

THE UNIVERSITY OF CHICAGO PRESS

## PLANNING & CONTROL

1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

**SUBJECT:** \_\_\_\_\_

P O S







JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT  
MINISTRY OF PUBLIC WORKS  
REPUBLIC OF INDONESIA

**THE STUDY  
ON  
CIUJUNG - CIDURIAN  
INTEGRATED WATER RESOURCES  
IN INDONESIA**

**FINAL REPORT**

**VOLUME III  
SUPPORTING REPORT**



28231

FEBRUARY 1995

NIPPON KOEI CO., LTD.  
TOKYO, JAPAN



**THE STUDY  
ON  
CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES**

**COMPOSITION OF REPORTS**

**Volume I : Executive Summary**

**Volume II : Main Report**

**Volume III : Supporting Report**

1. Present Socio-economic Conditions in the Study Area
2. Hydrological Study
3. Water Resources Study
4. Preliminary Design and Environmental Investigation of Pasir Kopo Dam
5. Topographic Survey for Karian-Serpong Conveyance System
6. Geological Investigation for Karian-Serpong Conveyance System
7. Karian-Serpong Conveyance System
8. Environmental Impact Analysis
9. Construction Plan and Cost Estimate
10. Financial and Economic Analyses
11. Reference Drawings Prepared by the Previous Studies and Projects

**Volume IV : Data Book**

- A. Topographic Maps Produced by the Study
- B. Hydrological Data in the Ciujung and Cidurian River Basins
- C. Geotechnical Data along the Karian-Serpong Conveyance System

**EXCHANGE RATE**

The exchange rates used in this Study are:

Rp.2,177 = US\$ 1.00 = ¥ 100

as of August, 1994

国際協力事業団

28231



**THE STUDY  
ON  
CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES**

**VOLUME III : SUPPORTING REPORT**

**LIST OF ANNEXES**

- 1. Present Socio-economic Conditions in the Study Area**
- 2. Hydrological Study**
- 3. Water Resources Study**
- 4. Preliminary Design and Environmental  
Investigation of Pasir Kopo Dam**
- 5. Topographic Survey for Karian-Serpong  
Conveyance System**
- 6. Geological Investigation for Karian-Serpong  
Conveyance System**
- 7. Karian-Serpong Conveyance System**
- 8. Environmental Impact Analysis**
- 9. Construction Plan and Cost Estimate**
- 10. Financial and Economic Analyses**
- 11. Reference Drawings Prepared by the Previous Studies  
and Projects**



***ANNEX 1***

***PRESENT SOCIO-ECONOMIC  
CONDITIONS  
IN THE STUDY AREA***



**THE STUDY  
ON  
CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES**

***Annex 1 : Present Socio-economic Conditions in the  
Study Area***

Table of Contents

	Page
1. INTRODUCTION .....	1
2. ADMINISTRATION .....	1
3. POPULATION .....	2
3.1 Population and Density .....	2
3.2 Population Growth and Spatial Distribution .....	2
3.3 Labor Force .....	4
4. ECONOMIC FEATURES .....	5
4.1 Gross Regional Domestic Products .....	5
4.2 Government Finance .....	5
4.3 External Trade and International Balance of Payment .....	6
4.4 Family Economy .....	7
4.4.1 Average monthly per-capita income .....	7
4.4.2 Average monthly per-capita expenditure .....	7
4.5 Economic Indicators .....	8
4.5.1 Consumer price .....	8
4.5.2 Exchange rate .....	8
5. LAND USE CONDITION IN THE STUDY AREA .....	9
5.1 Present Land Use Condition .....	9
5.2 Future Land Use Plans .....	12



### List of Tables

1. Area and Population in the Study Area
2. Restructuring of Kecamatan between 1980 and 1990
3. Population Growth during the Last 20 Years from 1971 to 1990 in the Study Area
4. Economic Active Population over Age of 10 Years Old in the Study Area
5. Economic Active Population in Industrial Sector in the Study Area
6. Distribution Rate of Economic Active Population over Age of 10 Years Old by Sex and Region
7. Occupation Rate of Working Population
8. Gross Regional Domestic Products in 1983 Constant Price Level in the Study Area
9. Government Finance
10. Local Government Finance by Kabupaten
11. International Balance of Payment
12. Main Import and Export Commodities of Indonesia
13. Volume and Value of Import and Export in West Java
14. Trading Situation of Tanjung Priok Port in Jakarta and Main Export Commodities in West Java
15. Average Per-Family Monthly Income by Kind of Receipts
16. Average Per-Capita Monthly Expenditure by Commodity Group
17. Consumer price Index and Inflation Rate
18. Exchange Rate
19. Land Used in the Study Area

### List of Figures

1. Administrative Boundary of the Study Area
2. Administrative Boundary of DKI Jakarta
3. Present Land Use in the Study Area
4. Future Land Use Plans in the Study Area



## 1. INTRODUCTION

The socio-economic study was carried out in order to clarify the present situation in the study area and to obtain the basic socio-economic data for review of water demands projected by the water supply master plan established by Jabotabek Water Resources Management Study and for evaluating the water resources development schemes proposed by the study on Ciujung-Cidurian integrated water resources.

## 2. ADMINISTRATION

The study area, situated in western part of Java Island and consisting of the Jabotabek and north Banten areas, is located between Long.  $105^{\circ} 48' E$  (Kab. Pandeglang) and  $107^{\circ} 27' E$  (Kab. Bekasi), and between Lat.  $5^{\circ} 50' S$  (Kab. Serang) and  $7^{\circ} 10' S$  (Kab. Bogor). The study area involved in the West Java Province is bounded by the Java sea to the north, the Strait of Sunda to the west, mountainous area to the south and Kab. Bekasi to the east which both mountainous areas.

The study area shown in Figures 1 and 2 is divided into eight (8) administration bodies which are DKI Jakarta, the capital city of Indonesia, Kabupatens of Bogor, Tangerang, Bekasi, Serang, Lebak and Pandeglang, and Kotamadya Bogor which is one of municipalities in West Java province. These administration bodies consist of some Kecamatans which contain several small size communities called as Kelurahan in the urban area and Desa in rural area. Kelurahan and Desa are regarded as the smallest local administrative units in principal.

The aforesaid bodies have the following administrative areas and structures:

Land Use Categories	Jabotabek Area					North Banten Area		
	DKI Jakarta	Kab. Bekasi	Kab. rang	Kota. Bogor	Kab. Bogor	Kab. Serang	Kab. Lebak	Kab. Pande- glang
(1) Area in the study area (km <sup>2</sup> )	662	1,314	1,301	22	2,770	1,781	1,386	253
(2) Municipality (nos.)	5	-	-	-	-	-	-	-
(3) Local administrative region	-	-	-	-	6	-	-	-
(4) Kecamatan (nos.)	43	20	21	-	29	-	15	3
(5) City (nos.)	-	-	-	5	1	-	-	-

Note : The figures in Serang, Lebak and Pandeglang indicate area in the north Banten area.



### 3. POPULATION

#### 3.1 Population and Density

According to the result of population census in 1990, the total population of Indonesia was 179 million, and that of the study area only were 19 million as broken down in Table 1 and summarized as follows:

Adminbistative Units	Population	Population Density per km <sup>2</sup>	Average Family Size (persons per household)
DKI Jakarta	8,227,746	12,433	4.71
Kab. Bogor	3,738,868	12,562	4.80
Kot. Bogor	271,341	1,336	5.00
Kab. Tangerang	2,703,053	2,063	4.90
Kab. Bekasi	2,104,392	1,591	4.61
Jabotabek area	17,045,469	2,809	4.75
Kab. Serang	1,470,838	808	4.88
Kab. Lebak	529,295	374	4.67
Kab. Pandeglang	215,687	684	5.08
North Banten area	2,167,748	634	4.84
Total	19,213,148	2,025	4.76

#### 3.2 Population Growth and Spatial Distribution

According to the result of recent population census made in 1980 and 1990, the total population of Indonesia increased from 147 million in 1980 to 179 million in 1990 with an average annual growth rate of 1.97 %.

During these 10 years from 1980 to 1990, several Kecamatans have been divided into 2 or 3 new Kecamatans as indicated in Table 2 and therefore number of population in Kecamatans divided was counted in 1 original Kecamatan in 1980 for calculation of population growth in the study. The population growth rate by Kecamatan was derived as shown in Table 3 taking into account restructuring of Kacematans as mentioned and is summarized as follows:

Region	Population Growth Rate (%)		
	'61-'71	'71-'80	'80-'90
Indonesia	2.10	2.32	1.97
DKI Jakarta	4.46	5.66	2.47
Jawa Barat	2.09	2.66	2.57
	2.44	4.60	4.10
Kodya Bogor	2.45	2.61	0.94
Kab. Tangerang	2.32	3.77	6.15
Kab. Bekasi	1.85	3.39	6.47
Kab. Serang	1.80	2.88	2.86
Kab. Lebak	2.50	2.41	2.52
Kab. Pandeglang	2.69	2.86	2.39

Source: Penduduk Indonesia, Hasil Sensus Penduduk 1990.

As indicated in the table, population in Kabs. Bogor, Bekasi and Tangerang has increased with a high rate of 4 % to 6.5 %, while the population growth rate in other areas was



comparative low as less than 3 %. It is noted that some Kecamatan were decreased in population during these 10 years as those in Jakarta Selatan, in Jakarta Timur, in Jakarta Pusat, in Jakarta Barat and Bogor Tengah in Kotamaya Bogor. It seems that the population densities in these areas have almost come near to the limit.

Population distributions in the study area have changed in composite rate between urban and rural populations. The urbanized ratios are given as follows:

Region	Urbanized Ratio (%)			Average Annual Urbanized Ratio (%)		
	1971	1980	1990	'71-'80	'80-'90	'71-'90
Indonesia	17.4	22.3	30.9	0.54	0.86	0.71
DKI Jakarta	100.0	100.0	100.0	0.00	0.00	0.00
Jawa Barat	12.4	20.8	34.5	0.93	1.37	1.16
Kab. Bogor	0.0	25.1	51.5	2.79	2.64	2.71
Kotamadya Bogor	100.0	100.0	100.0	0.00	0.00	0.00
Kab. Tangerang	4.8	19.2	55.0	1.61	3.58	2.64
Kab. Bekasi	5.5	16.5	54.8	1.22	3.83	2.59
Kab. Serang	6.6	11.0	18.3	0.49	0.73	0.62
Kab. Lebak	7.1	3.8	6.8	-0.37	0.30	-0.02
Kab. Pandeglang		6.9	6.7	0.02	-0.02	0.00

Sources: 1. Profil Kependudukan Propinsi DKI Jakarta, 1993.  
2. Profil Kependudukan Propinsi Jawa Barat, 1993.

As shown in this Table, Indonesia has been urbanized from 17 % to 31 % during these 19 years from 1971 to 1990, and West Java province has also been remarkably urbanized from 12 % to 35 % during the same period whose range was wider than that of the whole Indonesia. In the study area, DKI Jakarta and Kotamadya Bogor were already fully urbanized in 1971, while the areas of Kabs. Bogor, Tangerang and Bekasi drastically urbanized from 0 %, 5 % and 6 % in 1971 to 51 %, 55 % and 55 % in 1990 respectively. The ratios in Kab. Serang also shows the second highest urbanization in the study area as 7 % in 1971 to 18 % in 1990. It seems this urbanization reflects its industrialization by such state owned industry as Krakatau Steel Co. and other private industries concerned in the last decade.

Concurrently in the study area, the male inhabitants were gradually increased comparing with those of female, especially those in Kabs. Tangerang, Bekasi and Serang were reversed in distribution between number of persons of male and female (sex ratio) during last 10 years from 1980 to 1990 as follows:



Region	Male Population per 100 Persons of Female		
	1971	1980	1990
Indonesia	97.20		99.40
DKI Jakarta	102.10	102.60	101.90
Jawa Barat	96.80	99.12	100.52
Kab. Bogor	101.78	102.62	103.98
Kodya Bogor	101.44	101.02	101.46
Kab. Tangerang	99.94	102.44	102.46
Kab. Bekasi	99.99	100.79	101.11
Kab. Serang	97.31	99.06	102.14
Kab. Lebak	100.65	101.52	103.14
Kab. Pandeglang	99.59	100.64	102.21

Sources: 1. Penduduk Indonesia, Hasil Sensus Penduduk 1990  
 2. Statistic Indonesia 1992.  
 3. Profil Kependudukan Propinsi Jawa Barat, 1993.

It seems that male adult workers might fix their jobs in places where they live in with their families because of attraction of recent industrialization in these areas.

### 3.3 Labor Force

Economically active population and distribution ratio by economic sectors, sex and region and occupation rate in 1971, 1980 and 1990 in the study area are shown in Tables 4 to 7 and summarized as follows:

Adminbistative Units	Total Economically Active Population		Economically Active Population in Industrial Sector	
	Population in 1990 (thousand)	Growth Rate from (%)	Population in 1990 (thousand)	Growth Rate from 1980 to 1990 (%)
DKI Jakarta	3,129	4.6	2,890 (92.3)	4.3
Kab. Bogor	1,204	5.7	894 (74.3)	5.3
Kot. Bogor	90	3.1	80 (88.9)	2.1
Kab. Tangerang	941	8.8	803 (85.3)	16.7
Kab. Bekasi	713	2.6	583 (81.8)	7.2
Kab. Serang	482	4.5	276 (57.3)	4.1
Kab. Lebak	189	3.4	72 (38.1)	3.0
Kab. Pandeglang	60	3.3	18 (30.0)	3.2

Note : /1 Figures in Parenthesis indicates a percentage rate to total economically active population.

/2 Economically active population in industrial sector was estimated by excluding that in agriculture and agro-industry in Table 5.

In DKI Jakarta and surrounding Kabupatens, economically active population or labor force in the industrial sector was increased with a high growth rate more than 4 % in the last decade. Especially, labor force in the indusatrial sector in Tangerang was remarkably increased with a rate of 16.7 % due to industrialization along the existing national and highway roads.



## 4. ECONOMIC FEATURES

### 4.1 Gross Regional Domestic Products

Gross Regional Domestic Products (GRDP) in Indonesia, West Java Province and Kabpatens in the study area are given in Table 8 and summarized in the following table:

(trillion Rp.)									
Indonesia	West Java	Jabotabek					North Banten		
		DKI Jakarta	Kota. Bogor	Kab. Bogor	Kab. Tange- rang	Kab. Bekasi	Kab. Serang	Kab. Lebak	Kab. Pande- glang
115 (7.1)	17.8 (8.3)	13.7 (7.3)	0.2 (7.0)	1.4 (9.5)	1.3 (10.8)	0.8 (8.5)	1.1 (11.9)	0.3 (13.0)	0.3 (6.5)

Note : Figure in the parenthesis indicates an average economic growth rate from 1983 based on 1983 constant price level.

