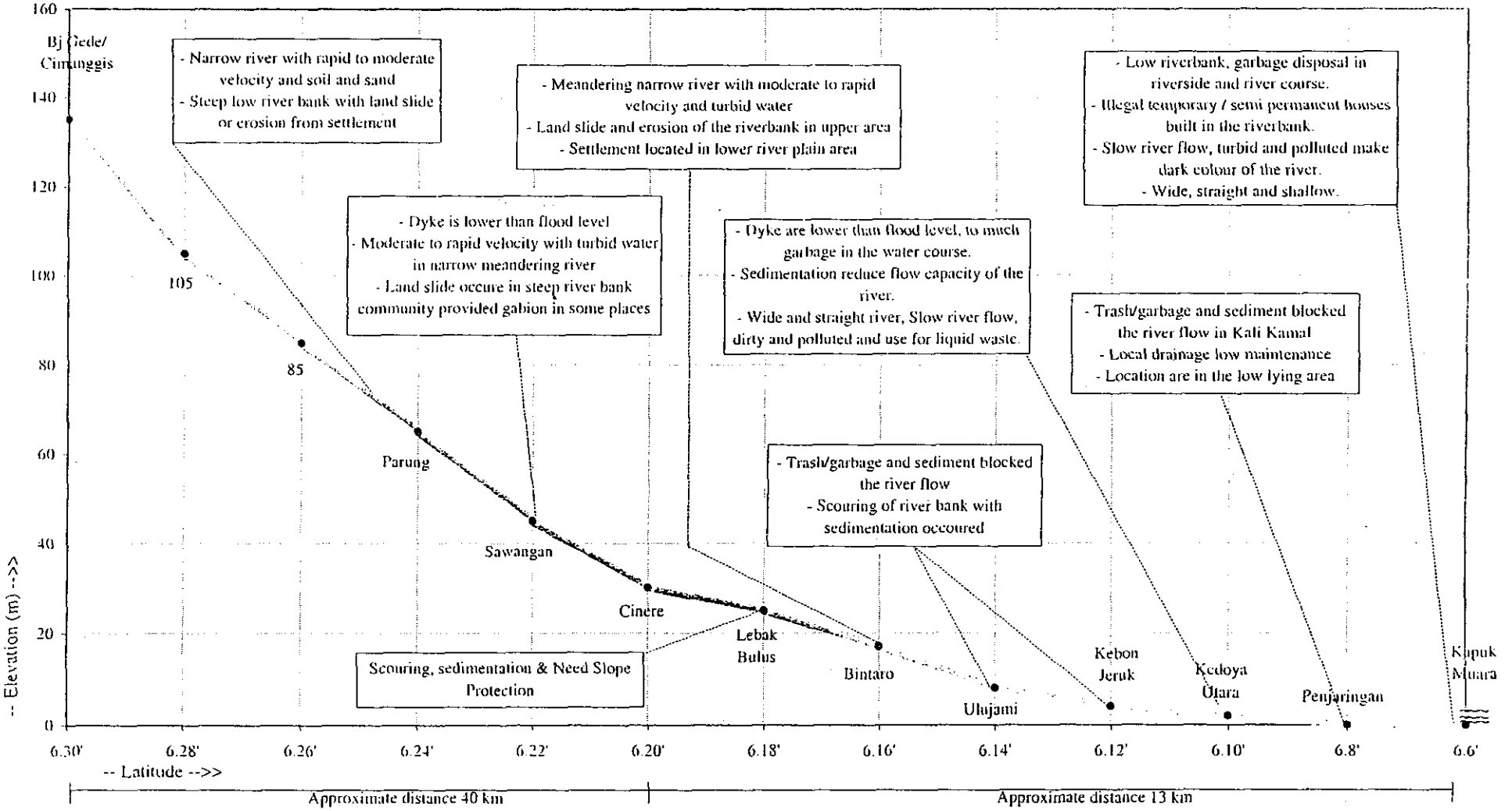


Figure 4-7. Profile of Pesanggrahan River



4.2 Information of heavily inundated area and flood facility sites

Based on the flood information given by Public Works Service from DKI Jakarta, Tangerang, Bekasi, Depok and Bogor, the heavily inundated areas were identified of 53 km^2 within the entire inundated area at flood 2002 of 526 km^2.

Due to short time allocation for field study has been made into 31 locations of inundated area selected from recorded flood inundation area from DKI Jakarta, Tangerang district and Tangerang municipality, Bekasi district and Bekasi municipality, and Depok municipality. The available information it self are not identical from either Kimpraswil, local government and other sector government (Social department).

The survey locations in 31 villages are selected to represent DAS (watershed) with criteria of flood depth more than 50 cm for more than one weeks (7days) inundation.

Survey result of flood control and protection facilities, list of selected area & survey location in 2003, and results of interview survey & observation are shown in Table 4-5 & Figure 2-3, Table 4-9 and Table 4-10, respectively.

4.2.1 Flood Control Facilities

The flood control and protection facilities in Jobodetabek have been undertaken. Limited time allocation of field survey become constraint to record all available facilities. The flood control and protection like river structure; gate and pump are observed as much as possible, from existing river and drainage system, as shown in the Table 4-6, Table 4-7 and Table 4-8.

Operation and maintenance of river in DKI Jakarta has been sharing with central government since 1994. Any river flows through administration two province become the responsibility for central government for O&M, rehabilitation, etc. Schematic diagrams of existing drainage, river and flood control facilities of Jabodetabek and River Management by Respective Institution are shown on Figures 4-5 and Figure 4-6, respectively.

- ***Flood control structure***

  Flood control structures in study area consist of gates and pumps. Condition of most gate structures are in working condition, except in Pasar Baru (Tangerang) weir two out of ten gate cannot operated properly, For better operation Manggarai will be constructed new gate in 2003 under tendering process. Condition of pump station were obtain in several location immerse during flood 2002, the pump cannot operate for several days to remove water and several other pump were decreased its capacity due to lack of maintenance as show on the following Table 4-7.

  For example : The existing pumps at Sunter and Mangga dua Abdad pumping stations which were installed in 1984, have discharge capacities of 2 x 3.3 m^3/s for 6 hours operation per day. Rehabilitation of the pumping stations to maintain operation was carried out in 1993. Survey results indicate that pump operation has to be increased to 7 - 10 hours/day to compete with pump previous normal capacity.

The pumps at Sunter Utara are operated during rainy season approximately 3 and 4 hours per day to control Sunter Utara reservoir. Operation manual is based to the machine capacity during design and installment, which in flooding 2002. The water level of the lake is beyond capacity of the pump capacity.

There are many gates, which have been installed without pumping stations to discharge the interior drains when gates are closed during flooding period. Therefore, gates such as those gates in Sunter Jaya, Kali Hitam cannot be operated optimally. In addition, many inundated areas, such as Cipinang Besar, do not have pumping equipment. Therefore portable pumps are required for low land area in DKI Jakarta.

Some communities in the study area such as Kapuk Muara and Kamal Muara have expectations of building control gates along Kali Angke and Kali Kamal.
The pumps station mentioned above is needed rehabilitated or to increase its capacity by adding more pump to drain the water.
Further polder and pumping facilities are required in the lower area of DKI Jakarta.

- ***River or channel and over passing structure***

- The number of bridges in JABODETABEK within the section of river studied for flood control purpose includes approximately 230 road bridges and 11 of railway bridges. These bridges are summarized in the Table 4-4.

This structures over the rivers and canals are laid under actual flow capacity of the river when flooded.

Table 4-4. Bridges in DKI Jakarta

River	Number of Bridges		River	Number of Bridges	
	Road	Railway		Road	Railway
Mookelvaart	27	-	Sunter	29	1
Angke	2	-	Buaran	12	-
Pesanggrahan	4	-	Cakung	21	-
Grogol	29	1	Cengkareng Floodway	13	-
Kurkut	28	1	Sodetan Grogol	2	-
Ciliwung	35	5	Western Banjir Canal	15	3
Cipinang	15	-			

Source: - *The Study on Comprehensive River Water Management Plan in Jabotabek, March 1997, Nikken Consultant, Inc and Nippon Koei, Ltd.*
- *Urgent Inventory Study on Damage of Flood 2002 in Jabodetabek area, PT. Mitrapacific Consulindo International, March 2003.*

In many rivers and canals accumulation of sediment has reduce discharge capacity with potential of overflow when flooded. Problem of lack of maintenance such as garbage, debris clogged in the river, control gate and reservoir. In higher density urban areas, which have a lot number of people susceptible to use river as disposal area.

Government to maintain the clean environment of rivers and drainage facilitates very limited community participation. Private non-government organization has succeeded in involving community for flood protection and clean environment in Penas Tanggul, Cipinang, DKI Jakarta.

- ***Dam and Reservoir***

Local governments within the Sub-Western river basin are responsible for the maintenance of 7 reservoirs (waduk), namely Grogol, Tomang Barat, Rawa Kepak, Jelembar/Wijaya Kusuma, Komplek IKPN, Komplek Hankam Slipi and CBL (Canal Bekasi Laut).

Local governments within Sub-central river basin are responsible for maintenance of 4 units of reservoir (waduk) at Setiabudhi Barat, Setiabudhi Timur, Melati and Pluit Barat.

Dam and reservoir include facility pump, in DKI Jakarta, there are 38 existing pump stations for urban drainage, with a total capacity of 193,63 m^3/s. A further 11 pump stations with total capacity 58,26 m^3/s are currently under construction. The main features of the pump stations and their locations are shown on Table 4-7.