As indicated in the aforesaid table, the economic growth rates in the study area excluding Kab. Pandeglang were higher than that in the whole Indonesia reflecting the industrialization in these areas as indicated in the following table showing percentage share of each sector in GRDP:

Industry of Origin	(unit : %)									
	Indo- nesia	West Java	DKI Jakarta	Kab. Bogor	Kodya Bogor	Kab. Tange- rang	Kab. Bekasi	Kab. Serang	Kab. Lebak	Kab. Pande- glang
Agriculture	21.78	21.86	1.05	18.58	1.52	15.83	20.05	10.85	46.97	53.32
Minings	14.54	11.15	0.00	0.68	0.00	0.04	0.47	0.54	0.62	0.10
Manufacturing and industry	19.52	20.67	26.37	28.99	8.04	32.62	36.43	63.54	5.80	5.61
Electricity, gas and water	0.64	1.64	4.05	2.19	5.94	1.88	2.02	0.42	0.08	0.37
Construction	5.48	6.46	7.45	9.64	15.67	7.83	9.73	6.12	7.49	1.55
Trade/commercial	16.26	20.59	20.00	24.17	22.57	21.10	18.64	10.10	21.56	16.17
Transportation and communication	5.58	4.92	10.47	5.24	19.43	13.53	3.38	2.93	2.83	5.29
Financing/banking	4.00	1.43	15.45	0.15	4.95	0.50	0.25	0.45	0.41	1.30
House rent	2.47	1.45	2.82	1.34	0.90	0.87	1.03	0.55	1.32	3.22
Official services	6.47	6.60	3.88	4.18	16.59	3.66	4.38	2.78	9.87	9.13
Services	3.25	3.23	8.45	4.84	4.38	2.13	3.62	1.73	3.04	1.95
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

### 4.2 Government Finance

In 1990/91 and 1991/92 fiscal year, the Government finance of Indonesia amounted to Rp.49,451 billion and Rp.50,555 billion respectively both in expenditures and receipts with the annual average rise rate of 14.0 % in expenditures and with 14.1 % in receipts since 1983/84 fiscal year as shown in Table 9.

On the expenditures, the development expenditure accounted for Rp.19,453 billion and Rp.19,997 billion in actual utilization in 1990/91 and 1991/92 respectively at an annual



average rise rate of 10.7 % for the period from 1983/84 which were nearly 40 % of the total expenditures.

In this development expenditure, the expenditure for betterment of infrastructure was only Rp. 679 billion (2.0 % of total development expenditure), but the expenditure for project aid was Rp.8,508 billion which shared about 43.7 % to the total development expenditure and 17.2 % to the whole expenditures.

On the other hand, the local Government finance in Kabupaten level is vary small as indicated in Table 10 comparing with that of the nation level. It means that the local Government finance is still weak to support the expenditure for betterment of infrastructure by themselves in their own areas. Also, expenditure for local development and for betterment of irrigation systems were 1 % or 2 % each only to the total development expenditure in any Kabupaten. Expenditure for transportation and tourism was a little bit higher as amount ranging from 30 % to 50 % in each Kabupaten. Even so, its actual amount was very low. Most of development expenditure was utilized for social welfare including youth education and state apparatus for consolidation of official facilities.

#### **4.3 External Trade and International Balance of Payment**

The current account is usually divided into two (2) items as merchandise representing as external trading, and services rendered. In Indonesia, the balance of external trading was kept constantly since 1985/86 fiscal year. Its amount was accounted at US\$ 5,115 million as of 1990/91. However, in the total current account, the credit exceeds the debit by the amount of US\$ 3,741 million in the same year as shown in Table 11. On the other hand, the capital account was kept in plus side since 1985/86. The total of international balance of payment amounted to US\$3,039 million as the excess of cash balance as of 1990/91.

In situation of external trading of Indonesia in 1991, main export commodities were crude petroleum, refined petroleum and related products, white pepper and black pepper. They were shared at 7.5 %, 8.5 %, 43.8 % and 22.7 % respectively. The total amount of export was US\$83,323 million in 1991. Detail is indicated in Table 12.

Main import commodities were chemical materials, manufacturing goods classified chiefly by materials and machinery and vehicles which they shared at 15.5 %, 16.3 % and 42.7 % respectively as of 1991. The total imported value counted at US\$25,906 million in the same year.

In West Java province, however, the amount of import exceeds the amount of export since 1987 as shown in Table 13. Most of those imported goods and exported goods were handled in Merak port (29.9 % in amount to the total import value) and Cigading port (57.4 % in import, and 35.5 % in amount of the total export value) which they are belonging to Kab. Serang. This may support a high commercial activities of households in Kec. Ciwandan, Kec. Cilegon and Kec. Pulomerak as mentioned previously about labor force.



The Merak port is situated in Kec. Pulomerak, the Cigading port in Kec. Ciwandan, and Kec. Cilegon is the biggest industrial and commercial area in Kab. Serang.

Of course Tanjung Priok port belonging to DKI Jakarta is the biggest trading port of Indonesia. The import amount of 55.0 % of total import value of the country was handled in Tanjung Priok port in 1990, and the export amount of 25.7 % was handled in this port in the same year as shown in Table 14. The Tanjung Priok port also has a role of external trading activities of West Java province, and may support the trading of goods resulting from industrialization in JABOTABEK area including the north Banten represented by Kab. Serang. Main export commodities in West Java province were cloths and textile as the first (59.5 % shared to total export amount), iron steel as the second (12.2 %) and tea as the third (6.9 %) as of 1990.

#### 4.4 Family Economy

##### 4.4.1 Average monthly per-capita income

Average monthly amount of per-family income was the sum of around Rp.440,000 in total with around Rp.87,000 per capita in DKI Jakarta as of 1989. The income usually reflects inflation in Indonesia payment system, so that the income in 1990 can be estimated at amount of around Rp.477,000 per family and Rp.94,000 per capita based on the inflation rate as mentioned later. People's livelihood in DKI Jakarta was supported by this amount of income every month.

Average monthly amount of per-family income in Bandung, the capital city of West Java province, was the sum of around Rp.357,000 in total with around Rp.70,000 per capita in 1989. The estimated income in 1990 was at sum of around Rp.385,000 per family and Rp.75,000 per capita. The income level in Bandung was about 20 % lower than that in DKI Jakarta. Table 15 shows its detail.

##### 4.4.2 Average monthly per-capita expenditure

Average monthly per-capita expenditures in DKI Jakarta and in West Java province were about Rp.67,000 and Rp.33,000 in 1990. The annual average increasing ratio was 12.3 % in DKI Jakarta and 11.3 in West Java Province. In these per-capita income, expenditure for food was not so high as about 44 % in DKI Jakarta, comaring with very high ratio of 61 % in West Java province.

Among expenditures for non-food commodities, share of the expenditure for housing, fuel, light and water was the highest both in DKI Jakarta and in West Java province. But, DKI Jakarta was higher as 24 % for the total amount of non-food expenditures, while West Java province was only 16 % for the total non-food expenditures as of 1990.

These figures reflects a difference of living condition between DKI Jakarta and West Java province. Detail situation is given in Table 16.



## 4.5 Economic Indicators

### 4.5.1 Consumer price

Table 17 shows a consumer price index with annual inflation rate in DKI Jakarta and in Bandung, the capital city of West Java province, during period from 1981. Comparing annual average increasing ratio between DKI Jakarta and Bandung, the rate of Bandung was higher than that of DKI Jakarta. But the inflation rate was slightly higher as 8.0% in DKI Jakarta than that of Bandung as 7.9 %.

For analysis of people's livelihood, actual daily prices of living commodities will be necessary to get. It seems that living condition in country side had become rather severer than in DKI Jakarta considering both per-capita income, per-capita expenditure mentioned in previous Sections and this consumer price index with inflation rate.

### 4.5.2 Exchange rate

Fluctuation of exchange rate of Indoensia's Rp. currency shows a rapid change during last 4 years from 1989 against both the US Dollar currency and Japanese Yen currency. As shown in Table 18, against US dollar, Rp. currency have fallen its value from Rp.1,735.38 per US\$ 1.00 as of January 1989 to Rp.2,177.25 per US\$ 1.00 as of August 1994 both in mid-rate during the period from 1989.

For Japanese yen, its value also have fallen over wider range than the case of US dollar from Rp.13.56 per Yen 1.00 to Rp.21.84 per Yen 1.00 in mid-rate during the same period.



## 5. LAND USE CONDITION IN THE STUDY AREA

### 5.1 Present Land Use Condition

The study area comprised of the Jabotabek and north Banten areas is mainly divided into 4 categories in land use as shown in Figure 3; (1) housing area including industrial area currently growing; (2) Paddy field; (3) upland crops; and (4) state forest and other areas, based on the statistical data issued by the Kabupatens in 1991. The areas and their percentage distribution are indicated in Table 19 and summarized as follows:

Land Use Categories	(unit : km <sup>2</sup> )							
	Jabotabek					North Banten		
	DKI Jakarta	Kab. Bekasi	Kab. Tange- rang	Kota. Bogor	Kab. Bogor	Kab. Serang	Kab. Lebak	Kab. Pande- glang
(1) Housing	271 (41)	290 (22)	361 (28)	18 (27)	499 (18)	226 (13)	81 (6)	17 (7)
(2) Paddy field	60 (9)	751 (57)	576 (44)	1 (2)	867 (31)	687 (39)	266 (19)	128 (51)
(3) Upland crops	80 (12)	253 (19)	326 (25)	3 (5)	1,212 (44)	797 (45)	929 (67)	89 (35)
(4) State forest and others	251 (38)	20 (2)	38 (3)	4 (67)	190 (7)	71 (4)	110 (8)	19 (8)
Total	662 (100)	1,314 (100)	1,301 (100)	22 (100)	2,770 (100)	1,781 (100)	1,386 (100)	253 (100)

Note : Figures in parenthesis show percentage distribution of areas against total area. Then, figures in Serang, Lebak and Pandeglang indicate area in the north Banten area.

#### (1) DKI Jakarta

DKI Jakarta with an area of 661 km<sup>2</sup> has been mainly developed as an urban area which has a role of political, administrative, and commercial center of the Indonesia. Industrial area is developed along the port in Tanjungpriok, relating to shipbuilding industry. The major industrial estates in DKI Jakarta are Jakarta Industrial Estates at Pulogadung in Jakarta Timur municipality and Kawasan Berikat Nusantara in Jakarta Utara municipality.

#### (2) Kabupaten Bekasi

In Bekasi, Prosijat irrigation area with an area of about 65,845 ha widely spreads and irrigation water for this area has been supplied from the Juanda dam in the Citarum river through the existing West Tarum Canal (WTC) with a length of about 50 km and an intake at Curug in the Citarum river.

Urbanization and industrialization has been expanded along the existing national road and highway and railway line aligned along the foot of hill area, where the water is available along the WTC. At present, 11 industrial estates with a total area of 3,250 ha are under operation and implementation of a new industrial estate development project with 220 ha is



scheduled to be commenced in 1993. Further, 10 estates with a total area of 2,780 ha are waiting for approval of implementation.

Fish ponds with a total area of 4,000 to 5,000 ha for brackish fishery are located along the coastal line in order to mainly produce tiger shrimp for export and milk fish, using river water of the Citarum and return flow and/or remaining water from the existing irrigation system.

(3) Kabupaten Tangerang

In Tangerang, the Prosida-Cisadane (31,000 ha), Cidurian-Rancasumur (11,000 ha) and Cicinta irrigation (1,400 ha) areas with a total area of about 43,400 ha were developed by providing irrigation canals and intake weirs, namely Pasar Baru weir in the Cisadane river, Rancasumur weir in the Cidurian river and Cicinta weir in the Cicinta river, which were constructed in 1930's. But, in these rivers there are no dam/reservoirs to regulate river flow for dry season water supply for paddy production.

Urbanization and industrialization have been expanded in the area between the existing highway and railway line aligned along the foot of hill area, especially around Tangerang, Cikupa, Balaraja and Cisoka. At present, 14 industrial estates with a total area of 3,100 ha are under operation and implementation of new 9 industrial estate development projects with 1,750 ha is ready for commencement and 4 estates with a total area of 1,100 ha are waiting for approval of implementation. Then, an integrated development scheme, comprising of settlement area, tourism development and industrial area, is also going on with an area of 6,000 ha at Serpong by PT. Bumi Serpong Damai (BSD).

Fish ponds with a total area of 3,000 to 4,000 ha for brackish fishery are located in the Kecamatans of Keronjo, Manuk, Sepetan, and Teluknaga in order to mainly produce tiger shrimp for export and milk fish, using river water of the Cidurian, Cimanceuri and Cisadane and return flow and/or remaining water from the existing irrigation system.

(4) Kabupaten Bogor

There are two irrigation systems, which are developed in the Empang and Katulampa areas and of which irrigation areas are about 5,800 ha and 3,900 ha respectively. These system provide the Empang intake weir in the upstream of the Cisadane river and the Katulampa weir on the Ciliwung river. Upland crop area spreads widely on the alluvial fan formed by the Cisadane, Ciliwung, Bekasi and small rivers flowing into DKI Jakarta and produces vegetables mainly. Forest area is located along the southern boundary of the Study area and unused area covered with bush or partly cultivated area is distributed in the mountainous area. Tree crop productions such as fruits, coconut and rubber are being made over the northern hilly land of the Kabupaten.



Urbanized areas are mainly developed in Kotamadya Bogor and Cibinong. Cibinong city functions as a center of the cement mining or industry.

The proposed Tanjung reservoir is located in the Kabupaten Bogor and is presently used for upland crop area including tree crops.

(5) Kotamadya Bogor

Kotamadya Bogor has been developed as a commercial and trading center for agricultural products in the Kab. Bogor, and also functions as tourism and recreation areas because of the existence of historical places and preferable weather.

(6) Kabupaten Serang

The north-eastern part of the Kabupaten Serang is occupied by the Ciujung irrigation area with a area of about 24,000 ha of which irrigation water comes from the Pamarayang weir in the Ciujung river.

While, the north-western part has been developed as a heavy industrial area such as steel, petroleum and chemical centralizing on Cilegon city and its zone is widening toward the coastal area of the northern peninsular of the city. There exists 18 industrial estates with a total area of 4,000 ha including Krakatau Industrial Estate Cilegon. As of 1993, development schemes of new 10 industrial estates with 1,950 ha are ready for commencement and 6 estates with a total area of 1,300 ha are waiting for approval of implementation.

Also, in this area, the Selaraya power plant with an installed capacity of 1,600 Mw is under operation and its second stage development with an installed capacity of 1,800 Mw is scheduled to be commenced within years. In addition, a new harbor construction is going on at the Kecamatan Bojonegara, of which the first stage is scheduled to be completed in 1997 and the second stage construction will be continued until 1999.

(7) Kabupaten Lebak

The Kabupaten Lebak is located at the area with an altitude more than EL. 50 m and its major land use is tree crop production such as palm, coconut and rubber which are mainly found along the trunk road from Rangkasbitung to Bogor. The reservoir area of the Karian and Cilawang dams belong to this Kabupaten and is presently used as paddy field on the narrow river banks or tree crop land.

(8) Kabupaten Pandeglang

The major land use in Pandeglang is paddy and upland crop production using more than 80 % of the land involved in the study area.



## 5.2 Future Land Use Plans

Based on the data and information from the local governments related to the study area, the future land use map was prepared together with transportation development plans as shown Figure 4.

### (1) Irrigation development

In the Jabotabek and north Banten areas, several new development schemes were formulated by the previous studies:

Irrigation Scheme	Irrigation Area (ha)	Location	Studies/Projects
Kopo-Cikande-Charenang (KCC)	10,300	Kab. Serang	Karian Multipurpose Dam Construction Project, JICA
Cidurian-Tanjung	5,568	Kab. Tangerang	Cisadane River Basin Development Project
Curug-Legok	2,966	Kab. Tangerang	do above
E6, E8, and E9 areas	6,810	Kab. Bekasi/Bogor	C-J-C project

Of the above schemes, most of areas for three schemes of KCC, Tanjung and Curug-Legok irrigation development is presently planned to be developed as industrial and/or settlement areas by the West Java Provincial Government.

While, the irrigation schemes E6, E8 and E9 are still prospective although development of these schemes are depending on the implementation of the Canal 2 of which purposes are mainly for M&I water supply to DKI Jakarta and/or irrigation development in these areas.

At present, purpose of land resources development in the aforesaid new irrigation areas is changed from agricultural production to industrial or housing development.

### (2) Expansion of the existing settlement areas

The existing settlement areas in the study area are expected to be largely expanded to support growing population with a high increasing rate. The JWRMS estimated in the draft final report that about 140,000 ha to 160,000 ha which is more than twice of the existing settlement areas in Kabs. Bogor, Bekasi, Tangerang and Serang will be additionally required to accomodate growing population in near future.