- ***Flood Retention and Retarding Area***

In some parts of the study area, small lakes (situ) are used for flood retention and in lowland areas are used for retarding purposes. There are 37 retention ponds (situ) concentrated in kabupaten Tangerang and 5 situ in Tangerang city, including Situ Patrasama (260 ha) and Situ Garugak (180 ha) located near the Cidurian River, and situ Cipondoh (128 ha) located in Tangerang City.

Referring to "Project Aid Proposal for Conservation Works of Situ-Situ in the Jabotabek Area" (DGWRD, August 1994), the total existing area of situ-situ is 21.25 km^2, which accounts for 0.35 % of total Study Area (6,070 km km^2). The areas of situ-situ by district are summarized as follows :

- DKI Jakarta (1.68 km^2)
- Kabupaten Bogor (5.15 km^2)
- Kabupaten Tangerang (13.06 km^2)
- Kabupaten Bekasi (1.36 km^2)

  Total (21.25 km^2)

Geomorphologically, situ-situ areas are generally located in shallow valley plains, which are less dissected than those along the major rivers. Few situ-situ are located on the alluvial coastal plain. Many small situ-situ are located at the upper end of valley plains where groundwater often rises to the surface.

As observed in several situ (Cipondoh, Patrasama, etc), the pond area is lack of maintenance as it covered by wild plants and debris. However, the number and area of situ-situ have decreased, significantly, especially in recent years, due to land reclamation and urbanization, as shown in Table 4-8.

- *Irrigation Channels*

  The existing irrigation channels in the study area are in working condition in both upstream and downstream areas of Bogor, Tangerang and Bekasi although significant numbers of irrigated area or sawah have change into settlements or industries. Most of irrigation control facilities in Tangerang and Bekasi, urban area were functioned more as flood control facilities.

- ***Dikes Embankments, etc.***

  Dikes have been constructed along river basins in flood plain areas. Some dikes have been damaged due to over topping by floodwater and soil excavation by the local people in order to fill up other development in low areas. The location of dyke, which were overtopping during flood 2002 appeared in 48 location of survey as shown in Table 4-3.

  Dyke improvements along the Sekretaris, Cipinang, Sunter and Pesanggrahan rivers are a major expectation of the community, resulting from interview to the local leaders.

Table 4-5. Survey Results of Flood Control and Protection Facilities

Observations	Risk/ Problem	Mitigative Measures
A. Facilities Rivers: • Erosion and sedimentation can be seen in river bend area. (*in part of Cisadane, Ciliwung, Cipinang, Cikarang rivers).* • Dykes damaged worsen the inundation area from overflow (*downstream Cidurian, Cisadane, Ciliwung, Angke, Cipinang and Cikarang rivers).* • Low dykes and dense settlement infringe on river. • Structure over the river (bridges) lies under actual flow capacity of the river (Bintaro, Angke, Ciliwung, and Grogol, etc.). • Accumulation of sediment in river outlet (no dredging) such as: *Cisadane, Baru and Item river.* • Embankment used as temporary garbage disposal (*Sunter, Cipinang and Cakung drain rivers*).	• Backwater flooding due to restricted flow at river crossing structures; floodgates and bottlenecks caused by solid waste and accumulated debris. • Flooding due to insufficient discharge capacity of river and canal due to sedimentation. • High rain upstream and tidal influence could make severe backwater flooding in northern lowland of Jakarta, Tangerang and Bekasi potential for serious flood damage in inundated areas.	**Structural Improvements:** • Improvement of rivers and dykes (dredging, slope protection) and rehabilitation of reservoir, lake and ponds. • Recondition obsolete pumps and gates including support facilities (normalization). • Urban drainage improvement (North Cipinang, Rawa Badak, East Kelapagading, Cisalak and Lembah Griya, Depok). **Non-structural:** • Assess the possibility of flood management linked with water resources management organization in autonomy framework, to accommodate integrated management of watershed. • River area revitalization and regulation for development in flood plain areas (flood plain management). • Law enforcement against violation and pollution to the river area. • Coordination among of private sector and government regarding opportunity of private investment in solid waste management.
Flood control and protection: • Existing gates were designed according to required peak flow, but too small for present flow (*Manggarai weir*).	• Floodgate operation is refrain by unavailability or obsolete condition of equipment.	**Structural Improvements:** • Improvement of rivers and dykes (dredging, slope protection) and rehabilitation of reservoir, lake and ponds.

Observations	Risk/ Problem	Mitigative Measures
• Floodgates operated by manual and absence of leveling scale instrument (*Cideng river at Setiabudi reservoir, Ciliwung river at marina Ancol gate, residential drainage canal at Margahayu village, Cipondoh lake*). • Clogging due to debris and solid waste in front of gates. Most gates are not equipped with trash rack (*Cisadane river at empang weir, Baru and Item rivers*). • Operator stays far from the gate (*Cipondoh lake and irrigation canal at Margajaya village, Bekasi*). • No appropriate data or inventory of gates located outside DKI.	• Uncontrolled flood in some area resulted from uncoordinated operation of floodgate. Long duration of inundation due to malfunction of floodgate.	Recondition obsolete pumps and gates including support facilities (normalization). • Additional observation stations in Angke, rivers in Tangerang and Bekasi, and in flood gate location close to areas exposed flooding. • Development of standard O&M for integrated operation and institutional development covers Jabodetabek district and municipality. • Warning system base to flood analysis (include forecasting) to access public/ community. **Non-structural:** • Review the authorities and share responsibilities of available institution in district level for integrated management of river and drainage facilities (PU District, PIPWSCC, Badan SDA, Otorita Jatiluhur etc. • Law enforcement against violation and pollution to the river area.
Pump station:		
• Pumps are not capable of reducing water levels during long periods of heavy rain (3-4 hours) due to inadequate capacity (*Sunter, Mangga dua abdad, Sunter Utara and Mangga dua raya*). In some location, pumps are laid below river dykes (*Setiabudi Timur and Setiabudi Barat*) • Some pumps are provided and operated by private with lack of operational coordination.	• Water level remains high during the period of long rainfall (more than 4 hours) • Flooding spread to other areas as no coordination of pump operation.	

Observations	Risk/ Problem	Mitigative Measures
Reservoir: • Some reservoir with control gate do not equipped with pump station. • Capacity of most reservoirs has decreased from sedimentation (*Pulomas, Sunter and Lido*). • Floating debris and water hyacinth (eceng gondok) are covered many ponds or lakes	• Without pump station, reservoir only functions as a retention system and cannot lower the water level. The smaller the capacity of reservoir, the larger the area inundated by flood.	
AWLR (Automatic Water Level Recorder): • Physically the buildings are in good condition for 8 locations surveyed.	• Flooding is difficult to monitor in those rivers, which do not have observation stations.	
Warning System: • All pump stations are equipped with walkie-talkie, in good condition. • Observation stations have no direct communication with the population to provide early warning information. All information transferred on single band to SATKORLAK.	• Warning system follows the organizational structure for disaster management. Warning system direct to community is not effective people have limited time to prepare for inminent disaster.	
B. Operation and Maintenance • Water level is labeled at emergency alert I, II, III and IV in each pump station, but no technical guidelines for integrated operation in region where 2 or 3 pumps should work simultaneously (pump station Ancol, reservoir Sunter and D. Sunter Selatan).	• Guideline provided for partial operation and maintenance. Lack of integrated guidelines for O&M system in Jabodetabek.	**Structural Improvements:** • Development of standard O&M for integrated operation and institutional development covers Jabodetabek district and municipality. • Warning system base to flood analysis (include forecasting) to access public/ community.

Observations	Risk/ Problem	Mitigative Measures
• Gate operation is based on visual observation of river level on site during flooding or rain. Technical guidelines and measurement scales are not provided at all floodgates. <u>Flood monitoring:</u> • No site monitoring facilities to indicate flood condition (present, past and future). • Flood forecasting should enter public issues (community awareness) not only consumed by technical operator.	• Difficult to anticipate requirement for preventive action before river water level rises. • Absence of flood monitoring to indicate flood conditions, telemetric equipment is not effectively operated.	**Non-structural:** • Use the role of central coordination team of water resources management (Keppres 123 Year 2001) for effective result of Jabodetabek coordination in planning, programming and monitoring included O&M of flood control and protection facilities. • Assess the possibility of flood management linked with water resources management organization in autonomy framework, to accommodate integrated management of watershed.
C. Institutional • Central government and DKI have the agreement for operation and maintenance. No similar arrangements exist at Bekasi, Bogor, Depok and Tangerang. • Horizontal coordination with BMG, seaport, airport and other sectors road infrastructure solid waste and wastewater is not clearly established.	• The operation and maintenance organization is established under various institutions (Kimpraswil (project), Dinas PU and district/municipality). Difficulties with integrating planning, operation and maintenance and disaster management result in lengthy decision-making process. • Lack of coordination to minimize conflict of interest in sector and districts, provincial, central.	**Non-structural:** • Use the role of central coordination team of water resources management (Keppres 123 Year 2001) for effective result of Jabodetabek coordination in planning, programming and monitoring included O&M of flood control and protection facilities. • Assess the possibility of flood management linked with water resources management organization in autonomy framework, to accommodate integrated management of watershed.
D. Community Participation: • Evidence of community potential to develop emergency protection, i.e. building dykes, emergency pumps, small dredging works and also management during disaster *(taman ratu, Greenfield, penas tanggul).* • Temporary settler has low awareness for environmental and conservation management	• The sustainability of community participation will not be achieved without involving their appreciation in every development stage	**Community Participation:** • Empower community organization for water and environment management in village level develop participatory program (PRA) for clear environmental of river and drainage within Jabodetabek solid waste management system. • Involve community and other stakeholders at all stages of development (planning, monitoring and evaluation)