According to the data and information from the provincial government, the following areas are planned or scheduled to be expanded or developed for settlement:



- Serpong-Cilegon along the national road where several housing and/or industrial developers are waiting for completion of highway construction and approval for implementation,
- Tigaraksa with an area of 3,000 ha is scheduled to be further expanded as a new capital city of Kab. Tangerang due to administrative change for the existing capital to Kotip,
- Serpong with an area of 6,000 ha, being developed by BSD,
- Bogor-Cibinong-Jakarta Selatan connected by the existing highway and national roads,
- Areas for low-cost houses for factory workers in the existing industrial estates in Kab. Bekasi,
- Expansion areas for Tangerang-Chengkareng urban development
- Housing development area in KCC area

### (3) Industrial development

In the last decade, Kabs. Tangerang, Serang and Bekasi have been rapidly industrialized because of advantage on transportation. This trend will be expanded to the further east and west. Actually, in the western part of Tangerang and eastern part of Serang, several industrial factories or estates are going on at Balaraja, Cisoka and Cikande. Also, in the east, some are being constructed at Bekasi, Cikarang and Karawang. Then, new industrial estates are waiting for approval of their implementation as stated in the previous section 2.4.1.

### (4) Transportation development

The main trunk transportation systems in the study area are; 1) national roads and highways and railway lines connecting DKI Jakarta area with Kab. Tangerang and Serang in the west, Bogor in the south, and Bekasi in the east.

In DKI Jakarta area, the outer ring road construction has been implemented and services at the several parts are commenced. One of sub-system to be expanded to Serpong will be constructed within years together with development of Serpong by BSD. The West Java Provincial Government has an intention to construct highway system connecting Serpong with Anyer for tourism development and for industrial and housing development along the highway in Kabs. Serang and Tangerang. In Kab. Bekasi, similar road development plan is also established by the provincial government.

In Kab. Serang, a new harbor construction is scheduled to be implemented in Kec. Bojonegara. First phase will be started in 1993 and completed in 1995. Following the first phase, second phase construction will be continued until 1999. This harbor construction is considered to further accelerate the current industrialization in Cilegon-Serang area due to reduction of cost for shipping materials and products.



# ***TABLES***







**Table 1 AREA AND POPOULATION OF ADMINISTRATION BODIES IN THE JABOTABEK AND NORTH BANTEN AREAS IN THE STUDY AREA AS OF 1990**

Administrative Units	Area (km <sup>2</sup> )	Population (persons)	No. of households	As of 1990	
				No. of persons per household	Population density (persons/ km <sup>2</sup> )
<b>DKI Jakarta</b>	661.73	8,227,746	1,745,206	4.72	13,914
Jakarta Selatan	142.98	1,905,283	392,474	4.85	13,326
Kebayoran Lama	20.11	299,721	61,833	4.85	14,904
Pesangrahan	12.36	153,715	31,263	4.92	12,436
Pasar Minggu	19.40	231,848	47,082	4.92	11,951
Jagakarsa	27.09	143,072	29,931	4.78	5,281
Mampang Prapatan	7.66	148,665	31,799	4.68	19,408
Pancoran	8.16	141,373	30,121	4.69	17,325
Kebayoran Baru	12.50	186,865	38,896	4.80	14,949
Setia Budi	8.77	179,495	37,122	4.84	20,467
Tebet	8.78	248,493	48,670	5.11	28,302
Cilandak	18.15	172,036	35,257	4.81	9,479
Jakarta Timur	184.23	2,064,499	444,975	4.64	11,206
Pasar Rebo	12.35	119,517	25,245	4.73	9,677
Cipayung	26.73	100,860	21,004	4.80	3,773
Ciracas	15.94	157,704	34,533	4.57	9,894
Kramat Jati	13.08	211,757	44,679	4.74	16,189
Makasar	21.58	146,532	30,650	4.78	6,790
Jatinegara	10.54	277,582	57,749	4.81	26,336
Duren Sawit	21.41	290,246	62,965	4.61	13,557
Matraman	4.81	165,372	34,304	4.82	34,381
Pulo Gadung	15.57	279,103	58,625	4.76	17,926
Cakung	42.22	315,826	75,221	4.20	7,480
Jakarta Pusat	48.67	1,074,997	224,592	4.79	22,087
Tanah Abang	9.24	192,152	39,016	4.92	20,796
Menteng	6.47	90,774	17,830	5.09	14,030
Senen	4.18	112,792	25,797	4.37	26,984
Cempata Putih	4.43	92,539	19,635	4.71	20,889
Johor Baru	2.35	122,866	25,927	4.74	52,283
Sawah Besar	6.15	124,482	25,809	4.82	20,241
Gambir	7.72	112,864	22,039	5.12	14,620
Kemayoran	8.13	226,528	48,539	4.67	27,863
Jakarta Barat	126.37	1,820,019	383,880	4.74	14,402
Kebon Jeruk	17.38	261,630	54,159	4.83	15,054
Kembangan	24.42	157,239	33,908	4.64	6,439
Cengkareng	27.94	372,332	85,555	4.35	13,326
Kali Deres	27.25	175,496	39,452	4.45	6,440
Grogol Petamburan	11.67	241,887	48,600	4.98	20,727
Palmerah	7.55	217,502	44,030	4.94	28,808
Tambora	5.80	263,607	53,296	4.95	45,449
Taman Sari	4.36	130,326	24,880	5.24	29,891
Jakarta Utara	159.48	1,362,948	299,285	4.55	8,546
Penjaringan	42.53	262,065	60,944	4.30	6,162
Pademangan	7.46	144,743	30,424	4.76	19,403
Tanjung Priok	24.58	328,272	65,903	4.98	13,355
Koja	14.41	288,271	68,460	4.21	20,005
Kelapa Gading	16.00	103,223	23,645	4.37	6,451
Kepulauan Seribu	11.45	14,826	2,717	5.46	1,295
Cilincing	43.05	221,548	47,192	4.69	5,146
<b>Kab. Bogor</b>	2,769.66	3,738,868	779,770	4.79	1,350
Citeureup	137.10	165,074	35,607	4.64	1,204
Cibinong	42.71	125,104	27,123	4.61	2,929
Gunung Putri	56.26	88,323	19,380	4.56	1,570
Cimanggis	50.28	220,308	47,379	4.65	4,382
Kedunghalang	57.45	185,464	38,382	4.83	3,228
Jonggol	224.48	128,638	31,606	4.07	573
Cariu	156.74	73,825	19,859	3.72	471
Cileungsi	161.36	137,108	31,421	4.36	850
Leuwiliang	101.69	123,084	25,096	4.90	1,210
Rumpin	123.05	81,486	17,585	4.63	662
Ciampea	55.97	130,518	26,212	4.98	2,332
Cibungbulang	97.26	173,149	34,592	5.01	1,780
Jasinga	143.69	79,994	16,301	4.91	557
Cigudeg	229.20	109,283	22,408	4.88	477
Parungpanjang	117.45	91,797	18,984	4.84	782
Nanggung	197.19	52,444	11,470	4.57	266

Administrative Units	Area (km <sup>2</sup> )	Population (persons)	No. of households	As of 1990	
				No. of persons per household	Population density (persons/ km <sup>2</sup> )
Ciawi	40.02	120,217	24,799	4.85	3,004
Cijeruk/Cigombong	58.03	123,388	25,947	4.76	2,126
Cisarua	186.62	136,479	27,792	4.91	731
Caringin	57.67	72,204	15,174	4.76	1,252
Ciomas	85.03	295,104	59,851	4.93	3,471
Parung	71.20	130,488	25,590	5.10	1,833
Gunungsindur	50.55	49,589	9,573	5.18	981
Sawangan	73.40	165,835	33,244	4.99	2,259
Semplak	62.59	160,127	31,706	5.05	2,558
Bojonggede	66.90	138,898	26,860	5.17	2,076
Pancoran Mas	19.72	111,380	21,460	5.19	5,648
Beji	14.81	71,034	15,018	4.73	4,796
Sukmajaya	31.24	198,526	39,351	5.05	6,355
<b>Kotamadya Bogor</b>	21.56	271,341	54,249	5.00	12,585
Kota Bogor Utara	7.62	80,896	16,473	4.91	10,616
Kota Bogor Selatan	2.74	51,991	10,607	4.90	18,975
Kota Bogor Timur	4.47	62,253	12,003	5.19	13,927
Kota Bogor Barat	3.56	40,808	8,322	4.90	11,463
Kota Bogor Tengah	3.17	35,393	6,844	5.17	11,165
<b>Kab. Tangerang</b>	1,301.07	2,703,053	564,499	4.79	2,078
Tangerang	24.35	223,355	44,401	5.03	9,173
Batu Ceper	33.45	162,987	34,397	4.74	4,873
Teluk Naga	72.38	72,741	26,893	2.70	1,005
Mauk	115.05	117,005	22,274	5.25	1,017
Rajeg	52.16	62,356	11,969	5.21	1,195
Sepatan	91.18	154,860	29,217	5.30	1,698
Pasar Kemis	61.58	91,378	18,312	4.99	1,484
Balaraja	73.11	100,005	19,904	5.02	1,368
Kresek	56.59	71,214	14,515	4.91	1,258
Kronjo	67.93	64,929	13,260	4.90	956
Curug	39.06	96,951	19,955	4.86	2,482
Cikupa	78.70	118,480	23,904	4.96	1,505
Legok	95.29	108,356	21,708	4.99	1,137
Tiga Raksa	77.93	72,741	14,376	5.06	933
Serpong	91.24	131,479	27,536	4.77	1,441
Ciputat	64.53	318,763	66,124	4.82	4,940
Ciledug	25.17	191,112	38,491	4.97	7,593
Cisoka	76.57	86,918	17,222	5.05	1,135
Jatiuwung	35.99	203,627	46,903	4.34	5,658
Cipondoh	39.17	140,767	29,121	4.83	3,594
Pondok Aren	29.64	113,029	24,017	4.71	3,813
<b>Kab. Bekasi</b>	1,313.94	2,104,392	456,745	4.61	1,602
Pondokgede	72.43	282,126	57,806	4.88	3,895
Bantargebang	50.40	58,200	12,874	4.52	1,155
Setu	67.37	60,889	13,733	4.43	904
Cibarusah	91.53	54,884	12,790	4.29	600
Serang	87.14	65,898	16,318	4.04	756
Lemahabang	104.54	116,290	27,187	4.28	1,112
Cikarang	81.70	137,874	29,633	4.65	1,688
Cibitung	88.33	132,469	29,378	4.51	1,500
Tambun	63.17	159,690	34,407	4.64	2,528
Tarumajaya	51.26	37,560	7,814	4.81	733
Babelan	57.10	71,032	14,695	4.83	1,244
Tambelang	85.13	56,450	12,951	4.36	663
Sukatani	73.72	77,482	16,601	4.67	1,051
Pebayuran	81.13	68,814	15,782	4.36	848
Cabangbungin	58.90	39,910	8,575	4.65	678
Muaragembong	103.82	21,500	4,618	4.66	207
Bekasi Timur	35.94	218,677	46,752	4.68	6,085
Bekasi Selatan	26.02	177,115	36,276	4.88	6,807
Bekasi Barat	18.07	164,449	36,342	4.53	9,101
Bekasi Utara	16.24	103,083	22,213	4.64	6,347
<b>JABOTABEK area</b>	6,067.96	17,045,400	3,600,469	4.73	2,809

Administrative Units	Area (km <sup>2</sup> )	Population (persons)	No. of households	As of 1990	
				No. of persons per household	Population density (persons/ km <sup>2</sup> )
<b>Kab. Serang</b>	1,781.32	1,470,838	301,689	4.88	826
Cinangka	123.02	45,034	10,164	4.43	366
Padarincang	74.40	49,252	10,359	4.75	662
Ciomas	57.12	28,005	5,738	4.88	490
Pabuaran	76.96	39,115	8,568	4.57	508
Baros	33.94	34,856	7,969	4.37	1,027
Petir	92.00	63,641	12,661	5.03	692
Cikeusai	96.13	77,045	15,749	4.89	801
Pamarayan	71.67	52,455	11,498	4.56	732
Kopo	87.30	60,763	12,145	5.00	696
Cikande	82.70	70,451	14,807	4.76	852
Kragilan	40.33	45,310	8,670	5.23	1,123
Walantaka	45.83	43,982	7,885	5.58	960
Serang	59.92	155,296	29,045	5.35	2,592
Taktakan	62.00	40,400	7,936	5.09	652
Wr. Kurung	43.90	27,334	5,544	4.93	623
Mancak	91.03	31,703	6,887	4.60	348
Anyer	58.85	33,519	7,435	4.51	570
Bojonegara	66.58	50,415	10,272	4.91	757
Kramat Watu	51.58	46,720	9,627	4.85	906
Kasemen	60.55	55,645	11,709	4.75	919
Ciruas	36.19	43,099	7,892	5.46	1,191
Pontang	75.65	42,814	8,925	4.80	566
Carenang	63.46	49,250	11,226	4.39	776
Tirtayasa	90.69	58,651	12,433	4.72	647
Ciwandan	43.47	63,552	12,441	5.11	1,462
Cilegon	39.70	77,601	15,793	4.91	1,955
Pulomerak	56.35	84,930	18,311	4.64	1,507
<b>Kab. Lebak</b>	1,385.75	529,295	113,294	4.67	382
Rangkasbitung	117.85	133,762	27,083	4.94	1,135
Maja	117.88	55,182	11,904	4.64	468
Sajira	107.16	33,208	7,516	4.42	310
Wrung Gunung	123.95	65,439	13,349	4.90	528
Cipanas	102.33	47,640	10,073	4.73	466
Leuwidamar	167.49	34,868	7,552	4.62	208
Muncang	148.14	47,065	10,730	4.39	318
Cimarga	196.53	42,708	9,406	4.54	217
Bojongmanik	157.18	37,434	8,671	4.32	238
Citeles	147.24	31,989	7,010	4.56	217
<b>Kab. Pandeglang</b>	252.69	167,615.00	32,518.00	5.16	702
Pandeglang	115.91	61,195	11,399	5.37	528
Cadasari	61.62	55,459	11,399	4.87	900
Banjar	75.16	50,961	9,720	5.24	678
<b>North Banten area</b>	3,419.76	2,167,748	447,501	4.84	634
<b>Total of Study Area</b>	9,487.72	19,213,148	4,047,970	4.75	2,025

Sources : DKI Jakarta Dalam Angka, Potensi Desa-Hasil Sensus Penduduk 1990 for DKI Jakarta, Kab. Bogor, Kotamadya Bogor, Kab. Tangerang, Kab. Bekasi, Kab. Serang, Kab. Lebak and Kab. Pandeglang (pro., DKI Jakarta Dalam Angka 1992). For Kab. Pandeglang, Potensi Desa 1990 for Kec. Cimanuk, Kec. Labuan and Kec. Mandalawangi were also referred.



Table 2 RESTRUCTURING OF KECAMATANS BETWEEN 1980 AND 1990

City/Kab.	No.	Kecamatan in 1980	Kecamatan in 1990
DKI Jakarta	(1)	Kebayoran Lama	Kebayoran Lama + Pesangrahan
	(2)	Pasar Minggu	Pasar Minggu + Jagakarsa
	(3)	Mampang Prapatan	Mampang Prapatan + Pancoran
	(3)	Tebet	Tebet + Cilandak
	(4)	Pasar Rebo	Pasar Rebo + Cipayung + Ciracas
	(5)	Kramat Jati	Kramat Jati + Makasar
	(6)	Jatinegara	Jatinegara + Duren Sawit
	(6)	Pulo Gadung	Pulo Gadung + Cakung
	(7)	Cempaka Putih	Cempaka Putih + Johor Baru
	(8)	Kebon Jeruk	Kebon Jeruk + Kembangan
	(9)	Cengkaren	Cengkaren + Kalidedes
	(10)	Grogol Petamburan	Grogol Petamburan + Palmerah
Kab. Bogor	(11)	Penjaringan	Penjaringan + Pademangan
	(12)	Koja	Koja + Kelapa Gading
	(12)	Kelapa Gading	Kelapa Gading + Koja + Cilincing
Tangerang	(13)	Leuwiliang	Leuwiliang + Nanggung
	(14)	Ciawi	Ciawi + Caringin
	(15)	Depok	Pancorang Mas + Beji + Sukmajaya
Bekasi	(16)	Tangerang	Tangerang + Cipondoh
	(17)	Curug	Curug + Jatiuwung
	(18)	Tiga Raksa	Tiga Raksa + Cisoka
	(19)	Ciledug	Ciledug + Pondok Aren
Serang	(20)	Setu	Setu + Bantargebang
	(21)	Cibarusah	Cibarusah + Serang
	(22)	Babelan	Babelan + Tarumajaya
	(23)	Sukatani	Sukatani + Tambelang
	(24)	Bekasi	Bekasi Timur + Bekasi Selatan + Bekasi Barat + Bekasi Utara
	(25)	Pulomerak	Pulomerak + Ciwandan







Table 3 POPULATION GROWTH DURING THE LAST 20 YEARS FROM 1971 TO 1990 IN THE STUDY AREA

Administration Units	Population			Average Annual Increasing Ratio			Remarks
	1971	1980	1990	1971-'80	1980-'90	1971-'90	
<b>DKI Jakarta</b>	3,927,055	6,444,654	8,227,746	5.66%	2.47%	3.97%	
Jakarta Selatan	1,054,635	1,579,795	1,905,283	4.59%	1.89%	3.16%	
Keb. Lama	184,098	201,700	299,721	1.02%	8.44%	4.86%	(1)
Pesangrahan	0	0	153,715				
Pasar Minggu	114,081	227,976	231,848	8.00%	5.10%	6.46%	(2)
Jagakarsa	0	0	143,072				
Mampang Prapatan	125,572	231,436	148,665	7.03%	2.28%	4.50%	(3)
Pancoran	0	0	141,373				
Keb. Baru	176,498	314,047	186,865	5.93%	-5.06%	0.30%	
Setia Budi	239,184	231,071	179,495	-0.34%	-2.49%	-1.50%	
Tebet	212,131	257,306	248,493	6.49%	1.19%	3.67%	(3')
Cilandak	*(3,071)	116,259	172,036		4.00%		
Jakarta Timur	805,722	1,456,750	2,064,499	6.80%	3.55%	5.08%	
Pasar Rebo	86,332	200,385	119,517	9.81%	6.55%	8.08%	(4)
Cipayung	0	0	100,860				
Cinacas	0	0	157,704				
Kramat Jati	132,487	269,364	211,757	8.20%	2.89%	5.38%	(5)
Makasar	0	0	146,532				
Jatinegara	230,241	404,111	277,582	6.45%	3.46%	4.87%	(6)
Duren Sawit	0	0	290,246				
Matraman	162,112	180,070	165,372	1.06%	-0.85%	0.10%	
Pulo Gadung	190,961	255,741	279,103	8.65%	4.43%	6.16%	(6')
Cakung	*(3,589)	147,079	315,826		7.94%		
Jakarta Pusat	624,859	1,236,876	1,074,997	7.88%	-1.39%	2.90%	
Tanah Abang	122,133	239,004	192,152	7.74%	-2.16%	2.41%	
Menteng	67,008	115,503	90,774	6.24%	-2.38%	1.61%	
Senen	78,869	135,306	112,792	6.18%	-1.80%	1.90%	
Cempaka Putih	90,021	215,428	92,539	10.18%	0.00%	4.70%	(7)
Johor Baru	*(5,183)	0	122,866				
Sawah Besar	82,517	156,871	124,482	7.40%	-2.29%	2.19%	
Gambir	85,080	144,802	112,864	6.09%	-2.46%	1.50%	
Kemayoran	94,048	229,962	226,528	10.44%	-0.15%	4.74%	
Jakarta Barat	824,190	1,231,188	1,820,019	4.56%	3.99%	4.26%	
Kebon Jeruk	72,369	171,346	261,630	10.05%	9.35%	9.68%	(8)
Kembangan	0	0	157,239				
Cengkarek	93,058	237,711	372,332	10.98%	8.71%	9.78%	(9)
Kalideres	0	0	175,496				
Grogol Petamburan	262,048	401,544	241,887	4.86%	1.35%	3.00%	(10)
Palmerah	*(3,434)	0	217,502				
Tambora	236,885	270,485	263,607	1.48%	-0.26%	0.56%	
Taman Sari	156,396	150,102	130,326	-0.46%	-1.40%	-0.96%	
Jakarta Utara	617,649	940,045	1,362,948	4.78%	3.78%	4.25%	
Penjaringan	196,031	305,133	262,065	5.04%	2.92%	3.92%	(11)
Pademangan	0	0	144,743				
Tanjung Priyok	147,824	233,260	328,272	5.20%	3.48%	4.29%	
Koja	260,184	237,865	288,271	-0.99%	5.11%	2.17%	(12)
Kelapa Gading	0	0	103,223	4.59%	4.64%	4.61%	(12')
Kepulauan Seribu	8,408	12,130	14,826	4.16%	2.03%	3.03%	
Cilincing	*(5,202)	151,657	221,548		3.86%		
<b>Kab. Bogor</b>	1,668,778	2,501,141	3,738,868	4.60%	4.10%	4.34%	
Citeureup	71,963	107,670	165,074	4.58%	4.37%	4.47%	
Cibinong	70,719	115,387	125,104	5.59%	0.81%	3.05%	
Gunung Putri	35,973	55,143	88,323	4.86%	4.82%	4.84%	
Cimanggis	51,305	160,175	220,308	13.48%	3.24%	7.97%	
Kedunghalang	81,835	118,058	185,464	4.16%	4.62%	4.40%	
Jonggol	78,635	101,249	128,638	2.85%	2.42%	2.62%	
Cariu	50,096	59,667	73,825	1.96%	2.15%	2.06%	
Cileungsi	68,064	92,942	137,108	3.52%	3.96%	3.75%	
Leuwiliang	96,810	131,468	123,084	3.46%	2.93%	3.18%	(13)
Rumpin	46,011	59,358	81,486	2.87%	3.22%	3.05%	
Ciampea	70,395	96,639	130,518	3.58%	3.05%	3.30%	
Cibungbulang	94,816	129,109	173,149	3.49%	2.98%	3.22%	
Jasinga	47,517	60,902	79,994	2.80%	2.76%	2.78%	
Cigudeg	61,612	80,184	109,283	2.97%	3.14%	3.06%	
Parungpanjang	50,356	65,598	91,797	2.98%	3.42%	3.21%	
Nanggung	0	0	52,444				
Administration Units	Population			Average Annual Increasing Ratio			Remarks
	1971	1980	1990	1971-'80	1980-'90	1971-'90	
Ciawi	94,363	134,860	120,217	4.05%	3.62%	3.82%	(14)
Cijeruk/Cigombong	67,681	92,537	123,388	3.54%	2.92%	3.21%	
Cisarua	74,235	100,975	136,479	3.48%	3.06%	3.26%	
Caringin	0	0	72,204				
Ciomas	138,911	208,607	295,104	4.62%	3.53%	4.05%	
Parung	60,204	90,632	130,488	4.65%	3.71%	4.16%	
Gunungsindur	25,127	35,996	49,589	4.07%	3.26%	3.64%	
Sawangan	52,682	93,798	165,835	6.62%	5.86%	6.22%	
Semplak	80,126	113,893	160,127	3.98%	3.47%	3.71%	
Bojonggede	0	0	138,898				
Pancoran Mas	99,342	196,294	111,380	7.86%	10.23%	9.10%	(15)
Beji	0	0	71,034				
Sukmajaya	0	0	198,526				
<b>Kotamadya Bogor</b>	195,882	247,104	271,341	2.61%	0.94%	1.73%	(15')
Bogor Utara	45,129	64,583	80,896	4.06%	2.28%	3.12%	
Bogor Selatan	39,242	50,911	51,991	2.93%	0.21%	1.49%	
Bogor Timur	35,471	51,397	62,253	4.21%	1.93%	3.00%	
Bogor Barat	36,695	40,697	40,808	1.16%	0.03%	0.56%	
Bogor Tengah	38,614	39,516	35,393	0.26%	-1.10%	-0.46%	
<b>Kab. Tangerang</b>	1,066,695	1,487,898	2,703,053	3.77%	6.15%	5.02%	
Tangerang	120,768	194,531	223,355	5.44%	6.47%	5.98%	(16)
Batu Ceper	80,896	94,721	162,987	1.77%	5.58%	3.76%	
Teluk Naga	67,656	95,259	72,741	3.88%	-2.66%	0.38%	
Mauk	67,977	83,580	117,005	2.32%	3.42%	2.90%	
Rajeg	33,978	44,313	62,356	2.99%	3.85%	3.25%	
Sepatan	82,430	110,362	154,860	3.30%	3.45%	3.37%	
Pasar Kemis	37,180	49,790	91,378	3.30%	6.26%	4.85%	
Balaraja	72,975	88,946	100,005	2.22%	1.18%	1.67%	
Kresik	43,316	54,603	71,214	2.61%	2.69%	2.65%	
Kronjo	40,934	50,425	64,929	2.34%	2.56%	2.46%	
Curug	53,021	108,393	96,951	8.27%	10.74%	9.56%	(17)
Cikupa	47,161	65,369	118,480	3.69%	6.13%	4.97%	
Legok	52,596	63,504	108,356	2.12%	5.49%	3.88%	
Tiga Raksa	65,249	78,702	72,741	2.10%	7.33%	4.82%	(18)
Serpong	55,480	79,920	131,479	4.14%	5.10%	4.65%	
Ciputat	69,917	113,996	318,763	5.58%	10.83%	8.31%	
Ciledug	75,161	111,484	191,112	4.48%	10.56%	7.63%	(19)
Cisoka	0	0	86,918				
Jatiuwung	0	0	203,627				
Cipondoh	0	0	140,767				
Pondok Aren	0	0	113,029				
<b>Kab. Bekasi</b>	832,721	1,123,976	2,104,392	3.39%	6.47%	5.00%	
Pondokgede	65,659	107,112	282,126	5.59%	10.17%	7.98%	
Bantargebang	0	0	58,200				
Setu	55,446	74,176	60,889	3.29%	4.85%	4.11%	(20)
Cibarusah	67,604	85,095	54,884	2.59%	3.56%	3.10%	(21)
Serang	0	0	65,898				
Lemahabang	79,791	102,351	116,290	2.81%	1.28%	2.00%	
Cikarang	65,625	102,556	137,874	5.09%	3.00%	3.98%	
Cibitung	64,930	87,239	132,469	3.34%	4.27%	3.82%	
Tambun	83,874	96,802	159,690	1.61%	5.13.		







Table 4 ECONOMIC ACTIVE POPULATION OVER 10 YEARS OLD IN THE STUDY AREA

		(Unit: Persons)								
Year of Census	Description	West Java	DKI Jakarta	Kab. Bogor	Kodya Bogor	Kab. Tangerang	Kab. Bekasi	Kab. Serang	Kab. Lebak	Kab. Pandeglang
1990 A) Economically active population										
	Total of Urban	4,297,339	3,129,369	637,804	89,554	561,570	400,591	87,571	9,894	3,397
	Male	3,020,486	2,138,138	472,295	62,277	396,155	288,753	65,192	7,532	2,472
	Female	1,276,853	991,231	165,509	27,277	165,415	111,838	22,379	2,362	925
	Total of Rural	8,821,105	0	566,619	0	379,528	312,433	394,387	179,423	57,030
	Male	6,180,815	0	453,710	0	294,002	246,427	284,560	119,301	38,354
	Female	2,640,290	0	112,909	0	85,526	66,006	109,827	60,122	18,676
	Total of Whole Area	13,118,444	3,129,369	1,204,423	89,554	941,098	713,024	481,958	189,317	60,427
	Male	9,201,301	2,138,138	926,005	62,277	690,157	535,180	349,752	126,834	40,826
	Female	3,917,143	991,231	278,418	27,277	250,941	177,844	132,206	62,483	19,602
B) Total Population >10 yrs										
	Total of Urban	9,304,482	6,500,073	1,429,029	216,896	1,137,458	841,146	1,051,448	26,897	8,034
	Male	4,645,342	3,261,558	719,609	108,486	575,313	419,127	99,170	13,725	3,991
	Female	4,659,140	3,238,515	709,420	108,410	562,145	422,019	952,278	13,171	4,043
	Total of Rural	17,077,960	0	1,256,234	0	868,248	675,688	828,571	336,512	109,023
	Male	8,483,389	0	639,555	0	434,337	337,473	413,531	170,693	54,694
	Female	8,594,571	0	616,679	0	433,911	338,215	415,040	165,819	54,329
	Total of Whole area	26,382,442	6,500,073	2,685,263	216,896	2,005,706	1,516,834	1,880,019	363,408	117,057
	Male	13,128,731	3,261,558	1,359,164	108,486	1,009,650	756,600	512,701	184,418	58,686
	Female	13,253,711	3,238,515	1,326,099	108,410	996,056	760,234	1,367,318	178,990	58,372
1980 A) Economically active population										
	Total of Urban	1,590,532	1,892,346	189,896	66,270	63,525	55,663	37,692	2,955	2,481
	Male	1,189,336	1,387,106	148,999	50,368	50,367	42,312	28,176	2,080	1,860
	Female	401,196	505,240	40,897	15,902	13,158	13,351	9,516	875	620
	Total of Rural	7,018,769	108,608	499,111	0	343,321	286,853	271,413	132,770	41,141
	Male	5,055,414	90,661	404,746	0	268,995	217,738	202,761	91,098	28,094
	Female	1,963,355	17,947	94,365	0	74,326	69,115	68,652	41,672	13,047
	Total of Whole Area	8,609,301	2,000,954	689,007	66,270	406,846	342,516	309,105	135,725	43,622
	Male	6,244,750	1,477,767	553,745	50,368	319,362	260,050	230,937	93,178	29,954
	Female	2,364,551	523,187	135,262	15,902	87,484	82,466	78,168	42,547	13,667
B) Total Population >10 yrs										
	Total of Urban	4,149,525	4,414,903	436,985	180,761	162,657	130,335	99,663	11,806	6,392
	Male	2,065,427	2,224,635	222,313	90,889	83,578	65,713	51,181	5,699	3,163
	Female	2,084,098	2,190,268	214,672	89,872	79,079	64,622	48,482	6,107	3,229
	Total of Rural	14,963,181	269,321	1,216,585	0	861,662	633,463	641,318	258,318	83,294
	Male	7,362,221	137,342	611,695	0	432,916	315,535	314,722	130,413	41,708
	Female	7,600,960	131,979	604,890	0	428,746	317,928	326,596	127,905	41,586
	Total of Whole area	19,112,706	4,684,224	1,653,570	180,761	1,024,319	763,798	740,981	270,124	89,685
	Male	9,427,648	2,361,977	834,008	90,889	516,494	381,248	365,903	136,112	44,871
	Female	9,685,058	2,322,247	819,562	89,872	507,825	382,550	375,078	134,012	44,814
1971 A) Economically active population										
	Total of Urban	719,589	1,351,394	0	17,416	12,584	19,139	13,523	5,502	1,876
	Male	-	1,036,024	-	-	-	-	-	-	-
	Female	-	315,370	-	-	-	-	-	-	-
	Total of Rural	5,969,734	0	440,364	225,693	234,741	418,441	227,727	123,460	30,058
	Male	-	0	-	-	-	-	-	-	-
	Female	-	0	-	-	-	-	-	-	-
	Total of Whole Area	6,689,323	1,351,394	440,364	243,109	247,325	437,580	241,250	128,962	31,934
	Male	-	1,036,024	-	-	-	-	-	-	-
	Female	-	315,370	-	-	-	-	-	-	-
B) Total Population >10 yrs										
	Total of Urban	-	-	-	-	-	-	-	-	-
	Male	-	1,576,076	-	-	-	-	-	-	-
	Female	-	1,550,338	-	-	-	-	-	-	-
	Total of Rural	-	-	-	-	-	-	-	-	-
	Male	-	0	-	-	-	-	-	-	-
	Female	-	0	-	-	-	-	-	-	-
	Total of Whole area	14,418,587	3,126,414	1,075,007	542,826	694,513	865,112	558,638	203,383	72,660
	Male	-	1,576,076	-	-	-	-	-	-	-
	Female	-	1,550,338	-	-	-	-	-	-	-
Gross Growth Ratio of Economic Active Population										
	1971 - 1980	2.56%	4.00%	4.58%	-12.19%	5.10%	-2.42%	2.51%	0.51%	3.17%
	1980 - 1990	4.30%	4.57%	5.74%	3.06%	8.75%	7.61%	4.54%	3.38%	3.31%
Growth Ratio of Population in 10 Years and Over Age										
	1971 - 1980	2.86%	4.13%	4.40%	-10.41%	3.96%	-1.24%	2.87%	2.88%	2.13%
	1980 - 1990	3.28%	3.33%	4.97%	1.84%	6.95%	7.10%	9.76%	3.01%	2.70%
Net Growth Ratio of Economic Active Population										
	1971 - 1980	-0.30%	-0.12%	0.18%	-1.78%	1.14%	-1.18%	-0.36%	-2.37%	1.04%
	1980 - 1990	1.03%	1.24%	0.78%	1.22%	1.80%	0.51%	-5.22%	0.37%	0.61%

Sources: Penduduk Jawa Barat and DKI Jakarta, 1971, 1980 and 1990 and Penduduk Indonesia 1990.