Observations	Risk/ Problem	Mitigative Measures
		• Public risk awareness to the community with flood forecasting information will protect themselves from flood damage (public campaign). Development and maintenance of minor protection system (dyke, slope protection and dredging). • Install and operate early warning system in flood exposed area of Posko using community participation
On-going Flood Control and Protection Project Proposal from Kimpraswil, DKI, Bogor district and city, Tangerang district and city, Depok city and Bekasi district and city • Bogor District: Ciawi reservoir development, Cisadane river reservoir development and rehabilitation of lake (Central government project). • Bogor City: Rehabilitation of lake and Ciliwung – Cisadane tunnel development (Central government project). • Depok: Rehabilitation of lake and rehabilitation of river dyke and drainage canal. • DKI Jakarta: Improvement dyke of Pesanggrahan river, normalization of Ciliwung river, Western Banjir Canal, Angke Krukut, Mampang, Cipinang, Sunter, Buaran/ Jt. Kramat, Cakung, Cengkareng drain, construction of Eastern Banjir Canal and procurement of pump mobile, rehabilitation of river dyke and banjir canal (Central government and DKI).	• Lack of government financing and/ or delays with receiving approvals from international funding agency • Slow implementation for large scale project, the smaller developments can be implemented through local budget (APBD)	• Authorities (central, provincial and district) and stakeholders should jointly evaluate all potential projects. Identify priorities and the largest sustainable action to lesson damage relative to the allocated budget and time frame • Identify projects to be undertaken by central, district or provincial (DKI) levels and activities suitable for community participation or private investment

Observations	Risk/ Problem	Mitigative Measures
• Tangerang District: Retention area of Cimanceuri river, dyke improvement of Cidurian and Ranca Liat river, solear water reservoir development, normalization of downstream Cisadane river (Tangerang drainage master plan).		
• Tangerang City: Normalization of upstream Cisadane river, Sabi, Pondok Arung and Periuk Jaya, FS/ DD Angke watershed and Cisadane river, rehabilitation of lake (Tangerang drainage master plan). • Bekasi District: Normalization of Sadang river (DT 5), Menir Sasak Jarang, Cibuntu, Cibeureum rivers, Cikarang, Ciheurang, Sadang, Lempak rivers, rehabilitation of river dyke • Bekasi City: Normalization of Bekasi, Cikeas, Cileungsi, Babelan rivers, Cikarang – Bekasi – Laut (CBL). • DKI Jakarta, Bogor and Tangerang: Installation of warning system, construction of supervision, study and detail design for mid-term. • New Master Plan of Flood Mitigation : a) Rehabilitation of Cisadane river for discharge capacity < 1500 m^3/s consist of: rehabilitation of Cisadane river from Pasar Baru to estuary (22 km), Pasar Baru gates 10 units, upstream Pasar Baru (if required) up to km 37, Sabi river and Empang weir		

Observations	Risk/ Problem	Mitigative Measures
b) Construction of reservoir or Ciawi Dam at upstream Ciliwung river, Parung Badak Dam at Cisadane river, installation of warning system along Ciliwung – Cisadane river, construction of 1 unit tunnel Ciliwung to Cisadane diameter 8m, discharge < 300 m^3/s and Rehabilitation of Western Banjir Canal.		

Table 4-6. Inventory of Gate Condition

No	Location		Equipment Facility and Information					Condition in 2003 Survey Base on Site
	Name of Gate	River / River System	Total Gate (Nos)	Dimension (m)	Accessories	Function	Management	
1	Manggarai	West Banjir Canal / Ciliwung	2	2 x 5.20	Electrical operated, equipped with trashrack, handy talky are provided	Drainage	Kimpraswil	Good condition
2	Kali Cideng Setiabudi Reservoir	Cideng / Ciliwung	2		Handy talky provided	Drainage	PU DKI	Constructed 3 new gates.
3	Kali Cideng Kebon Kacang	Cideng / Ciliwung	2	2 x 2.00	Electrical operated, AWLR and warning system through radio telecomunication	Drainage	PU DKI	Good condition
4	Kali Cideng Gate	Cideng / Ciliwung	3	3 x 3.00	Electrical operated, warning system through radio telecomunication	Flood control	PU DKI	Good condition
5	Kartini V	Ciliwung	2	2 x 1.00	Electrical operated, warning system through radio telecomunication	Drainage	PU DKI	Good condition
6	Mangga Dua	Ciliwung	2	2 x 2.00	Electrical operated, warning system through radio telecomunication	Flood control	PU DKI	Good condition
7	Ancol	Ancol / Ciliwung	2	2 x 2.50	Electrical operated through radio telecomunication	Flushing	PU DKI	Good condition
8	Marina Ancol	Ancol / Ciliwung	5		-	To regulate the tidal influence to Ciliwung river	PU DKI	Level scale was damage
9	Ancol Pump Station	Ancol / Ciliwung	2	2 x 3.00	Equipment with radio comunication	Drainage	PU DKI	The gate working well
10	Sunter Utara	Ancol / Ciliwung	2		Equipped with pump station	Drainage	PU DKI	Pump cannot control waterlevel for long period of rain.
11	Jl. Griya Utama	Sunter / Cipinang	2	2 x 3.00	Operated by manual	Drainage	PU DKI	Gate not covered by roof
12	Sunter Selatan	Sunter / Cipinang	5		Telephone with radio comunication is provided	To control water level of the south sunter reservoir	PU DKI	Good operation
13	Simpang Tujuh Gate	Cisadane	3	3 x 2.50	Telephone with radio comunication is provided	To regulate the tidal influence to Cisadane river	PSDA Tangerang	One of gates not working
14	Pintu 10	Cisadane	10	10 x 5.00	Equipped with AWLR and warning system, telephone and radio cummunication	To regulate the tidal influence to Cisadane river	PSDA Tangerang	Part of machine are not in function and leakes occurred on some gates

Table 4-6. Inventory of Gate Condition

No	Location		Equipment Facility and Information					Condition in 2003 Survey Base on Site
	Name of Gate	River / River System	Total Gate (Nos)	Dimension (m)	Accessories	Function	Management	
15	Aplat Luise Gate	Mookervart / Cisadane	2	2 x 5.00	Telephone with radio comunication is provided	Flood control	PSDA Tangerang	Need maintenance to clear,debris in front of gate.
16	Pulomas Reservoir	Sunter / Cipinang	2	No data	Equipped with trashrack	Retention area	PU DKI	Trashrack not working and garbage removal by manual
17	Kartini Gate Bekasi	Bekasi / Cikarang	3	2 x 1.50 1 x 1.00	Telephone with radio comunication is provided	Drainage	PU Bekasi	Gate not covered by roof and manual operation.
18	Margajaya Gate	Bekasi / Cikarang	4	4 x 2.00	Telephone with radio comunication is provided	Drainage	PU Bekasi	Operation with manual too much sediment in front of gate
19	West Cisadane Drainage	Cisadane	4	4 x 3.00	Equipped with level scale measurement	Drainage	PSDA Tangerang	One gate is not working, roofing structure are damaged.
20	Waduk Besar Cikokol	Cisadane	4	4 x 1.50	-	Retention lakes	Developer	Good condition
21	Situ Cipondoh	Cisadane	3	3 x 1.50	-	Flood control	PSDA Tangerang	Gate not working
22	Kali Cirarab	Cirarab / Cidurian	5	3 x 1.50 2 x 0.80	-	Irrigation	PSDA Tangerang	Debris accumulate in front of gate
23	Kali Item Gate	Item / Cipinang	3	3 x 3.00	Equipment telephone with radio comunication	Flood control	PU DKI	Some damages accurred in gate house, need maintenance to clean up the garbage in front of gate.
24	Rajawali Gate	K. Mati / Ciliwung	1	1 x 1.00	Equipped with pump and trash rack	Drainage	Private Sector	Good condition
25	Jati Pinggir Gate	West Banjir Canal / Ciliwung	4	4 x 5.90	Electrical operated, equipped with trashrack and handy talky	Drainage	PU DKI	Good condition
26	Jembatan Merah Gate	Ciliwung	4	4 x 3.60	All gate operated by electrical	Flood control	PU DKI	One of gate is leaking
27	Kali Baru Gate	Kali Baru / Cisadane	4	4 x 1.50	Manual operated, handy talky is provided	Flood & Irrigation	PSDA Bogor	One of gate is leaking and facilities not covered by roof.
28	Kali Sulang BBL.3	K. Sulang / Cisadane	7	3 x 1.50 2 x 1.00 2 x 0.50	-	Irrigation	PSDA Tangerang	Two gates damage.
29	Cisadane Barat	Cisadane	8	No data	-	Irrigation	PSDA Tangerang	Two gates damage
30	Bekasi Weir	Bekasi / Cikarang	3	3 x 12.50	Electrical operated and radio telecomunication is provided.	Irrigation & PDAM	Jasa Tirta 2	Good condition
31	Kyai Tapa	Ciliwung	No data	No data	No data	Flood control	PIPWSCC	No data