Table 5 ECONOMIC ACTIVE POPULATION IN INDUSTRIAL SECTOR IN THE STUDY AREA

Industrial Group	DKI Jakarta	Kab. Bogor	Kodya Bogor	Kab. Tangge- rang	Kab. Bekasi	Kab. Serang	Kab. Lebak	Kab. Pande- glang
<b>A) NUMBER OF ECONOMIC ACTIVE POPULATION IN 1990</b>								
a) Agriculture & agro-industry	48,159	255,236	1,271	1,104,087	102,289	184,122	110,899	42,103
b) Mining	17,353	22,918	343	10,046	7,867	4,444	379	299
c) Manufacturing	527,228	233,254	16,733	276,661	143,621	74,916	15,154	3,180
d) Electricity, gas & water	16,309	5,155	398	5,682	2,583	1,075	108	41
e) Construction	182,181	85,743	4,330	59,236	32,187	22,830	5,041	1,462
f) Commercial & trading	754,756	239,603	22,038	176,459	160,886	89,157	23,036	5,519
g) Transportation & communication	213,771	77,627	4,432	65,490	57,876	25,321	6,752	1,717
h) Finance, insurance & banking	121,407	14,137	2,845	27,250	19,482	3,032	814	91
i) Social services	982,597	212,714	28,871	167,796	148,050	50,178	17,679	5,023
j) Others	4,816	115	0	765	205	330	27	8
k) Not stated	69,530	2,601	85	13,841	9,926	5,413	1,819	461
Total in 1990	2,938,107	1,149,103	81,346	1,907,313	684,972	460,818	181,708	59,905
1980	1,927,634	689,007	66,270	406,846	342,516	309,105	135,725	43,622
1971	1,351,394	440,364	(-)	247,325	437,580	241,250	128,962	31,934
Growth ratio/year								
1971 - 1980	4.03%	5.10%	(-)	5.69%	-2.68%	2.79%	0.57%	3.53%
1980 - 1990	4.30%	5.25%	2.07%	16.71%	7.18%	4.07%	2.96%	3.22%
1971 - 1990	4.17%	5.18%	(-)	11.35%	2.39%	3.46%	1.82%	3.37%
<b>B) COMPOSITION &amp; RATE</b>								
a) Agriculture & agro-industry	1.64%	22.21%	1.56%	57.89%	14.93%	39.96%	61.03%	70.28%
b) Mining	0.59%	1.99%	0.42%	0.53%	1.15%	0.96%	0.21%	0.50%
c) Manufacturing	17.94%	20.30%	20.57%	14.51%	20.97%	16.26%	8.34%	5.31%
d) Electricity, gas & water	0.56%	0.45%	0.49%	0.30%	0.38%	0.23%	0.06%	0.07%
e) Construction	6.20%	7.46%	5.32%	3.11%	4.70%	4.95%	2.77%	2.44%
f) Commercial & trading	25.69%	20.85%	27.09%	9.25%	23.49%	19.35%	12.68%	9.21%
g) Transportation & communication	7.28%	6.76%	5.45%	3.43%	8.45%	5.49%	3.72%	2.87%
h) Finance, insurance & banking	4.13%	1.23%	3.50%	1.43%	2.84%	0.66%	0.45%	0.15%
i) Social services	33.44%	18.51%	35.49%	8.80%	21.61%	10.89%	9.73%	8.39%
j) Others	0.16%	0.01%	0.00%	0.04%	0.03%	0.07%	0.02%	0.01%
k) Not stated	2.37%	0.23%	0.10%	0.73%	1.45%	1.17%	1.00%	0.77%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Sources:

1. Penduduk DKI Jakarta and Penduduk Jawa Barat, Hasil Sensus Penduduk 1971, 1980 and 1990, Biro Pusat Statistik DKI Jakarta and Kantor Statistik Jawa Barat.
2. Penduduk Jawa Barat - Hasil Sensus Penduduk 1990-, Biro Pusat Statistik, Indonesia.
3. Penduduk Indonesia, Hasil Sensus Penduduk 1990, Biro Pusat Statistik Jakarta.



Table 6 DISTRIBUTION RATE OF ECONOMIC ACTIVE POPULATION OVER AGE OF 10 YEARS OLD BY SEX AND REGION

Description	West Java	DKI Jakarta	Kab. Bogor	Kodya Bogor	Kab. Tangge-rang	Kab. Bekasi	Kab. Serang	Kab. Lebak	Kab. Pande-glang
<b>(A) DISTRIBUTION RATIO BY SEX</b>									
<b>1990 a) Economically active population</b>									
Total of Urban	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	70.3%	68.3%	74.1%	69.5%	70.5%	72.1%	74.4%	76.1%	72.8%
Female	29.7%	31.7%	25.9%	30.5%	29.5%	27.9%	25.6%	23.9%	27.2%
Total of Rural	100.0%	0.0%	100.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	70.1%	0.0%	80.1%	0.0%	77.5%	78.9%	72.2%	66.5%	67.3%
Female	29.9%	0.0%	19.9%	0.0%	22.5%	21.1%	27.8%	33.5%	32.7%
Total of Whole Area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	70.1%	68.3%	76.9%	69.5%	73.3%	75.1%	72.6%	67.0%	67.6%
Female	29.9%	31.7%	23.1%	30.5%	26.7%	24.9%	27.4%	33.0%	32.4%
<b>b) Total Population &gt;10 yrs</b>									
Total of Urban	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	49.9%	50.2%	50.4%	50.0%	50.6%	49.8%	9.4%	51.0%	49.7%
Female	50.1%	49.8%	49.6%	50.0%	49.4%	50.2%	90.6%	49.0%	50.3%
Total of Rural	100.0%	0.0%	100.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	49.7%	0.0%	50.9%	0.0%	50.0%	49.9%	49.9%	50.7%	50.2%
Female	50.3%	0.0%	49.1%	0.0%	50.0%	50.1%	50.1%	49.3%	49.8%
Total of Whole area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	49.8%	50.2%	50.6%	50.0%	50.3%	49.9%	27.3%	50.7%	50.1%
Female	50.2%	49.8%	49.4%	50.0%	49.7%	50.1%	72.7%	49.3%	49.9%
<b>1980 a) Economically active population</b>									
Total of Urban	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	74.8%	73.3%	78.5%	76.0%	79.3%	76.0%	74.8%	70.4%	75.0%
Female	25.2%	26.7%	21.5%	24.0%	20.7%	24.0%	25.2%	29.6%	25.0%
Total of Rural	100.0%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	72.0%	83.5%	81.1%	0.0%	78.4%	75.9%	74.7%	68.6%	68.3%
Female	28.0%	16.5%	18.9%	0.0%	21.6%	24.1%	25.3%	31.4%	31.7%
Total of Whole Area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	72.5%	73.9%	80.4%	76.0%	78.5%	75.9%	74.7%	68.7%	68.7%
Female	27.5%	26.1%	19.6%	24.0%	21.5%	24.1%	25.3%	31.3%	31.3%
<b>b) Total Population &gt;10 yrs</b>									
Total of Urban	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	49.8%	50.4%	50.9%	50.3%	51.4%	50.4%	51.4%	48.3%	49.5%
Female	50.2%	49.6%	49.1%	49.7%	48.6%	49.6%	48.6%	51.7%	50.5%
Total of Rural	100.0%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	49.2%	51.0%	50.3%	0.0%	50.2%	49.8%	49.1%	50.5%	50.1%
Female	50.8%	49.0%	49.7%	0.0%	49.8%	50.2%	50.9%	49.5%	49.9%
Total of Whole area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male	49.3%	50.4%	50.4%	50.3%	50.4%	49.9%	49.4%	50.4%	50.0%
Female	50.7%	49.6%	49.6%	49.7%	49.6%	50.1%	50.6%	49.6%	50.0%
<b>(B) DISTRIBUTION RATIO BY REGION</b>									
<b>1990 a) Economically active population</b>									
Total of Urban	32.8%	100.0%	53.0%	100.0%	59.7%	56.2%	18.2%	5.2%	5.6%
Total of Rural	67.2%	0.0%	47.0%	0.0%	40.3%	43.8%	81.8%	94.8%	94.4%
Total of Whole Area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>b) Total Population &gt;10 yrs</b>									
Total of Urban	35.3%	100.0%	53.2%	100.0%	56.7%	55.5%	55.9%	7.4%	6.9%
Total of Rural	64.7%	0.0%	46.8%	0.0%	43.3%	44.5%	44.1%	92.6%	93.1%
Total of Whole Area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>1980 a) Economically active population</b>									
Total of Urban	18.5%	94.6%	27.6%	100.0%	15.6%	16.3%	12.2%	2.2%	5.7%
Total of Rural	81.5%	5.4%	72.4%	0.0%	84.4%	83.7%	87.8%	97.8%	94.3%
Total of Whole Area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>b) Total Population &gt;10 yrs</b>									
Total of Urban	21.7%	94.3%	26.4%	100.0%	15.9%	17.1%	13.5%	4.4%	7.1%
Total of Rural	78.3%	5.7%	73.6%	0.0%	84.1%	82.9%	86.5%	95.6%	92.9%
Total of Whole Area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>(C) RATE OF ECONOMICALLY ACTIVE POPULATION TO THE TOTAL POPULATION OVER AGE OF 10 YEARS OLD</b>									
1980	49.7%	48.1%	44.9%	41.3%	46.9%	47.0%	25.6%	52.1%	51.6%
1990	45.0%	42.7%	41.7%	36.7%	39.7%	44.8%	41.7%	50.2%	48.6%



Table 7 OCCUPATION RATE OF WORKING POPULATION

Region	Economically Active Population (persons)			Occupation Rate (%)
	Actual Working Population	Population on Seeking Work	Total	
(A) Economically active population				
1990				
West Java	12,574,116	544,328	13,118,444	95.85%
DKI Jakarta	2,938,097	191,272	3,129,369	93.89%
Kab. Bogor	1,149,103	55,320	1,204,423	95.41%
Kodya Bogor	81,347	8,207	89,554	90.84%
Bogor (Kab. + Kodya)	1,230,450	63,527	1,293,977	95.09%
Kab. Tangerang	907,313	33,785	941,098	96.41%
Kab. Bekasi	684,952	28,072	713,024	96.06%
Kab. Serang	460,818	21,140	481,958	95.61%
Kab. Lebak	185,874	3,443	312,484	59.48%
Kab. Pandeglang	58,562	1,865	309,476	18.92%
1980				
West Java	8,426,169	183,132	8,609,301	97.87%
DKI Jakarta	1,337,471	51,971	1,389,442	96.26%
Kab. Bogor	675,190	13,817	689,007	97.99%
Kodya Bogor	63,665	2,603	66,268	96.07%
Bogor (Kab. + Kodya)	738,855	16,420	755,275	97.83%
Kab. Tangerang	400,281	6,565	406,846	98.39%
Kab. Bekasi	335,813	6,703	342,516	98.04%
Kab. Serang	302,637	6,468	309,105	97.91%
Kab. Lebak	134,610	1,115	135,725	99.18%
Kab. Pandeglang	42,887	735	43,622	98.32%
1971				
West Java	5,715,500	973,823	6,689,323	85.44%
DKI Jakarta	923,641	112,383	1,036,024	89.15%
Kab. Bogor	393,021	47,343	440,364	89.25%
Kodya Bogor	163,259	79,850	243,109	67.15%
Bogor (Kab. + Kodya)	556,280	127,193	683,473	81.39%
Kab. Tangerang	162,079	85,246	247,325	65.53%
Kab. Bekasi	401,464	36,116	437,580	91.75%
Kab. Serang	200,306	40,944	241,250	83.03%
Kab. Lebak	120,618	8,344	128,962	93.53%
Kab. Pandeglang	30,011	1,923	31,934	93.98%
(B) Growth ratio (1971 - 1980)				
West Java	4.41%	-16.95%	2.84%	
DKI Jakarta	4.20%	-8.21%	3.32%	
Kab. Bogor	6.20%	-12.79%	5.10%	
Kodya Bogor	-9.93%	-31.64%	-13.45%	
Bogor (Kab. + Kodya)	3.20%	-20.35%	1.12%	
Kab. Tangerang	10.57%	-24.79%	5.69%	
Kab. Bekasi	-1.96%	-17.07%	-2.68%	
Kab. Serang	4.69%	-18.54%	2.79%	
Kab. Lebak	1.23%	-20.04%	0.57%	
Kab. Pandeglang	4.05%	-10.14%	3.53%	
(C) Growth ratio (1980 - 1990)				
West Java	4.55%	12.87%	4.79%	
DKI Jakarta	9.14%	15.58%	9.44%	
Kab. Bogor	6.09%	16.67%	6.40%	
Kodya Bogor	2.76%	13.61%	3.40%	
Bogor (Kab. + Kodya)	5.83%	16.22%	6.16%	
Kab. Tangerang	9.52%	19.96%	9.77%	
Kab. Bekasi	8.24%	17.25%	8.49%	
Kab. Serang	4.78%	14.06%	5.06%	
Kab. Lebak	3.65%	13.35%	9.71%	
Kab. Pandeglang	3.52%	10.90%	24.32%	

Sources: Penduduk Jawa Barat and DKI Jakarta, 1971, 1980 and 1990.



Table 8

GROSS REGIONAL DOMESTIC PRODUCTS IN 1983 CONSTANT PRICE  
LEVEL IN THE STUDY AREA

Industry of origin	(Rp. million)									
	Indonesia (Rp. billion)	West Jawa	Jakarta	Kab. Bogor	Kodya Bogor	Kab. Tange- rang	Kab. Bekasi	Kab. Serang	Kab. Lebak	Kab. Pande- glang
<b>(A) Gross Regional Domestic Products</b>										
1) Agriculture	22,604	3,328,748	128,220	230,181	2,499	163,479	138,337	126,777	125,604	182,093
Foodcrops	13,596	2,377,068	54,739	150,635	457	74,561	92,430	84,277	53,048	141,056
Estate	3,867	421,948	6,920	10,094	18	1,314	755	25,210	63,710	23,727
Livestocks	2,434	343,439	56,011	61,991	1,941	80,474	38,335	13,319	6,864	13,156
Forestry	1,013	8,559	0	24	0	0	0	0	214	214
Fishery	1,694	177,734	10,550	7,437	83	7,130	6,817	3,971	1,768	3,940
2) Minings	17,538	2,371,312	0	10,314	0	576	4,218	5,964	2,070	364
3) Manufacturing industry	22,277	3,669,601	3,583,103	452,566	14,585	359,285	327,362	696,231	18,105	15,434
4) Electricity, gas & water	726	298,237	602,695	38,638	9,692	32,063	18,637	5,781	241	980
Electricity	-	285,687	561,871	38,548	5,130	29,168	18,523	5,585	209	724
Gas	-	3,076	33,423	0	3,295	0	0	0	0	0
Water	-	9,474	7,401	90	1,267	2,895	114	196	32	256
5) Construction	6,715	1,158,925	1,152,022	146,337	29,426	103,826	88,189	84,675	23,714	5,796
6) Trade/Commercial	18,645	3,682,985	2,854,809	357,299	41,249	268,668	166,623	127,416	63,959	51,596
Store and shops	15,501	2,894,749	2,536,767	281,154	28,892	227,605	139,374	106,457	50,629	46,065
Hotel	-	17,081	253,671	2,038	189	60	134	1,093	78	740
Restaurant	3,144	771,155	64,371	74,107	12,168	41,003	27,115	19,866	13,252	4,791
7) Transportation & communication	6,392	992,605	1,497,526	84,567	42,323	229,808	35,831	33,495	10,032	17,544
Road	-	620,579	661,143	63,838	31,153	24,613	31,243	25,372	6,235	16,724
Railway	5,620	21,032	8,626	4,312	4,047	680	646	1,076	2,958	0
Sea	-	28,818	285,013	0	0	0	0	4,074	0	21
Air	-	173,433	9,367	0	0	175,395	0	0	0	0
Communication	772	63,525	333,014	1,194	3,633	1,773	1,322	1,009	275	230
Support services	-	85,218	200,363	15,223	3,490	27,347	2,620	1,964	564	569
8) Financing/banking	4,788	271,528	1,881,502	2,384	9,800	7,911	2,275	7,068	1,364	3,296
9) Ownership of dwelling	2,999	281,089	402,461	21,483	1,875	12,464	10,173	8,461	4,476	10,843
10) Official services	8,783	1,134,044	562,324	63,991	31,529	59,785	40,243	39,145	27,234	36,466
11) Services	3,981	614,664	1,016,452	77,931	8,061	32,807	34,885	19,780	10,267	8,434
Total : 1991	-	-	-	1,485,691	191,039	1,270,672	866,773	1,154,793	-	332,846
1990	115,448	17,803,738	13,681,114	1,361,966	176,324	1,288,549	808,810	1,062,366	287,066	312,924
1989	107,523	16,293,138	12,506,088	1,247,098	164,967	-	713,047	-	261,145	291,123
1988	99,981	15,111,411	11,469,201	1,161,429	155,216	1,016,116	658,099	923,631	232,202	273,406
1987	94,512	14,007,974	10,757,764	1,044,163	142,159	931,525	587,162	864,301	196,320	258,443
1986	90,081	13,504,535	10,163,638	870,977	136,365	865,648	564,490	826,148	176,012	-
1985	85,082	12,671,165	9,678,677	802,242	129,905	800,459	536,730	673,020	-	-
1984	77,758	11,940,200	9,204,771	758,896	116,182	630,948	493,755	554,855	-	-
1983	71,303	10,190,718	8,347,899	720,312	111,542	559,530	452,667	469,039	-	-
<b>(B) Composite Rate (%)</b>										
1) Agriculture	19.58%	18.70%	0.94%	15.49%	1.31%	12.87%	15.96%	10.98%	43.75%	54.71%
Foodcrops	11.78%	13.35%	0.40%	10.14%	0.24%	5.87%	10.66%	7.30%	18.48%	42.38%
Estate	3.35%	2.37%	0.05%	0.68%	0.01%	0.10%	0.09%	2.18%	22.19%	7.13%
Livestocks	2.11%	1.93%	0.41%	4.17%	1.02%	6.33%	4.42%	1.15%	2.39%	3.95%
Forestry	0.88%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.06%
Fishery	1.47%	1.00%	0.08%	0.50%	0.04%	0.56%	0.79%	0.34%	0.62%	1.18%
2) Minings	15.19%	13.32%	0.00%	0.69%	0.00%	0.05%	0.49%	0.52%	0.72%	0.11%
3) Manufacturing industry	19.30%	20.61%	26.19%	30.46%	7.63%	28.28%	37.77%	60.29%	6.31%	4.64%
4) Electricity, gas & water	0.63%	1.68%	4.41%	2.60%	5.07%	2.52%	2.15%	0.50%	0.08%	0.29%
Electricity	-	1.60%	4.11%	2.59%	2.69%	2.30%	2.14%	0.48%	0.07%	0.22%
Gas	-	0.02%	0.24%	0.00%	1.72%	0.00%	0.00%	0.00%	0.00%	0.00%
Water	-	0.05%	0.05%	0.01%	0.66%	0.23%	0.01%	0.02%	0.01%	0.08%
5) Construction	5.82%	6.51%	8.42%	9.85%	15.40%	8.17%	10.17%	7.33%	8.26%	1.74%
6) Trade/Commercial	16.15%	20.69%	20.87%	24.05%	21.59%	21.14%	19.22%	11.03%	22.28%	15.50%
Store and shops	13.43%	16.26%	18.54%	18.92%	15.12%	17.91%	16.08%	9.22%	17.64%	13.84%
Hotel	-	0.10%	1.85%	0.14%	0.10%	0.00%	0.02%	0.09%	0.03%	0.22%
Restaurant	2.72%	4.33%	0.47%	4.99%	6.37%	3.23%	3.13%	1.72%	4.62%	1.44%
7) Transportation & communication	5.54%	5.58%	10.95%	5.69%	22.15%	18.09%	4.13%	2.90%	3.49%	5.27%
Road	-	3.49%	4.83%	4.30%	16.31%	1.94%	3.60%	2.20%	2.17%	5.02%
Railway	4.87%	0.12%	0.06%	0.29%	2.12%	0.05%	0.07%	0.09%	1.03%	0.00%
Sea	-	0.16%	2.08%	0.00%	0.00%	0.00%	0.00%	0.35%	0.00%	0.01%
Air	-	0.97%	0.07%	0.00%	0.00%	13.80%	0.00%	0.00%	0.00%	0.00%
Communication	0.67%	0.36%	2.43%	0.08%	1.90%	0.14%	0.15%	0.09%	0.10%	0.07%
Support services	-	0.48%	1.46%	1.02%	1.83%	2.15%	0.30%	0.17%	0.20%	0.17%
8) Financing/banking	4.15%	1.53%	13.75%	0.16%	5.13%	0.62%	0.26%	0.61%	0.48%	0.99%
9) House rent	2.60%	1.58%	2.94%	1.45%	0.98%	0.98%	1.17%	0.73%	1.56%	3.26%
10) Official services	7.61%	6.37%	4.11%	4.31%	16.50%	4.70%	4.64%	3.39%	9.49%	10.96%
11) Services	3.45%	3.45%	7.43%	5.25%	4.22%	2.58%	4.02%	1.71%	3.58%	2.53%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
<b>(C) Average Annual Growth Rate (%)</b>										
	7.13%	8.30%	7.31%	9.47%	6.96%	10.80%	8.46%	11.92%	13.01%	6.53%

Sources: 1. DKI Jakarta Dalam Angka 1990, and Jawa Barat Dalam Angka 1991.

2. Pendapatan Regional Propinsi-Propinsi di Indonesia Menurut Lapangan Usaha 1993 - 1990.



Table 9 GOVERNMENT FINANCE

Kind of Receipts/Expenditures	Fiscal year									(Rp. billion)
	1983/ 1984	1984/ 1985	1985/ 1986	1986/ 1987	1987/ 1988	1988/ 1989	1989/ 1990	1990/ 1991	1991/ 1992	Average annual growth rate(%)
<b>DKI JAKARTA</b>										
<b>RECEIPT</b>	18,315	19,383	22,824	21,893	26,961	32,995	38,169	49,451	50,555	14.06%
<b>I. Routine Receipts</b>	14,433	15,905	19,252	16,141	20,803	23,004	28,740	39,546	40,184	14.84%
A. Oil & gas	9,520	10,430	11,144	6,338	10,047	9,527	11,252	17,712	15,009	10.86%
B. Non oil & gas	4,913	5,475	8,108	9,803	10,756	13,477	17,488	21,834	25,175	23.17%
Income tax	1,932	2,121	2,313	2,271	2,663	3,949	5,488	6,755	8,021	-
Value added tax	831	878	2,327	2,900	3,390	4,505	5,837	7,463	8,224	-
Import duties	557	530	607	960	938	1,192	1,587	2,486	2,574	-
Excises duties	773	873	944	1,056	1,106	1,390	1,477	1,917	2,215	-
Export tax	104	91	51	79	184	156	171	44	121	-
Other taxes	65	138	207	190	223	292	276	243	351	-
Tax on land and buildings	132	157	167	190	275	424	590	811	839	-
Non tax receipts	519	687	1,492	1,147	1,977	1,569	2,062	2,115	2,830	-
Other oil receipts	0	0	0	1,010	0	0	0	0	0	-
<b>II. Development Receipts</b>	3,882	3,478	3,572	5,752	6,158	9,991	9,429	9,905	10,371	15.84%
Program aid	15	69	69	1,957	728	2,041	1,007	1,397	1,537	-
Project aid	3,867	3,409	3,503	3,795	5,430	7,950	8,422	8,508	8,834	-
<b>EXPENDITURE</b>	18,311	19,381	22,824	22,342	26,957	32,989	37,665	49,451	50,555	14.03%
<b>I. Rutine Expenditure</b>	8,412	9,429	11,951	14,009	17,480	20,739	23,831	29,998	30,558	17.77%
A. Personnel Expenditures	2,757	3,047	4,018	4,311	4,617	4,998	5,701	7,054	7,753	14.09%
Rice allowance	346	407	402	406	451	518	588	640	-	-
Wages and salaries	1,996	2,207	3,073	3,330	3,561	3,833	4,326	5,570	-	-
Food allowance	261	271	300	288	299	327	373	382	-	-
Other internal personnel expenditures	88	90	161	177	176	185	243	264	-	-
External personnel expenditures	66	72	82	110	130	135	171	198	-	-
B. Material Expenditures	1,057	1,183	1,367	1,367	1,329	1,492	1,702	1,830	2,201	9.85%
Domestic material expenditures	1,007	1,134	1,309	1,294	1,239	1,378	1,569	1,670	-	-
External material expenditures	50	49	58	73	90	114	133	160	-	-
C. Subsidies to Regions	1,547	1,883	2,489	2,649	2,815	3,037	3,566	4,236	4,660	15.09%
For Irian Jawa	42	203	241	239	223	259	228	275	-	-
For other local government	1,505	1,680	2,248	2,410	2,592	2,778	3,338	3,961	-	-
D. Debt Repayment	2,103	2,776	3,323	5,508	8,204	10,941	11,939	13,395	14,381	28.56%
Internal debt	30	39	20	0	39	78	149	250	-	-
External debt	2,073	2,737	3,303	5,508	8,165	10,863	11,790	13,145	-	-
E. Other Expenditures	948	540	754	174	515	271	923	3,483	1,563	66.39%
<b>II. Development Expenditure</b>	9,899	9,952	10,873	8,333	9,477	12,250	13,834	19,453	19,997	10.72%
Department/Institution	3,220	3,474	4,467	2,003	1,385	1,855	2,509	4,854	-	-
Development subsidy to villages	92	93	99	87	102	112	112	181	-	-
Development subsidy to Kabpatens	194	195	189	188	263	267	270	392	-	-
Development subsidy to Provinces	253	253	287	293	291	334	324	486	-	-
Development of primary schools	549	572	526	496	193	130	100	374	-	-
Facilities/public health centers	87	65	111	108	74	99	122	193	-	-
Infrastructural developments	65	101	70	75	164	180	294	679	-	-
Subsidies to reconstruction and development of markets	11	25	4	12	3	3	3	3	-	-
Subsidies for regreening & reforestation	59	61	42	31	16	16	16	33	-	-
Development subsidies to East Timor	5	4	7	7	5	6	0	0	-	-
Tax subsidies on land and buildings	132	157	168	171	223	344	478	657	-	-
Fertilizer subsidy	324	732	477	467	756	200	278	265	-	-
Government capital participation	592	336	412	86	57	125	141	323	-	-
Others	449	475	511	514	515	629	765	505	-	-
Project aid	3,867	3,409	3,503	3,795	5,430	7,950	8,422	8,508	-	-
Development reserves	0	0	0	0	0	0	0	2,000	-	-
<b>SURPLUS/DEFICIT</b>	4	2	0	-449	4	6	504	0	0	-

Sources:

1. Statistik Keuangan 1990/1991, Biro Pusat Statistik Jakarta.
2. Indikator Ekonomi, Buletin Statistik Bulanan, May 1993, Biro Pusat Statistik Jakarta.



Table 10 LOCAL GOVERNMENT FINANCE BY KABUPATEN

Kind of Receipts/Expenditures	West Java (Million Rp.)						
	Kab. Bogor	Kodya Bogor	Kab. Tangge- rang	Kab. Bekasi	Kab. Serang	Kab. Pande- glang	Kab. Lebak
<b>RECEIPT</b>	66,315	24,777	76,900	42,089	34,889	16,457	26,718
I. City's and/or Kabupaten's Own Receipts	38,102	18,045	54,610	26,364	14,753	3,880	13,807
Previous year surplus	1,047	349	7,150	2,245	555	84	565
Local revenue	14,189	6,918	17,545	8,676	5,275	1,576	11,183
Local tax receipts	3,044	1,164	4,221	1,216	1,189	67	71
Retribution receipts	8,678	3,860	12,369	6,768	3,649	645	876
Local government corporate profit	33	862	132	203	21	10	4
Official service receipts	15	171	11	56	14	14	146
Other revenue	2,418	861	813	432	401	839	86
II. Capital Transfer from Central Government	28,213	6,732	22,290	15,725	20,136	12,577	12,911
Tax and non-tax share	5,440	545	6,427	4,033	3,791	879	1,102
Subsidies	4,123	2,699	3,069	3,320	3,441	4,031	3,160
Capital transfer	18,650	3,488	12,794	8,372	12,829	7,572	8,649
Development receipts	0	0	0	0	75	95	0
III. Internal/External Loan for Local Corporate	0	0	0	0	0	0	0
IV. Liquidation	0	0	0	0	0	0	0
<b>EXPENDITURE</b>	39,840	13,436	20,404	21,777	25,013	14,562	13,433
I. Rutine Expenditure	14,128	7,528	12,268	10,051	9,735	5,215	4,520
Personnel current expenditure	5,183	3,619	3,657	3,671	3,471	2,956	2,580
Material current expenditure	2,776	1,219	3,242	2,301	2,113	527	463
Repair & maintenance current expenditure	626	571	686	795	1,311	136	131
Official travel expenditure	511	83	252	419	521	157	114
Other current expenditure	3,266	1,912	2,382	1,959	1,646	829	579
Debt and interest payment	30	0	14	94	72	0	0
Subsidies	718	0	1,416	691	410	0	0
Pension and aid expence	0	0	0	0	0	364	434
Other current expenditure	1,018	117	519	85	191	246	219
Unpredicted current expenditure	0	7	100	36	0	0	0
II. Development Expenditures	25,712	5,908	8,136	11,726	15,278	9,347	8,913
Agriculture and irrigation	374	21	284	169	144	13	151
National industrial development	33	3	18	6	5	7	0
Mining and energy	69	0	50	52	223	50	50
Transportation and tourism	14,142	1,885	3,493	5,064	7,816	4,469	5,220
Trade and cooperatives	68	4	10	113	27	5	1
Manpower and resettlement	239	10	16	28	4	1	0
Local development	256	105	205	282	1,667	811	63
Youth education, culture, belief in almighty t	3,348	1,363	506	2,315	1,769	1,920	1,995
Religion	256	105	205	282	423	48	222
Health and public welfare	766	263	469	1,044	1,303	661	322
Housing and community	126	5	5	0	24	0	20
Law	395	34	77	37	20	4	21
Security and public defence	102	22	58	125	146	71	4
Information and social communication	84	97	49	45	21	35	4
Science, technology and research	86	73	72	36	66	3	0
State apparatus	4,307	1,595	138	1,750	637	1,099	577
Business enterprises	35	34	158	222	168	2	19
Natural resources and environment	666	289	23	29	154	148	181
Subsidies and development aid	360	0	2,300	127	661	0	63
<b>SURPLUS/DEFICIT</b>	26,475	11,341	56,496	20,312	9,876	1,895	13,285

Source: Statistik Keuangan Pemerintah Daerah, Daerah TK II (Kabupaten/Kotamadya), Sumatera, Jawa & Madura, 1987/88 - 1990/91. Biro Pusat Statistik Jakarta.