Table 4-6. Inventory of Gate Condition

No	Location		Equipment Facility and Information					Condition in 2003 Survey Base on Site
	Name of Gate	River / River System	Total Gate (Nos)	Dimension (m)	Accessories	Function	Management	
32	Karet	West Banjir Canal / Ciliwung	No data	No data	No data	Flood control	Kimpraswil	No data
33	Karet II	West Banjir Canal / Ciliwung	No data	No data	No data	Flushing	Kimpraswil	No data
34	Pondok Pinang	Grogol / Pesanggrahan	No data	No data	No data	Drainage	Kimpraswil	No data
35	Tarum Barat	Tarum Barat	No data	No data	No data	Water Supply / Irrigation	Kimpraswil	No data
36	Pasar Ikan	Pakin / Ciliwung	No data	No data	No data	Drainage	PU DKI	No data
37	Tarum Barat II	Tarum Barat	No data	No data	No data	Flushing	PU DKI	No data
38	Istiqlal	Ciliwung	No data	No data	No data	Flushing	PU DKI	No data
39	Tangki	Ciliwung	No data	No data	No data	Flushing	PU DKI	No data
40	Pekapuran	Gunung Sahari / Ciliwung	No data	No data	No data	Flood control	PU DKI	No data

Source :

(1) Urgent Inventory Study on Damage of Flood 2002 in Jabodetabek area in Indonesia, PT. Mitrapacific Consulindo International, February 2003

(2) The Study on Comprehensive River Water Management Plan in Jabodetabek by NIKKEN & NIPPON KOEI CO,. LTD. 1996

Table 4-7. Inventory of Pump Condition

No	Location		Equipment Facility and Information							Condition	
	Name / Region	River System	Total (Nos)	Total Capacity (m3/s)	Daily Operation System	Built on	Inlet Flow	Outlet Flow	Coverage Area (ha)	Condition in Flood 2002 at Base on Site Survey	Condition in 2003 at Base on Site Survey
1	Melati / Central Jkt	Ciliwung	4	4.40	3 pumps 3-5 hr/day	1970	Melati Reservoir	Ciliwung	110	3 pumps 24 hr/day	New pumps installed in Sep.' 2002
2	Pluit-1 / North Jkt.	Ciliwung	4	16.00	1 pumps 10-20 hr/day	1967, 1995	Pluit Reservoir	Java sea	2083	Full operation (2weeks 20hr/day, each 3 pumps)	No data
3	Pluit-2 / North Jkt.	Ciliwung	4	16.00	1 pumps 10-20 hr/day	1986	Pluit Reservoir	Java sea		Full operation (2weeks 10-20hr/day, all 3 pumps)	No data
4	Tomang Barat / West Jkt.	Pesanggrahan	4	4.00	1 pumps 3-5 hr/day	1999	Tomang Reservoir	Sekretaris	200	Not working equipment submerged by flood.	Already repair, completion in 2002
5	Grogol / West Jkt.	Ciliwung	3	1.50	1 pumps 6 hr/day	1972, 1979	Grogol Reservoir	West Floodway	80	Not Working from cable damage	No data
6	Setiabudi Timur / South	Ciliwung	3	3.30	2 pumps 6 hr/day	1980	East Setiabudi Reservoir	Ciliwung	132	Full operation (2weeks 10-20hr/day, all 3 pumps)	Already repair on 2003
7	Setiabudi Barat / South	Ciliwung	5	5.50	2 pumps 6 hr/day	1979, 1983	West Setiabudi Reservoir	Ciliwung	216	Full operation (2weeks 10-20hr/day, all 3 pumps)	Already repair on 2003
8	Muara Angke / Nort	Pesanggrahan	2	1.00	Warm up in normal condition	1999	Angke Reservoir	Angke	50	2 pumps 8 hr/day, in rainy season	No data
9	Rawa Kepa / West Jkt.	Ciliwung	4	8.00	Warm up in normal condition	1986	Urban Drainage	West Floodway	229	3 pumps 15hr/day, 3 days in rainy season	No data
10	Istana Negara / Central Jkt.	Ciliwung	3	0.75	Warm up in normal condition	1974	Palace Area	Ciliwung Tributary	15	3 pumps 3 hr/day in rainy season	In working condition
11	IKPN Bintaro / South Jkt.	Pesanggrahan	3	1.2	Warm up in normal condition	1985, 1986, 1996	Urban Drainage	Pesanggrahan	5.5	Not working 7 days full operation later	In working condition
12	Kali Cideng / Central Jkt.	Ciliwung	6	40.00	1 pumps 1-3 hr/day	1989	Urban Drainage	West Floodway	750	5 pumps 20 hr operation	In working condition
13	Pondok Bandung-1 / West Jkt.	Ciliwung	2	2.60	Warm up in normal condition	1981	Urban Drainage	West Floodway	90	2 pumps 1 week full operation	In working condition
14	Pondok Bandung-2 / West Jkt.	Ciliwung	2	2.60	Warm up in normal condition	1999	Urban Drainage	West Floodway		2 pumps 1 week full operation	In working condition
15	Sunter Timur I (Kodamar) / North Jkt.	Cipinang	3	3.90	2 pumps 3 hr/day	1995	East sunter Reservoir	Sunter	200	2 pumps 10-15 hr/day	No data
16	Sunter Timur III (Rawa Badak) / North Jkt.	Cipinang	3	15.00	2 pumps 6 hr/day	1995	Rawa Badak	Sunter	570	Not working equipment submerged by flood.	In working condition

Table 4-7. Inventory of Pump Condition

No	Location		Equipment Facility and Information							Condition	
	Name / Region	River System	Total (Nos)	Total Capacity (m3/s)	Daily Operation System	Built on	Inlet Flow	Outlet Flow	Coverage Area (ha)	Condition in Flood 2002 at Base on Site Survey	Condition in 2003 at Base on Site Survey
17	Ancol / North Jkt.	Ciliwung	3	15.00	1 pumps 5 hr/day to control water level when the big flooding from upstream appears.	1995	Ancol River	Ancol	635	2 pumps 6 hr/day	Can be operated
18	Mangga Dua Abdad / Central Jkt.	Ciliwung	2	2.60	1 pumps 5 hr/day to control flood water level in the surrounding.	1984	Urban Drainage	Ciliwung	77	Not working equipment submerged by flood.	Can be operated
19	Teluk Gong / North Jkt.	Pesanggrahan	6	2.40	4 pumps 6 hr/day	1990,1991,1992	Teluk Gong Reservoir	Angke	90	Not working equipment submerged by flood.	Can be operated
20	Pulo Mas / East Jkt.	Cipinang	3	7.50	Warm up in normal condition	1976	Pulomas Reservoir	Sunter	460	Not working, cable damage 2 weeks full operation after repair.	Can be operated, trashrack is not working, garbage removal by manual.
21	Sunter Utara / North Jkt.	Cipinang	3	9.90	2 pumps 6 hr/day to control water level under 70 cm on north sunter reservoir	1993	North Sunter Reservoir	Ancol	1250	3 pumps 15-20 hr/day	Can be operated
22	Hankam Slipi / West Jkt.	Pesanggrahan	6	0.45	Warm up in normal condition	1970.1975	Hankam Reservoir	Grogol	4	2 pumps 6 hr/day	In working condition
23	Terowongan Duku Atas / Central Jkt.	Ciliwung	6	0.36	Warm up	1994	Drainage of underpass	West Floodway	Tunnel	Not working	In working condition
24	Mangga Dua Raya 1 and 2 / North Jkt.	Ciliwung	2	3.60	1 pumps 5 hr/day to control flood water level in surrounding	-	Urban Drainage	Ciliwung	No data	No data	Can be operated (Private sector)
25	Gaya Motor-1/2 / North Jkt.	Cipinang	2	0.50	Warm up in normal condition	1995	Urban Drainage	Sunter	No data	Not working, equipment submerged later 4 days full operation	In working condition
26	Terowongan D.I. Panjaitan / East Jkt.	Cipinang	6	0.36	Warm up in normal condition	1995	Urban Drainage	Sunter Tributary	No data	4 pumps 4 hr/day	In working condition
27	Terowongan Manggarai / South Jkt.	Ciliwung	6	0.36	1 pumps 5 hr/day to control flood water level from surrounding	1996	Drainage of underpass	West Floodway	No data	4 pumps 10 days full operation	In working condition

Table 4-7. Inventory of Pump Condition

No	Location		Equipment Facility and Information							Condition	
	Name / Region	River System	Total (Nos)	Total Capacity (m3/s)	Daily Operation System	Built on	Inlet Flow	Outlet Flow	Coverage Area (ha)	Condition in Flood 2002 at Base on Site Survey	Condition in 2003 at Base on Site Survey
28	Bojong Indah / West Jkt.	Pesanggrahan	-	0.90	No data (Private sector)	-	Cengkareng Reservoir	Cengkareng Drain	No data	No data	In working condition
29	Bimoli / North Jkt.	Ciliwung	2	1.00	Warm up	1999	Urban Drainage	Muara karang	No data	2 pumps 2 days full operation,	In working condition
30	Jelambar / West Jkt.	Ciliwung	3	1.20	1 pumps 6 hr/day	1996	Urban Drainage	Muara karang	No data	Not working equipment submerged by flood.	In working condition
31	Penggilingan / East Jkt.	Ciliwung	-	1.60	No data (Private sector)	-	Urban Drainage	Angke	103	No data	No data (Private sector)
32	Kemayoran / Central Jkt.	Cipinang	-	2.00	No data (Private sector)	-	Reservoir	Pademangan	850	No data	In working condition (Private sector)
33	Sumur Batu / North Jkt.	Cipinang	2	0.60	Warm up	1996	Sumur Batu Reservoir	East Pademangan	278	Not working, equipment submerged by flood, later 3 days full operation	In working condition
34	Yos Sudarso / North Jkt.	Cipinang	1	0.25	Warm up	1997	Urban Drainage	Item	No data	4 days full operation	In working condition
35	Pinangsia / West Jkt.	Cipinang	2	0.35	Warm up	1997	Urban Drainage	Sunter	No data	Not working, equipment submerged full operation in the following days.	In working condition
37	Sunter Selatan / North Jkt.	Cipinang	6	15.00	1 pumps 5 hr/day to control water level under 60 cm on south sunter reservoir	1999	South Sunter Reservoir	Sunter	1000	4 pumps 6 hr/day	In working condition
38	Gang Macan / West Jkt.	Pesanggrahan	2	2.00	Warm up	1995	Urban Drainage	Mookervart	No data	Not working, equipment submerged by flood, later 4 days full operation	No data
39	Kartini / Central Jkt.	Ciliwung	1	0.50	1 pumps 5 hr/day to drain water from urban area	No data	Urban Drainage	Ciliwung	No data	Equipment damage, later 4 days full operation	In working condition
40	Jati pinggir / Central Jkt.	Ciliwung	2	1.00	No data (Private sector)	No data	Urban Drainage	West Floodway	No data	Not in operation	No data
41	Kwitang / Central Jkt.	Ciliwung	2	0.20	No data	No data	Urban Drainage	Ciliwung	No data	Not in operation	Only pump house no pump is installed up to now.

Table 4-7. Inventory of Pump Condition

No	Location		Equipment Facility and Information							Condition	
	Name / Region	River System	Total (Nos)	Total Capacity (m3/s)	Daily Operation System	Built on	Inlet Flow	Outlet Flow	Coverage Area (ha)	Condition in Flood 2002 at Base on Site Survey	Condition in 2003 at Base on Site Survey
42	Rajawali / Central Jkt.	K. Mati / Ciliwung	1	0.25	No data	No data	Urban Drainage	Kali Mati	No data	Not in operation	Operation trial during 2003, by private, not handing over to DKI Jakarta.
43	Kapuk muara / North Jkt.	Pesanggrahan	1	0.25	No data	No data	Urban Drainage	Cengkareng Drain	No data	No data	No data
44	Pondok Arum / Tangerang	K. Sabi / Cisadane	2	No data	No data	No data	Reservoir	Kali Sabi	No data	Not working due low maintenance.	Repair is required to operate the pump.
45	Situ Periuk Jaya / Tangerang	K. Sabi / Cisadane	2	0.20	No data	No data	Situ Periuk Jaya	Kali Sabi	No data	Working with low capacity (data unknown).	Repair for pump and and pump house facilities are required.
46	Perumahan Total Persada / Tangerang	K. Sabi / Cisadane	9	No data	Operated by private	6 provided by private, 3 provided by local government.	Urban Drainage	Kali Sabi	No data	Working condition with low capacity.	Low maintenance of the pumps.

Sources :

(1) Urgent Inventory Study on Damage of Flood 2002 in Jabodetabek area in Indonesia, PT. Mitrapacific Consulindo International, February 2003

(2) Survey Report by Ebara Corporation. 2002

(3) The Study on Comprehensive River Water Management Plan in Jabodetabek by NIKKEN & NIPPON KOEI CO,. LTD. 1996

Table 4-8. Inventory of Reservoir for Drainage System in JABODATABEK

No.	Location	Region	Area		Drain Area	Related Structure			Related Rivers	River System
			Previous	Present		Pump Station	Gate	Syphon		
			(ha)	(ha)	(ha)	Name	Nos	Nos		
1	Pluit	North Jakarta	No data	80.00	3,430.00	Pluit Barat	1	12	K. Jelakeng	Ciliwung
						Pluit Timur	unavailable	unavailable	K. Pakin	
									K. Jl. Pluit Selatan	
2	Muara Angke	North Jakarta	No data	0.50	53.00	Muara Angke	1	unavailable	K. Angke	Pesanggrahan
									West Flood Way	
3	Melati	South Jakarta	No data	3.50	185.00	Melati	unavailable	unavailable	West Flood Way	Ciliwung
4	Setiabudi	South Jakarta	No data	4.00	232.00	Setiabudi Barat	1	1	West Flood Way	Ciliwung
						Setibudi Timur	unavailable	unavailable	K. Cideng	
5	Grogol	West Jakarta	No data	3.00	60.00	Grogol	1	unavailable	K. Grogol	Ciliwung
									K. Jelambar	
6	Tomang Barat	West Jakarta	No data	6.80	170.00	Tomang Barat	unavailable	unavailable	K. Sekretaris	Pesanggrahan
7	Pulo Mas	East Jakarta	No data	5.30	25.00	Pulo Mas	1	unavailable	K. Sunter	Cipinang
	(to be extended)			9.00						
8	Rawa Kepa	West Jakarta	No data	0.50	253.00	Rawa Kepa	unavailable	unavailable	West Flood Way	Ciliwung
9	Teluk Gong	North Jakarta	No data	2.50	95.00	Teluk Gong	1	unavailable	K. Angke	Pesanggrahan
10	Sunter Barat	North Jakarta	No data	30.00	1,250.00	Sunter Utara / Barat	2	unavailable	K. Lagra Tenggiri	Cipinang
	(North / South)								K. Ancol	
11	Hankam Slipi	West Jakarta	No data	No data	No data	Hankam Slipi	unavailable	unavailable	K. Grogol	Ciliwung
12	Sunter Timur I	North Jakarta	No data	15.00	390.00	Sunter Timur I	1	unavailable	K. Sunter	Cipinang
13	Sunter Timur III	North Jakarta	No data	8.00	570.00	Sunter Timur III	2	unavailable	K. Sunter	Cipinang
14	Sunter II	North Jakarta	No data	No data	214.00	unavailable	unavailable	unavailable	Cakung Drain	Cipinang
15	Marunda	North Jakarta	No data	No data	990.00	unavailable	unavailable	unavailable	Eastern Banjir Canal	Cipinang
16	Situ Arman	Bogor District	No data	No data	No data	unavailable	1	unavailable	K. Jantung	Ciliwung
17	Danau Lido	Bogor District	No data	No data	No data	unavailable	-	unavailable	K. Cisadane	Cisadane
18	Situ Periuk Jaya	Tangerang Municipality	No data	No data	No data	Situ Periuk Jaya	1	unavailable	K. Sabi	Cisadane
19	Pondok Arum	Tangerang Municipality	No data	No data	No data	Pondok Arum	unavailable	unavailable	K. Sabi	Cisadane
20	Cikokol	Tangerang Municipality	No data	11.00	No data	unavailable	4	unavailable	Cisadane	Cisadane
21	Cipondoh	Tangerang Municipality	No data	128.00	No data	unavailable	3	unavailable	K. Angke	Cisadane
22	Situ Cangkring	Tangerang Municipality	No data	5.60	No data	No data	No data	No data	No data	Cimanceuri
23	Rawa Rancailat	Tangerang District	63.00	67.98	No data	No data	No data	No data	No data	Cimanceuri
24	Rawa Garukgak	Tangerang District	180.00	0.00	No data	No data	No data	No data	No data	Cimanceuri
25	Situ Parigi	Tangerang District	4.00	5.25	No data	No data	No data	No data	No data	Pesanggrahan
26	Situ Bungur	Tangerang District	2.50	3.25	No data	No data	No data	No data	No data	Pesanggrahan
27	Situ Kayu Antap	Tangerang District	2.50	4.00	No data	No data	No data	No data	No data	Pesanggrahan
28	Situ Rompong	Tangerang District	10.00	174.00	No data	No data	No data	No data	No data	Pesanggrahan
29	Situ Legoso	Tangerang District	4.00	2.00	No data	No data	No data	No data	No data	Pesanggrahan
30	Situ Gintung	Tangerang District	31.00	21.49	No data	unavailable	1	unavailable	Urban drainage to K. Angke and Mookervart Canal	Pesanggrahan
31	Situ Pamulang	Tangerang District	31.00	25.32	No data	unavailable	1	No data	No data	Pesanggrahan