(Note): Data for DKI Jakarta could not collected this time.



Table 11 INTERNATIONAL BALANCE OF PAYMENT

Items	(unit : US\$ million)					
	Fiscal Year					
	1985/ 1986	1986/ 1987	1987/ 1988	1988/ 1989	1989/ 1990	1990/ 1991
A) Current Account	-1,832	-4,051	-1,707	-1,859	-1,599	-3,741
1) Merchandise	6,060	2,246	5,391	5,513	6,456	5,115
a) Export (F.O.B)	18,612	13,697	18,343	19,824	23,830	28,143
Non-oil and non-gas	6,175	6,731	9,502	12,184	14,493	15,380
Oil and gas	12,437	6,966	8,841	7,640	9,337	12,763
- Oil	8,816	4,798	6,159	5,007	6,288	8,053
- LNG	3,621	2,168	2,628	2,508	2,801	4,304
- LPG	0	0	54	125	248	406
b) Import (F.O.B)	-12,552	-11,451	-12,952	-14,311	-17,374	-23,028
Non-oil and non-gas	-10,078	-9,356	-10,597	-12,239	-14,845	-19,448
Oil and gas	-2,474	-2,095	-2,355	-2,072	-2,529	-3,580
- Oil	-2,282	-1,908	-2,190	-1,912	-2,342	-3,388
- LNG	-192	-187	-165	-160	-187	-192
2) Services (net)	-7,892	-6,297	-7,098	-7,372	-8,055	-8,856
a) Non-oil and non-gas	-4,052	-4,010	-4,372	-4,864	-5,158	-5,683
b) Oil and gas	-3,840	-2,287	-2,726	-2,508	-2,897	-3,173
- Oil	-2,530	-1,464	-1,635	-1,560	-1,635	-1,783
- LNG	-1,310	-823	-1,091	-948	-1,262	-1,390
B) Capital Account	2,360	4,575	3,235	2,614	2,405	6,780
1) Official capital (net)	1,788	3,343	1,526	2,825	1,830	924
a) Inflows	3,432	5,472	4,575	6,588	5,516	5,006
IGGI	2,751	3,978	4,368	5,468	4,668	4,897
Non-IGGI	681	1,494	207	1,120	848	109
b) Debt repayment	-1,644	-2,129	-3,049	-3,763	-3,686	-4,082
2) Private capital	572	1,232	1,709	-211	575	5,856
a) Direct investment	299	252	544	585	722	1,424
b) Others	273	980	1,165	-796	-147	4,432
C) Total (A through B)	528	524	1,528	755	806	3,039
D) Errors and Omissions (net)	-498	214	57	-1,432	-558	263
E) Reserves	-30	-738	-1,585	677	-248	-3,302
1) Foreign assets	-30	-738	-1,585	677	-248	-3,302
2) Foreign liabilities	0	0	0	0	0	0

Sources: Indokator Ekonomi 1993 January and May, Biro Pusato Statistik Jakarta.



Table 12 MAIN IMPORT AND EXPORT COMMODITIES OF INDONESIA

Commodity Group	(As of 1991)		
	Volume (1,000ton)	Value (US\$million)	Rate(*) (%)
<b>(A) Import</b>			
a) Food crops and livestock	2,957	1,011	3.90%
b) Drinks and tobacco	32	64	0.25%
c) Raw materials (inedible)	7,955	2,236	8.63%
d) Fuel, lubricants and related materials	10,683	2,298	8.87%
e) Fats derived from plants and animals	50	30	0.12%
f) Chemical materials	4,322	4,026	15.54%
g) Manufacturing goods classified chiefly by materials	3,475	4,215	16.27%
h) Machinery and vehicles	1,554	11,066	42.72%
i) Other industrial goods	93	945	3.65%
j) Other trading goods (not stated)	2	15	0.06%
Total	31,123	25,906	100.00%
<b>(B) Export</b>			
a) Crude petroleum	42,680	6,212	7.46%
b) Petroleum and related products	50,870	7,117	8.54%
c) Gas	25,791	4,312	5.18%
d) Rubber	1,141	922	1.11%
e) Coffee	371	350	0.42%
f) Tea	134	163	0.20%
g) Tobacco	23	61	0.07%
h) Shrimp	90	799	0.96%
i) White pepper	27,256	36,495	43.80%
j) Black pepper	12,256	18,949	22.74%
k) Quinine, quinine crundum and quinine salt	158	9	0.01%
l) Wood sawn	499	326	0.39%
m) Tin	28	138	0.17%
n) Copper	412	400	0.48%
o) Cotton, textile and related products	229	1,651	1.98%
p) Ready made cloths	130	2,082	2.50%
q) Triplex, multiplex and duplex	5,107	2,802	3.36%
r) Oil palm	1,114	302	0.36%
s) Fertilizer	1,305	233	0.28%
Total	169,594	83,323	100.00%

Source : Statistic Indonesia 1991.

Note : Symbol of (\*) indicates distribution rate in value.



Table 13 VOLUME AND VALUE OF IMPORT AND EXPORT IN WEST JAWA

Port of Import and/or Export	Volume and Value by Year									
	1986		1987		1988		1989		1990	
	Volume (ton)	Value (US\$1,000)	Volume (ton)	Value (US\$1,000)	Volume (ton)	Value (US\$1,000)	Volume (ton)	Value (US\$1,000)	Volume (ton)	Value (US\$1,000)
<b>(A) Import</b>										
<i>Merak</i>	255,036	115,431	1,051,547	267,521	798,903	251,911	743,093	265,519	459,802	248,314
Contribution(%)		21.48%		38.45%		26.39%		30.03%		29.90%
<i>Cirebon</i>	52,086	163,721	24,813	114,264	67,238	72,673	101,391	23,466	29,872	9,730
Contribution(%)		30.47%		16.42%		7.61%		2.65%		1.17%
<i>Ereian</i>	48	49	6	7	2,859	3,295	30	121	221	444
Contribution(%)		0.01%		0.00%		0.35%		0.01%		0.05%
<i>Palimanan</i>	0	0	3,132	1	0	3	0	0	0	0
Contribution(%)		0.00%		0.00%		0.00%		0.00%		0.00%
<i>H.S.Nagara</i>	0	0	0	0	0	14	6,552	1,689	0	1
Contribution(%)		0.00%		0.00%		0.00%		0.19%		0.00%
<i>Balongan</i>	88	29	0	0	0	0	31,197	3,794	43	44
Contribution(%)		0.01%		0.00%		0.00%		0.43%		0.01%
<i>Bandung (PTT)</i>	72	10	0	48	0	19	0	1	20,000	3,219
Contribution(%)		0.00%		0.01%		0.00%		0.00%		0.39%
<i>TG.Lenceng</i>	52	194	1,085,838	43,096	1,124	1,094	7,765	8,216	95,536	21,517
Contribution(%)		0.04%		6.19%		0.11%		0.93%		2.59%
<i>TG.Sekong</i>	93,691	24,903	26,776	11,907	39,670	18,927	55,268	35,148	185,752	69,899
Contribution(%)		4.63%		1.71%		1.98%		3.98%		8.42%
<i>Cigading</i>	2,276,041	233,026	1,943,356	257,657	2,202,776	605,635	3,477,587	545,939	3,436,509	476,535
Contribution(%)		43.36%		37.04%		63.45%		61.75%		57.39%
<i>Indramayu</i>	0	4	37,948	1,178	637	867	48	72	95	154
Contribution(%)		0.00%		0.17%		0.09%		0.01%		0.02%
<i>Cilamaya</i>	0	9	0	0	0	8	0	0	0	0
Contribution(%)		0.00%		0.00%		0.00%		0.00%		0.00%
<i>Gede Bage</i>	0	0	0	0	0	0	256	187	213	220
Contribution(%)		0.00%		0.00%		0.00%		0.02%		0.03%
<i>Bogor</i>	0	0	0	0	0	0	0	0	0	3
Contribution(%)		0.00%		0.00%		0.00%		0.00%		0.00%
<i>Cirebon(PTT)</i>	0	0	0	0	0	0	0	0	36	276
Contribution(%)		0.00%		0.00%		0.00%		0.00%		0.03%
<b>Total</b>	<b>2,677,114</b>	<b>537,376</b>	<b>4,173,416</b>	<b>695,679</b>	<b>3,113,207</b>	<b>954,446</b>	<b>4,423,187</b>	<b>884,152</b>	<b>4,228,079</b>	<b>830,356</b>
Contribution(%)		100.00%		100.00%		100.00%		100.00%		100.00%
<b>(B) Export</b>										
<i>Merak</i>	6,060	1,380	3,501	1,211	35,231	3,790	55,329	18,580	44,685	10,490
Contribution(%)		0.37%		0.35%		1.29%		4.34%		3.50%
<i>Cirebon</i>	99,333	9,151	224,010	16,458	267,007	0	436,654	25,543	238,625	15,572
Contribution(%)		2.45%		4.77%		0.00%		5.96%		5.20%
<i>Ereian</i>	0	0	0	0	16	202	0	0	0	0
Contribution(%)		0.00%		0.00%		0.07%		0.00%		0.00%
<i>Palimanan</i>	0	0	0	0	0	0	0	0	6,500	841
Contribution(%)		0.00%		0.00%		0.00%		0.00%		0.28%
<i>Balongan</i>	917,673	118,134	601,625	71,850	673,616	70,434	585,774	72,580	417,851	61,984
Contribution(%)		31.63%		20.83%		23.94%		16.94%		20.70%
<i>Bandung (PTT)</i>	0	0	0	0	10	31	220	33	0	0
Contribution(%)		0.00%		0.00%		0.01%		0.01%		0.00%
<i>TG.Lenceng</i>	0	0	4	78	0	0	3,787	4,335	9,976	8,886
Contribution(%)		0.00%		0.02%		0.00%		1.01%		2.97%
<i>Cigading</i>	317,100	61,027	591,952	143,643	582,152	171,058	545,533	215,750	306,674	106,174
Contribution(%)		16.34%		41.64%		58.13%		50.35%		35.45%
<i>Indramayu</i>	1,406,642	183,845	1,058,599	111,710	558,442	48,744	825,713	91,480	749,170	95,310
Contribution(%)		49.22%		32.38%		16.56%		21.35%		31.83%
<i>Gede Bage</i>	0	0	0	0	0	0	568	180	79	37
Contribution(%)		0.00%		0.00%		0.00%		0.04%		0.01%
<i>TG. Sekong</i>	0	0	0	0	0	0	0	0	1	170
Contribution(%)		0.00%		0.00%		0.00%		0.00%		0.06%
<b>Total</b>	<b>2,746,808</b>	<b>373,537</b>	<b>2,479,691</b>	<b>344,950</b>	<b>2,116,474</b>	<b>294,259</b>	<b>2,453,578</b>	<b>428,481</b>	<b>1,773,561</b>	<b>299,464</b>
Contribution(%)		100.00%		100.00%		100.00%		100.00%		100.00%

Source: Jawa Barat Dalam Angka 1990, Kantor Statistik Propinsi Jawa Barat.

Annex 1 : Present Socio-economic Conditions in the Study Area



Table 14 TRADING SITUATION OF TANJUNG PRIOK PORT IN JAKARTA AND MAIN EXPORT COMMODITIES IN WEST JAVA

## (A) Trading Situation of Tanjung Priok Port

Port of Import and/or export	Volume and value by year									
	1986		1987		1988		1989		1990	
	Volume (1,000 ton)	Value (US\$ million)	Volume (1,000 ton)	Value (US\$ million)	Volume (1,000 ton)	Value (US\$ million)	Volume (1,000 ton)	Value (US\$ million)	Volume (1,000 ton)	Value (US\$ million)
(A) Import										
Tanjung Priok	5,566	5,000	6,199	5,895	6,197	6,527	7,238	8,395	9,245	12,008
Contribution(%)		46.65%		47.66%		49.26%		51.31%		54.99%
Indonesia	19,250	10,718	23,081	12,370	21,518	13,249	26,082	16,360	30,280	21,837
Contribution(%)		100.00%		100.00%		100.00%		100.00%		100.00%
(B) Export										
Tanjung Priok	6,338	1,486	7,547	2,013	8,144	2,795	9,759	3,891	8,176	5,123
Contribution(%)		10.04%		11.75%		14.54%		17.56%		19.95%
Indonesia	148,094	14,805	134,249	17,136	115,381	19,219	102,263	22,159	107,566	25,675
Contribution(%)		100.00%		100.00%		100.00%		100.00%		100.00%

Sources: Statistik Indonesia 1990 and 1992, Biro Pusat Statistik Jakarta.

## (B) Main Export Commodities in West Java

Kind of commodities	As of 1990		
	Volume (ton)	Value (US\$ 1,000)	Share (%)
Electronics	891	19,028	2.16%
Sanitair	38	1,583	0.18%
Tires	654	1,002	0.11%
Iron steel	283,550	107,607	12.20%
Chocolate	2,490	8,722	0.99%
DDT	670	1,773	0.20%
Frozen shrimp and sea food	1,103	12,718	1.44%
Gliserin	2,641	3,100	0.35%
Sawn wood	2,602	5,220	0.59%
Plywood	9,274	10,121	1.15%
Timber	3,086	6,058	0.69%
Rubber and rubber products	7,639	26,160	2.97%
Leather and leather products	1,182	13,621	1.54%
Potatos	1,526	1,005	0.11%
Handcrafts	5	2,573	0.29%
Safety matches	86	1,653	0.19%
Lumber	1,003	7,826	0.89%
Meats	58,044	6,644	0.75%
Fertilizer	35	4,213	0.48%
Cement	6,688	31,488	3.57%
Spareparts for aircrafts	27	5,702	0.65%
Stearic acid	1,909	8,905	1.01%
Chopsticks	2,774	4,847	0.55%
Cloths and textile	51,948	524,688	59.48%
Tea	37,042	61,209	6.94%
Rattan products	1,245	4,628	0.52%
Total	478,152	882,094	100.00%

Source: Jawa Barat Dalam Angka 1990, Kantor Statistik Propinsi Jawa Barat.