Table 4-8. Inventory of Reservoir for Drainage System in JABODATABEK

No.	Location	Region	Area		Drain Area	Related Structure			Related Rivers	River System
			Previous	Present		Pump Station	Gate	Syphon		
			(ha)	(ha)	(ha)	Name	Nos	Nos		
32	Situ Cileduk	Tangerang District	22.00	31.44	No data	No data	No data	No data	No data	Pesanggrahan
33	Rawa Waluh	Tangerang District	35.00	35.00	No data	No data	No data	No data	No data	Cimanceuri
34	Rawa Panggang	Tangerang District	18.00	11.00	No data	No data	No data	No data	No data	Cimanceuri
35	Rawa Setingin	Tangerang District	26.00	24.41	No data	No data	No data	No data	No data	Cimanceuri
36	Rawa Patrasana	Tangerang District	360.00	260.00	No data	No data	No data	No data	No data	Cimanceuri
37	Rawa Gede	Tangerang District	4.00	2.80	No data	No data	No data	No data	No data	Cimanceuri
38	Situ Jengkol	Tangerang District	3.75	3.75	No data	No data	No data	No data	No data	Cimanceuri
39	Rawa Gabus	Tangerang District	15.00	9.27	No data	No data	No data	No data	No data	Cimanceuri
40	Rawa Ganggong	Tangerang District	15.00	15.00	No data	No data	No data	No data	No data	Cimanceuri
41	Rawa Sulang	Tangerang District	11.00	8.00	No data	No data	No data	No data	No data	Cisadane
42	Rawa Koja	Tangerang District	7.00	0.00	No data	No data	No data	No data	No data	Cimanceuri
43	Rawa Kepuh	Tangerang District	45.00	0.00	No data	No data	No data	No data	No data	Cimanceuri
44	Situ Kelapa Dua	Tangerang District	39.00	37.50	No data	No data	No data	No data	No data	Cisadane
45	Situ Cihuni	Tangerang District	27.50	32.34	No data	No data	No data	No data	No data	Cisadane
46	Rawa Pondok Jagung	Tangerang District	8.00	7.95	No data	No data	No data	No data	No data	Cisadane
47	Rawa Pangodokan	Tangerang District	15.00	0.00	No data	No data	No data	No data	No data	Cimanceuri
48	Rawa Dadap	Tangerang District	12.00	0.00	No data	No data	No data	No data	No data	Cimanceuri
49	Rawa Jambu	Tangerang District	2.00	0.00	No data	No data	No data	No data	No data	Cimanceuri
50	Rawa Warung Rebo	Tangerang District	4.00	7.90	No data	No data	No data	No data	No data	Cimanceuri
51	Rawa Pasir Gudang	Tangerang District	3.00	7.30	No data	No data	No data	No data	No data	Cimanceuri
52	Situ Pondok	Tangerang District	21.00	33.00	No data	No data	No data	No data	No data	Cimanceuri
53	Cilongok	Tangerang District	15.00	23.08	No data	No data	No data	No data	No data	Cimanceuri
54	Rawa Loksum	Tangerang District	1.50	1.50	No data	No data	No data	No data	No data	Pesanggrahan
55	Rawa Kemuning	Tangerang District	2.50	1.70	No data	No data	No data	No data	No data	Cimanceuri
56	Rawa Kwaron	Tangerang District	4.00	7.90	No data	No data	No data	No data	No data	Cimanceuri
57	Rawa Bojong	Tangerang District	4.00	0.00	No data	No data	No data	No data	No data	Cisadane
58	Rawa Sarakan	Tangerang District	7.50	0.00	No data	No data	No data	No data	No data	Cimanceuri
59	Rawa Terate	Tangerang District	7.50	0.00	No data	No data	No data	No data	No data	Cimanceuri
60	Situ Baru (TVRI)	Depok Municipality	7.50	7.50	No data	unavailable	1	unavailable	K. Sugutamu	Ciliwung
61	Cilangkap	Depok Municipality	7.16	6.00	No data	No data	No data	No data	K. Cilangkap	Cipinang
62	Rawa Kalong	Depok Municipality	11.21	8.25	No data	No data	No data	No data	K. Cipinang	Cipinang
63	Pendongkelan	Depok Municipality	8.40	5.76	No data	No data	No data	No data	No data	Ciliwung
64	Tipar	Depok Municipality	15.24	11.32	No data	No data	No data	No data	No data	Cipinang
65	Pulo	Depok Municipality	8.00	4.40	No data	No data	No data	No data	K. Cikeas	Cikarang
66	Rawa Besar	Depok Municipality	17.00	13.02	No data	No data	No data	No data	Kali Baru I	Ciliwung
67	Bojong Sari	Depok Municipality	28.25	28.25	No data	No data	No data	No data	No data	Pesanggrahan
68	Telaga Subur	Depok Municipality	4.00	4.00	No data	No data	No data	No data	No data	Pesanggrahan
69	Citayam	Depok Municipality	8.15	7.00	No data	No data	No data	No data	K. Citayam	Ciliwung
70	Cilodong	Depok Municipality	10.60	9.50	No data	No data	No data	No data	K. Cikumpa	Ciliwung

Table 4-8. Inventory of Reservoir for Drainage System in JABODATABEK

No.	Location	Region	Area		Drain Area	Related Structure			Related Rivers	River System
			Previous	Present		Pump Station	Gate	Syphon		
			(ha)	(ha)	(ha)	Name	Nos	Nos		
71	Jatijajar	Depok Municipality	10.00	6.50	No data	No data	No data	No data	K. Cipinang	Cipinang
72	UI	Depok Municipality	6.00	6.00	No data	No data	No data	No data	No data	Ciliwung
73	Patinggi	Depok Municipality	6.40	5.50	No data	No data	No data	No data	K. Sunter	Cipinang
74	Pancoran Mas	Depok Municipality	0.60	0.20	No data	No data	No data	No data	K. Krukut	Ciliwung
75	Pengasinan	Depok Municipality	6.00	1.50	No data	No data	No data	No data	K. Caringin	Pesanggrahan
76	Pladen	Depok Municipality	1.50	1.50	No data	No data	No data	No data	Sal. Tanah Baru	Ciliwung
77	Pengarengan	Depok Municipality	2.00	2.00	No data	No data	No data	No data	No data	Ciliwung
78	Ciming	Depok Municipality	2.50	0.50	No data	No data	No data	No data	No data	Ciliwung
79	Gadog	Depok Municipality	1.30	1.30	No data	No data	No data	No data	Kali Baru 2	Cipinang
80	Gembung Baru	Depok Municipality	11.00	11.00	No data	No data	No data	No data	K. Sunter	Cipinang
81	Gede	Depok Municipality	1.00	1.00	No data	No data	No data	No data	K. Sunter	Cipinang

Sources :

(1) Urgent Inventory Study on Damage of Flood 2002 in Jabodetabek area in Indonesia, PT. Mitrapacific Consulindo International, February 2003

(2) The Study on Comprehensive River Water Management Plan in Jabodetabek by NIKKEN & NIPPON KOEI CO,. LTD. 1996

(3) Studi Master Plan Drainase Kabupaten / Kota Tangerang, 2002

(4) Kaji Ulang Penataan Ruang Kab. Tangerang, Kota Tangerang, Kab. Bekasi, Kota Bekasi, Kota Depok dan Kab. Cianjur Dalam Rangka Mengatasi Banjir JABODETABEK.

4.2.2 Condition of Flood 2002

The flooding 2002 has covered around 8706 ha of urban areas in DKI Jakarta, 1,519 ha of urban areas in Tangerang, Bekasi and Depok City and 26,633 ha of rural and agricultural area in Tangerang and Bekasi District.

The inundation occurred in various condition of flood area from few days to almost 2 months continuous with depth ranging from 20 cm to more than 3 meter.

This flood inundation creates damage to the settlement, public facilities (School, health center, mosque, local market), infrastructures, others building (commercial and industries) and agricultural properties.

The direct loss occurred to the personal belonging and caused by fatal accident or loss of life includes cost of medical recovery.

Other indirect impact of damage also resulting from loss of economic opportunities (working day and services), loss by service termination of transportation and communication and public utility, loss created by decrease of land value.

Survey to the damage impact in 31 location selected area are spread over DKI Jakarta, Tangerang district and municipality, Bekasi district and municipality including Depok municipality. The survey were made by collecting direct information from population and local leader through interview and site observation. Data also collected as available from local village or sub-district.

The survey result of inundation and flooding condition in the respective location is appeared in the Table 4-3.

Compilation of damage condition in physical term and other influencing impact during inundation is persecuted in the Table 4-10.

Locations suffered from serious inundation as recorded from survey result are :

- DKI Jakarta urban area :
  - Bukit duri tebet, lower plain area of Ciliwung.
  - Cipinang besar utara, overflow from Cipinang river.
  - Bitaro, IKPN houses located in lower plain of Pesanggrahan river.
  - Kelapa gading timur, overflow from Sunter river.
  - Penjaringan, overflow from Cengkareng drain.
  - Kapuk muara coastal area, tidal and overflow from Cengkareng drain.
  - Rawa badak coastal area, tidal and overflow from Sunter river.

- Tangerang City urban area :
  - Periuk Jaya, lower part of Sabi river
  - Gondrong, local drainage overflow from Cipondoh lake.

- Bekasi city urban area :
  - Kranji, overflow from irrigated canal to Cikarang river.
  - Bintara, overflow from irrigated canal to Cikarang river.

- Tangerang and Bekasi district which suffered damage to rural and agriculture area.
  - Renged-Kresek, Tangerang, overflow from estuary Cimanceuri river.
  - Pantai Hurip coastal area-Bekasi, overflow from Bekasi river.

The summary of inundation condition of selected site are shown in Table 4-9 and flood impact condition in individual site is inform in Table 4-10.

Survey location of 31 selected inundation areas are performed from data collection to related agency and interview to the community leader, with the following indication of inundated houses condition.

PAM (municipal water supply) condition during flood are indicate as 47% turbid and 53% normal.

Telecommunication service during flood are recorded as not working 28% and in function 72%.

PLN (State electricity enterprise serve during flood period 2002 with 61% loss power and 39% in operation.

Tabel 4-9. Inundation in 31 Selected Location

No	Village/Kelurahan	Sub district / Kecamatan	Region	No. of Population Affected	Flood water depth (cm)	Inundation duration (day)
1	Semanan	Kalideres	West Jakarta	3.000	min 50 max 220	50
2	Kedoya Utara	Kebon jeruk	West Jakarta	3.020	min 80 max 160	40
3	Sumur Batu	Kemayoran	Central Jakarta	19.504	min 50 max 70	7
4	Bintaro	Pesanggrahan	South Jakarta	1.000	min 70 max 250	35
5	Bukit Duri	Tebet	South Jakarta	11.075	min 150 max 400	30
6	Jatinegara Kaum	Pulogadung	East Jakarta	4,916	min 50 max 200	7
7	Cipinang Besar Utara	Jatinegara	East Jakarta	24.224	min 50 max 250	30
8	Cipinang Besar Selatan	Jatinegara	East Jakarta	5.004	min 50 max 200	30
9	Kebon Pala	Makasar	East Jakarta	10,338	min 80 max 200	20
10	Rawa Badak Utara	Koja	North Jakarta	11.831	min 50 max 70	7
11	Rawa Badak Selatan	Koja	North Jakarta	3,574	min 50 max 100	30
12	Kelapa Gading Timur	Kelapa Gading	North Jakarta	24.208	min 50 max 120	30
13	Penjaringan	Penjaringan	North Jakarta	15.680	min 50 max 150	30
14	Papanggo	Tanjung Priok	North Jakarta	7.850	min 50 max 100	7
15	Kapuk Muara	Penjaringan	North Jakarta	12.664	min 50 max 200	30
16	Kamal Muara	Penjaringan	North Jakarta	500	min 30 max 50	30
17	Pantai Hurip	Babelan	Bekasi District	2.263	min 50 max 200	60
18	Hurip Jaya	Babelan	Bekasi District	2,731	min 50 max 150	60
19	Sukadaya	Sukawangi	Bekasi District	472	min 50 max 100	16
20	Sukabakti	Tambelang	Bekasi District	575	min 50 max 100	16
21	Kranji	Bekasi Barat	Bekasi Municipal	6.615	min 50 max 100	7
22	Bintara	Bekasi Barat	Bekasi Municipal	4.750	min 50 max 100	7
23	Pengasinan	Rawalumbu	Bekasi Municipal	7.630	min 50 max 60	7
24	Jatirasa	Jatiasih	Bekasi Municipal	11.285	min 50 max 300	7
25	Renged	Kresek	Tangerang District	203	min 50 max 100	14
26	Teluk Naga	Teluk Naga	Tangerang District	4.450	min 50 max 100	15
27	Periuk Jaya	Jati Uwung	Tangerang Municipal	4.400	min 50 max 200	10
28	Gondrong	Cipondoh	Tangerang Municipal	785	min 50 max 160	20
29	Cisalak	Sukmajaya	Depok Municipal	11.200	min 50 max 80	7
30	Abadi Jaya	Sukmajaya	Depok Municipal	5.600	min 50 max 100	7
31	Mekar Jaya	Sukmajaya	Depok Municipal	9.600	min 50 max 100	7

Tabel 4-10. Flood Condition from Interview and Observation

No.	Location	Item	Physical Damage				Sanitation Condition	Major Personal belonging can be resqued	Waste Facilities	Local Drainage
			Total Damage	Light Damage	Medium Damage	Heavy Damage				
1	Semanan / Kalideres	Number of Houses Inundated:	1,614				Poor	Vehicle	Moderate	Poor
		- Permanent	968	387	581					
		- Semi-Permanent	646	-	599	47				
		- Non-Permanent	-	-	-	-				
		Public Facility	4	-	4	-				
		Commercial	800 m^2	800 m^2	-	-				
		Industry	20 unit	20 unit	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
2	Kedoya Utara / Kebon Jeruk	Number of Houses Inundated:	1,027				Poor	Vehicle	Good	Poor
		- Permanent	616	493	123	-				
		- Semi-Permanent	411	-	123	288				
		- Non-Permanent	-	-	-	-				
		Public Facility	1	-	1	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
3	Sumur Batu / Kemayoran	Number of Houses Inundated:	3,432				Poor	Vehicle	Moderate	Poor
		- Permanent	2,059	2,059	-	-		Furniture		
		- Semi-Permanent	1,373	1,373	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	28	-	28	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
4	Bintaro / Pesanggrahan	Number of Houses Inundated:	571				Poor	Vehicle	Moderate	Poor
		- Permanent	530	467	63	-				
		- Semi-Permanent	21	-	16	5				
		- Non-Permanent	20	-	15	5				
		Public Facility	4	-	4	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
5	Bukit Duri / Tebet	Number of Houses Inundated:	1,947				Poor		Moderate	Poor
		- Permanent	390	117	273	-				
		- Semi-Permanent	1,460	155	993	312				
		- Non-Permanent	97	-	97	-				
		Public Facility	3	3	-	-				
		Commercial and Industry	800 m^2	800 m^2	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
6	Jatinegara Kaum / Pulo Gadung	Number of Houses Inundated:	676				Poor	Vehicle	Poor	Poor
		- Permanent	203	142	61	-		Furniture		
		- Semi-Permanent	473	284	189	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	7	7	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
7	Cipinang Besar Utara / Jatinegara	Number of Houses Inundated:	3,778				Poor		Moderate	Poor
		- Permanent	1,511	907	604	-				
		- Semi-Permanent	1,889	939	950	-				
		- Non-Permanent	378	-	378	-				
		Public Facility	13	13	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
8	Cipinang Besar Selatan / Jatinegara	Number of Houses Inundated:	570				Poor	Furniture	Poor	Poor
		- Permanent	342	205	137	-				
		- Semi-Permanent	228	91	137	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	7	7	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
9	Kebon Pala / Makasar	Number of Houses Inundated:	1,750				Poor	Vehicle	Moderate	Poor
		- Permanent	525	420	105	-		Furniture		
		- Semi-Permanent	1,050	-	630	420				
		- Non-Permanent	175	-	105	70				
		Public Facility	6	6	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
10	Rawa Badak Utara / Koja	Number of Houses Inundated:	1,991				Poor	Furniture	Good	Moderate
		- Permanent	1,194	955	239	-				
		- Semi-Permanent	797	478	319	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	5	5	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							

Tabel 4-10. Flood Condition from Interview and Observation

No.	Location	Item	Physical Damage				Sanitation Condition	Major Personal belonging can be resqued	Waste Facilities	Local Drainage
			Total Damage	Light Damage	Medium Damage	Heavy Damage				
11	Rawa Badak Selatan / Koja	Number of Houses Inundated:	1,121				Poor	Furniture	Good	Poor
		- Permanent	672	470	202	-				
		- Semi-Permanent	449	180	231	38				
		- Non-Permanent	-	-	-	-				
		Public Facility	1	1	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
12	Kelapa Gading Tmr./ Kelapa Gading	Number of Houses Inundated:	3,125				Moderate	Furniture	Good	Poor
		- Permanent	3,085	3,085	-	-				
		- Semi-Permanent	40	-	40	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	4	4	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
13	Penjaringan / Penjaringan	Number of Houses Inundated:	5,594				Poor	Furniture	Moderate	Poor
		- Permanent	280	280	-	-				
		- Semi-Permanent	3,916	588	3132	196				
		- Non-Permanent	1,398	-	419	979				
		Public Facility	2	2	-	-				
		Commercial and Industry	1500 m^2	1500 m^2	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
14	Papanggo / Tanjung Priok	Number of Houses Inundated:	1,519				Moderate	Furniture	Moderate	Poor
		- Permanent	456	410	46	-				
		- Semi-Permanent	911	46	774	91				
		- Non-Permanent	152	-	152	-				
		Public Facility	4	3	1	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
15	Kapuk Muara / Penjaringan	Number of Houses Inundated:	1,992				Poor	Furniture	Poor	Poor
		- Permanent	1,195	836	359	-				
		- Semi-Permanent	797	159	638	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	3	3	-	-				
		Commercial and Industry	136 unit	136 unit	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
16	Kamal Muara / Penjaringan	Number of Houses Inundated:	85				Poor	Furniture	Poor	Poor
		- Permanent	10	10	-	-				
		- Semi-Permanent	75	75	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	1	1	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
17	Pantai Hurip / Babelan	Number of Houses Inundated:	715				Poor		Poor	Poor
		- Permanent	500	250	250	-				
		- Semi-Permanent	179	-	172	7				
		- Non-Permanent	36	-	29	7				
		Public Facility	2	-	2	-				
		Commercial and Industry	600 m^2	600 m^3	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and							
18	Hurip Jaya / Babelan	Number of Houses Inundated:	600				Poor		Poor	Poor
		- Permanent	270	189	81	-				
		- Semi-Permanent	300	89	210	1				
		- Non-Permanent	30	-	25	5				
		Public Facility	2	-	2	-				
		Commercial and Industry	1300 m^2	1300 m^2	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
19	Sukadaya / Sukawangi	Number of Houses Inundated:	198				Poor		Poor	Poor
		- Permanent	100	50	50	-				
		- Semi-Permanent	98	38	60	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	4	-	4	-				
		Commercial and Industry	800 m^2	800 m^2	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
20	Sukabakti / Tambelang	Number of Houses Inundated:	166				Poor		Poor	Poor
		- Permanent	49	29	20	-				
		- Semi-Permanent	117	50	67	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	2	-	1	1				
		Commercial and Industry	500 m^2	500 m^2	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
21	Kranji / Bekasi Barat	Number of Houses Inundated:	1,323				Poor	Vehicle	Poor	Moderate
		- Permanent	1,323	793	530	-		Furniture		
		- Semi-Permanent	-	-	-	-				

Tabel 4-10. Flood Condition from Interview and Observation

No.	Location	Item	Physical Damage				Sanitation Condition	Major Personal belonging can be resqued	Waste Facilities	Local Drainage
			Total Damage	Light Damage	Medium Damage	Heavy Damage				
21	Kranji / Bekasi Barat	- Non-Permanent	-	-	-	-				
		Public Facility	-	-	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
22	Bintara / Bekasi Barat	Number of Houses Inundated:	950				Poor	Furniture	Poor	Poor
		- Permanent	950	500	450	-				
		- Semi-Permanent	-	-	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	3	1	2	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
23	Pengasinan / Rawalumbu	Number of Houses Inundated:	1,526				Poor	Furniture	Moderate	Moderate
		- Permanent	1,526	916	610	-				
		- Semi-Permanent	-	-	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	2	1	1					
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
24	Jatirasa / Jatiasih	Number of Houses Inundated:	3,713				Poor	Vehicle	Poor	Moderate
		- Permanent	3,713	1,485	2228	-		Furniture		
		- Semi-Permanent	-	-	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	9	-	9	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
25	Renged / Kresek	Number of Houses Inundated:	121				Poor		Good	Poor
		- Permanent	63	63	-	-				
		- Semi-Permanent	48	30	17	1				
		- Non-Permanent	10	-	10	-				
		Public Facility	2	-	-	2				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
26	Teluk Naga / Teluk Naga	Number of Houses Inundated:	127				Poor	Furniture	Good	Poor
		- Permanent	63	62	1	-				
		- Semi-Permanent	50	48	-	2				
		- Non-Permanent	14	-	14	-				
		Public Facility	1	1	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and							
27	Periuk Jaya / Periuk	Number of Houses Inundated:	600				Poor	Vehicle	Good	Poor
		- Permanent	600	240	240	120				
		- Semi-Permanent	-	-	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	2	-	1	1				
		Commercial and Industry	8 unit	8 unit	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
28	Gondrong / Cipondoh	Number of Houses Inundated:	210				Poor	Vehicle	Poor	Poor
		- Permanent	147	57	30	60				
		- Semi-Permanent	52	21	21	10				
		- Non-Permanent	11	-	11	-				
		Public Facility	-	-	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
29	Cisalak / Sukma Jaya	Number of Houses Inundated:	419	419	-	-	Moderate	Furniture	Moderate	Poor
		- Permanent	419	-	-	-				
		- Semi-Permanent	-	-	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	-	-	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
30	Abadi Jaya / Sukma Jaya	Number of Houses Inundated:	509	509	-	-	Moderate	Vehicle	Moderate	Moderate
		- Permanent	509	-	-	-		Furniture		
		- Semi-Permanent	-	-	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	-	-	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							
31	Mekar Jaya / Sukma Jaya	Number of Houses Inundated:	380				Moderate	Vehicle	Moderate	Moderate
		- Permanent	380	380	-	-		Furniture		
		- Semi-Permanent	-	-	-	-				
		- Non-Permanent	-	-	-	-				
		Public Facility	-	-	-	-				
		Commercial and Industry	-	-	-	-				
		Public Utilities	Data recorded from State Electricity (PLN) and City Water (PAM and other)							

4.2.3 River basin management and flood control

Management in water and land resources conservation and river basin development involves several central level agencies i.e. directorate of water resources in river management, directorate of urban and housing in water supply, sanitation and urban drainage, directorate of spatial planning for land use, Ministry of forestry in conservation, etc.

In term of geography condition, river basin locates also within various district autonomy or more than one provinces. Central level will manage the main river system within provinces authorities and province take care main-river passing through districts boundaries.

Decentralization has changed the authorities and decision-making process into district level, which trends to concerned to district own interest rather than interregional objectives.

Intensive development of urban area are growing in outside DKI Jakarta, which were controlled by districts (Tangerang, Bekasi and Bogor) without appropriate storm water drain system and protection facilities (provision of erosion control, retention area, dyke protection, etc.)

Operation and maintenance of drainage and facilities after monetary crisis is decline, due to lack of budget for maintenance of infrastructure and human resources management. Also operation procedure is depend to the rigid centralized command (Bakornas Coordination System).

Present management of river basin and flood control

DKI Jakarta

In DKI Jakarta region, river and drainage system are managed by both central (Kimpraswil) and region (PU office DKI). The management has share responsibility for construction, operation and maintenance of river and drainage facilities under central authority (Kimpraswil) and region authority (PU – DKI).

The system under control (Kimpraswil) responsibility is managed under PIPWSCC which covered DKI Jakarta, Bogor, Depok and Tangerang since the facilities locate within Ciliwung – Cisadane basin. PIPWSCC is not an independent body like PU – DKI. The organization is developed under project model framework, responsible to Kimpraswil.

The previous Figure 4-8 and Figure 4-9 show the schematic diagram of drainage river and canal including sharing management sub-division between Central (Kimpraswil) and DKI Jakarta.

The urban drainage facilities which include under DKI responsibilities are noticed in the following table :

Table 4-11. Urban Drainage Facilities with O & M under DKI

River, Canal	Gate/ Syphon/ Trash Rack	Reservoir/ Pump
Sepak river	Pasar ikan gate	Tomang Barat reservoir and pump
Ulujami river	Teluk Gong trash rack	Grogol reservoir and pump
Maruya river	Pluit siphon/ gate	Rawa Kepa reservoir and pump
Mookervart river	Bendungan Jagi I & II gate	Pluit reservoir and pump
Sekretaris river	Manggarai II gate	Muara Angke reservoir and pump
Pluis river	Krukut gate	Setia Budi reservoir and pump
Grogol river	Capitol gate	Setia Budi Timur reservoir & pump
Sodetan Grogol Sekretaris	Tangki gate	Pondok Bandung pump
Jelambar river	Kali Duri gate	Cideng pump
Duri river	Kampung Gusti gate	Istana pump
Muara Karang river	Jembatan Dua gate	Mangga Dua utara pump
Ciragil river	Jembatan Merah gate	Sunter Timur I reservoir and pump
Mampang river	Pekapuran gate	Sunter Timur III reservoir & pump
Cideng river	Cideng gate	Sunter Barat Utara reservoir & pump
Jelakeng river	Bunderan Grogol gate	Sunter Barat Selatan reservoir
Besar river	Kali Ciden syphone	Teluk Gong reservoir and pump
Krukut Bawah river	Teluk Gong syphone	Ancol reservoir and pump
Baru Barat river	Gunung Sahari trash rack	Melati reservoir
Kalibata canal	Other related facilities	
Sodetan Bali Matraman		
Lower Ciliwung river		
Ciliwung Gunung Sahari river		
Ciliwung Gajah Mada river		
Anak Ciliwung river		
Bara Timur river		
Ancol river		
Sentiong-Sunter river		
Cakung Lama river		
Mati river		
Pademangan Barat river		
Pademangan Timur river		
Other rivers in DKI Jakarta		

Source : Nikken Consultant, Study on Comprehensive River Water Management, 1996

Tangerang District and Tangerang Municipal

All river system of Cisadane, Cimanceuri and Cidurian in general are under management authority of Central government (Kimpraswil). Cisadane system include in PIPWSCC management. Minor system of urban drainage is managed by Dinas PU Tangerang Municipal.

The institution involves in the management of river and drainage facilities in Tangerang District and City are :

- PIPWSCC (Ciliwung Cisadane) for major Cisadane river management under central (Kimpraswil) project fund.
- Balai PSDA as central agent in Province to monitor and operate main irrigation facilities under central / province routine budget.
- PU Tangerang district for management of minor river and drainage include storm water drain, provides routine budget from APBD (District budget allocation).

Although information network between above institution is working under district coordination, integration of authorities and share responsibilities among institutions are

remain unclear. Inter region coordination of upstream downstream (Tangerang Bogor) is implemented through PIPWSCC rather than between both PU District.

Since many drainage network previously use for irrigation in non-urban area, lot of drainage and river facilities in new urbanized area in Tangerang District managed by Irrigation Service Tangerang District. The responsibility, management authority sharing in construction, operation and maintenance of river and drainage facilities in District and Municipal Tangerang are not in complete establishment.

Watershed management to coordinate, control and monitoring of land and water utilization for large settlement and industrial development are managed by Tangerang District (Bappeda).

Budget allocation for O&M of drainage management in Tangerang district is approximately only 10% from total budget for drainage management. According to Bappeda office this number is below the minimum requirement. However from limited budget allocation Tangerang District/City has prepare comprehensive drainage master plan (2002).

The management activities in sub district level is undertake by UPTD (technical implementation unit of dinas) which responsible to District Public Work (PU).

Community participation are effective implemented in some areas, facilitate by sub district is UPK (implementation unit) under sub district office.

Bekasi District and Municipal

River and drainage system in urban area (Bekasi Municipal) is managed by Dinas PU – Bekasi Municipal. Other drainage system particularly in urbanized downstream area of Cisadang, Cikarang and Bekasi river, with dominated by irrigation facilities are still under Prosijat (Jasa Tirta).

The institution involves in the management of river and drainage facilities in Bekasi District and City are :

- Prosijat through Jasa Tirta still involves in the management of drainage and irrigation within Tarum Canal System, under Jatiluhur otorita budget.
- PIPWS Citarum, Cikarang and Bekasi undertake the management major river, within project budget allocation from Kimpraswil.
- PU Bekasi should responsible for minor system includes storm water drain, but funding limitation become major constraint. The interregional coordination in basin management is excuted through control government (PIPWS Cikarang, Bekasi) with less involvement at district (PU).

Interrelation including information network between above institutions are not affectively implemented. Budget for river and drainage O&M only allocated below 5% from drainage development budget provided by district office in the latest years. Large portion are still depend to Jasa Tirta or request to Kimpraswil.

The management arrangement between related agency in construction and O & M of river and drainage facilities are not settling down within Bekasi District authorities. The

watershed management in the region, where large of urban and industry township development established is under the authority of Bappeda Bekasi.

Sub district implementation level is weak. Only in this year (2003) branch of dinas implementation unit are start working. but effective particularly for Bina Marga. Community participation for minor system is not significantly productive since no available sub district organization unit to facilitate the program.

Depok Municipal

The existing river and its facilities under Ciliwung system is mainly under Central Government PIPWSCC (Ciliwung Cisadane). The minor system which was previously used for irrigation are operate by Dinas PU Depok.