Table 15 AVERAGE MONTHLY INCOME PER  
FAMILY BY KINDS OF RECEIPTS

Kind of Receipts	As of 1989			
	DKI Jakarta		Bandung	
	Amount	(%)	Amount	(%)
I. Income from wages/salaries	212,355	48.09%	126,389	35.45%
A. Money income	189,038	42.81%	115,220	32.32%
B. Non-money income	23,317	5.28%	11,169	3.13%
1. Food items	6,120	1.39%	6,442	1.81%
2. Non-food items	2,089	0.47%	1,090	0.31%
3. Net market price	178	0.04%	86	0.02%
4. Health, transportation and housing	14,930	3.38%	3,551	1.00%
II. Income from own account employed	83,357	18.88%	75,623	21.21%
III. Other income	81,678	18.50%	73,606	20.65%
A. Imputed rent of own dwelling/rent free	49,167	11.13%	34,763	9.75%
B. Net income from property	9,038	2.05%	6,568	1.84%
C. Income from non-own account employed	3,284	0.74%	2,324	0.65%
D. Pension and life insurance	10,284	2.33%	15,653	4.39%
E. Regular remittance	9,905	2.24%	14,298	4.01%
IV. Other receipts	64,200	14.54%	80,903	22.69%
A. Withdrawal from savings	16,096	3.65%	13,592	3.81%
B. Selling goods/pawning goods	6,490	1.47%	11,860	3.33%
C. Debt repayment	12,513	2.83%	12,890	3.62%
D. Debt/credit	11,478	2.60%	19,805	5.56%
E. Irregular remittance	14,530	3.29%	19,060	5.35%
F. Others	3,093	0.70%	3,696	1.04%
1989 Total per family	441,590	100.00%	356,521	100.00%
Average per-capita income	86,624	-	69,776	-
1990 Total per family	476,917	-	384,544	-
Average per-capita income	93,554	-	75,260	-

Note: Amount of total per family and average per-capita income as of 1990 are estimated by using annual average inflation rate of 8.00 % in DKI Jakarta and 7.86 % in Bandung.



Table 16 AVERAGE MONTHLY PER-CAPITA EXPENDITURE BY COMMODITY GROUP

Commodity group	DKI Jakarta (Urban area only)			Urban area			West Java Rural area			Average in both areas		
	1984	1987	1990	1984	1987	1990	1984	1987	1990	1984	1987	1990
<b>(A) Expenditure in Rupiah Currency</b>												
<b>FOOD</b>												
Cereals	3,000	3,689	5,083	3,244	3,843	5,495	3,833	4,446	6,460	3,707	4,284	6,137
Tubers	163	220	263	175	206	228	168	161	239	170	173	235
Fish	1,106	1,645	2,345	1,060	1,183	1,832	991	1,157	1,701	1,006	1,164	1,745
Meat	1,175	1,887	2,232	1,014	1,274	1,578	325	473	774	472	688	1,043
Eggs and milk	1,076	1,500	2,102	783	1,060	1,600	282	502	684	389	652	990
Vegetables	1,326	1,924	2,477	1,097	1,231	1,768	865	1,056	1,478	914	1,106	1,575
Legumes	568	797	1,099	626	894	1,104	354	518	736	412	619	859
Fruits	830	1,193	2,040	737	1,001	1,682	513	719	1,159	561	795	1,334
Other food items	2,160	2,960	3,984	1,876	2,143	2,955	1,269	1,527	2,175	1,398	1,693	2,436
Prepared food	3,197	4,246	5,207	1,723	2,405	3,126	923	1,745	1,362	1,094	1,923	1,953
Alcoholic beverages	29	43	52	18	17	30	8	6	9	10	9	16
Tobacco and betelnut	1,624	2,083	2,422	1,080	1,352	1,754	850	1,063	1,498	899	1,141	1,584
<b>TOTAL</b>	<b>16,254</b>	<b>22,187</b>	<b>29,306</b>	<b>13,433</b>	<b>16,609</b>	<b>23,152</b>	<b>10,381</b>	<b>13,373</b>	<b>18,275</b>	<b>11,032</b>	<b>14,247</b>	<b>19,907</b>
<b>NON-FOOD</b>												
Housing, fuel, light and water	8,654	12,684	16,266	5,543	6,322	8,404	2,309	3,185	3,810	3,000	4,028	5,347
Miscellaneous goods and services	5,661	9,465	13,926	3,233	4,163	7,225	773	1,374	1,694	1,299	2,124	3,545
Clothing, footwear and headwear	1,259	1,979	3,419	1,206	1,635	2,541	738	1,142	1,652	838	1,274	1,949
Durable goods	532	660	1,087	1,043	642	1,172	429	513	846	560	548	955
Consumption taxes and ins. premiums	493	984	1,413	328	391	758	86	134	228	138	203	405
Parties and ceremonies	499	964	1,471	519	618	874	450	506	722	465	536	773
<b>TOTAL</b>	<b>17,098</b>	<b>26,736</b>	<b>37,582</b>	<b>11,872</b>	<b>13,771</b>	<b>20,974</b>	<b>4,785</b>	<b>6,854</b>	<b>8,952</b>	<b>6,300</b>	<b>8,713</b>	<b>12,974</b>
<b>GRAND TOTAL</b>	<b>33,352</b>	<b>48,923</b>	<b>66,888</b>	<b>25,305</b>	<b>30,380</b>	<b>44,126</b>	<b>15,166</b>	<b>20,227</b>	<b>27,227</b>	<b>17,332</b>	<b>22,960</b>	<b>32,881</b>
<b>(B) Distribution Ratio (%)</b>												
<b>FOOD</b>												
Cereals	9.0%	7.5%	7.6%	12.8%	12.6%	12.5%	25.3%	22.0%	23.7%	21.4%	18.7%	18.7%
Tubers	0.5%	0.4%	0.4%	0.7%	0.7%	0.5%	1.1%	0.8%	0.9%	1.0%	0.8%	0.7%
Fish	3.3%	3.4%	3.5%	4.2%	3.9%	4.2%	6.5%	5.7%	6.2%	5.8%	5.1%	5.3%
Meat	3.5%	3.9%	3.3%	4.0%	4.2%	3.6%	2.1%	2.3%	2.8%	2.7%	3.0%	3.2%
Eggs and milk	3.2%	3.1%	3.1%	3.1%	3.5%	3.6%	1.9%	2.5%	2.5%	2.2%	2.8%	3.0%
Vegetables	4.0%	3.9%	3.7%	4.3%	4.1%	4.0%	5.7%	5.2%	5.4%	5.3%	4.8%	4.8%
Legumes	1.7%	1.6%	1.6%	2.5%	2.9%	2.5%	2.3%	2.6%	2.7%	2.4%	2.7%	2.6%
Fruits	2.5%	2.4%	3.0%	2.9%	3.3%	3.8%	3.4%	3.6%	4.3%	3.2%	3.5%	4.1%
Other food items	6.5%	6.1%	6.0%	7.4%	7.1%	6.7%	8.4%	7.5%	8.0%	8.1%	7.4%	7.4%
Prepared food	9.6%	8.7%	7.8%	6.8%	7.9%	7.1%	6.1%	8.6%	5.0%	6.3%	8.4%	5.9%
Alcoholic beverages	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%
Tobacco and betelnut	4.9%	4.3%	3.6%	4.3%	4.5%	4.0%	5.6%	5.3%	5.5%	5.2%	5.0%	4.8%
<b>TOTAL</b>	<b>48.7%</b>	<b>45.4%</b>	<b>43.8%</b>	<b>53.1%</b>	<b>54.7%</b>	<b>52.5%</b>	<b>68.4%</b>	<b>66.1%</b>	<b>67.1%</b>	<b>63.7%</b>	<b>62.1%</b>	<b>60.5%</b>
<b>NON-FOOD</b>												
Housing, fuel, light and water	25.9%	25.9%	24.3%	21.9%	20.8%	19.0%	15.2%	15.7%	14.0%	17.3%	17.5%	16.3%
Miscellaneous goods and services	17.0%	19.3%	20.8%	12.8%	13.7%	16.4%	5.1%	6.8%	6.2%	7.5%	9.3%	10.8%
Clothing, footwear and headwear	3.8%	4.0%	5.1%	4.8%	5.4%	5.8%	4.9%	5.6%	6.1%	4.8%	5.5%	5.9%
Durable goods	1.6%	1.3%	1.6%	4.1%	2.1%	2.7%	2.8%	2.5%	3.1%	3.2%	2.4%	2.9%
Consumption taxes and ins. premiums	1.5%	2.0%	2.1%	1.3%	1.3%	1.7%	0.6%	0.7%	0.8%	0.8%	0.9%	1.2%
Parties and ceremonies	1.5%	2.0%	2.2%	2.1%	2.0%	2.0%	3.0%	2.5%	2.7%	2.7%	2.3%	2.4%
<b>TOTAL</b>	<b>51.3%</b>	<b>54.6%</b>	<b>56.2%</b>	<b>46.9%</b>	<b>45.3%</b>	<b>47.5%</b>	<b>31.6%</b>	<b>33.9%</b>	<b>32.9%</b>	<b>36.3%</b>	<b>37.9%</b>	<b>39.5%</b>
<b>GRAND TOTAL</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Source: Pengeluaran untuk Konsumsi Penduduk Indonesia per Propinsi 1990, Biro Pusat Statistik Jakarta.

Note:

1. DKI Jakarta has urban areas only.
2. Other food items include oil & fats, beverage stuffs and spices.



Table 17 CONSUMER PRICE INDEX AND INFLATION RATE

Year	DKI Jakarta					Inflation Rate (%)	
	General	Foodstuffs	Housing	Clothing	Miscellaneous	(Calender)	(Fiscal)
1981	163.37	163.37	169.35	185.52	146.88	5.83	
1982	176.52	167.60	194.61	186.82	161.52	8.71	
1983	198.63	183.90	224.01	189.16	197.41	10.70	
1984	221.73	204.30	253.76	190.92	226.65	11.25	
1985	232.28	207.77	272.79	194.85	242.25	3.94	
1986	239.92	222.20	275.97	195.91	246.28	8.18	
1987	263.50	242.31	292.61	225.29	281.28	9.02	8.60
1988	286.70	283.10	309.80	230.10	289.80	4.44	8.08
1989	301.02	300.94	324.20	239.91	299.63	5.56	5.99
	(100)	(100)	(100)	(100)	(100)		
1990	112.31	109.18	115.06	113.96	111.90	11.26	4.97
1991	123.79	118.63	127.87	119.98	126.49	10.38	10.29
1992	134.30	129.45	137.65	130.32	137.55	5.46	10.75
1993	148.29	139.60	156.67	147.10	149.03	10.28	11.50
1994							7.29
Annual average increasing ratio	8.74%	8.19%	9.59%	5.50%	9.71%	8.23%	
Annual average inflation rate in calender year since 1988						8.03%	8.39%

Year	Bandung, Capital City of West Java Province					Inflation Rate (%)	
	General	Foodstuffs	Housing	Clothing	Miscellaneous	(Calender)	(Fiscal)
1981	180.28	182.58	165.99	229.63	168.01	7.71	
1982	195.27	192.94	186.42	210.47	191.42	10.52	
1983	229.54	227.66	227.33	262.17	220.08	13.30	
1984	247.57	237.45	262.43	274.62	238.03	7.32	
1985	263.35	246.78	287.36	284.84	256.24	5.50	
1986	276.64	267.76	295.42	297.43	263.07	10.19	
1987	305.81	295.53	312.02	341.96	302.16	8.63	8.76
1988	324.40	342.60	327.70	357.50	318.60	4.50	9.47
1989	347.31	356.88	341.54	361.42	327.39	5.07	5.33
	(100)	(100)	(100)	(100)	(100)		
1990	111.47	105.93	120.52	104.81	112.71	9.67	5.45
1991	122.93	114.54	135.64	109.72	127.09	9.29	9.62
1992	131.22	123.12	144.56	110.88	137.63	4.51	9.19
1993	142.64	129.69	165.71	114.07	149.40	9.76	8.41
1994							8.05
Annual average increasing ratio	8.79%	8.06%	10.76%	5.00%	9.31%	8.16%	
Annual average inflation rate in calender year since 1988						7.32%	7.92%

## Sources :

1. Jawa Barat Dalam Angka 1990 and 1991, Kantor Statistik Jawa Barat.
2. Indikator Ekonomi Juni 1981 to 1993, Biro Pusat Statistik.
3. Indikator Ekonomi Mei 1994, Biro Pusat Statistik, Jakarta.

## Note :

1. Figures mentioned above are those as of June in each year except 1982 and 1989.
2. Figures in 1982 and 1989 are those as of May and January respectively.
3. The year in fiscal year means from April of a year to March of next year.
4. Base year : April 1977/March 1978 = 100



Table 18 EXCHANGE RATE

Year/month	US dollar Equivalent			Japanese Yen Equivalent		
	Selling Rate	Buying Rate	Mid-Rate	Selling Rate	Buying Rate	Mid-Rate
1989 January	1,742.25	1,728.50	1,735.38	13.71	13.41	13.56
February	1,748.50	1,734.50	1,741.50	13.65	13.35	13.50
March	1,758.30	1,743.30	1,750.80	13.48	13.18	13.33
April	1,762.00	1,748.00	1,755.00	13.33	13.04	13.19
May	1,772.00	1,758.00	1,765.00	12.81	12.50	12.66
June	1,777.90	1,763.90	1,770.90	12.37	12.04	12.21
July	1,779.50	1,765.50	1,772.50	12.64	12.30	12.47
August	1,786.30	1,772.30	1,779.30	12.67	12.34	12.51
September	1,793.25	1,779.25	1,786.25	12.38	12.03	12.21
October	1,794.05	1,780.00	1,787.03	12.63	12.32	12.48
November	1,800.20	1,786.10	1,793.15	12.53	12.23	12.38
December	1,801.38	1,787.00	1,794.19	12.54	12.24	12.39
1990 January	1,810.70	1,796.80	1,803.75	12.50	12.20	12.35
February	1,816.30	1,805.60	1,810.95	12.48	12.18	12.33
March	1,826.00	1,812.00	1,819.00	12.00	11.69	11.85
April	1,832.75	1,818.75	1,825.75	11.56	11.26	11.41
May	1,837.80	1,823.80	1,830.80	11.93	11.63	11.78
June	1,847.00	1,833.00	1,840.00	12.13	11.71	11.92
July	1,852.80	1,838.80	1,845.80	12.42	12.13	12.28
August	1,860.50	1,846.60	1,853.55	12.63	12.33	12.48
September	1,866.63	1,852.50	1,859.57	13.43	13.13	13.28
October	1,872.00	1,858.00	1,865.00	14.45	14.13	14.29
November	1,881.50	1,867.70	1,874.60	14.60	14.27	14.44
December	1,895.88	1,881.94	1,888.91	13.98	13.88	13.93
1991 January	1,914.40	1,900.40	1,907.40	14.30	13.96	14.13
February	1,922.00	1,908.00	1,915.00	14.72	14.39	14.56
March	1,935.25	1,921.25	1,928.25	14.14	13.79	13.97
April	1,942.20	1,928.20	1,935.20	14.12	13.77	13.95
May	1,950.00	1,936.00	1,943.00	14.11	13.75	13.93
June	1,958.50	1,944.50	1,951.50	13.98	13.62	13.80
July	1,964.00	1,950.00	1,957.00	14.21	13.84	14.03
August	1,968.40	1,953.80	1,961.10	14.36	14.02	14.19
September	1,973.00	1,959.00	1,966.00	14.65	14.33	14.49
October	1,980.80	1,966.80	1,973.80	15.11	14.82	14.97
November	1,987.75	1,973.75	1,980.75	15.32	14.99	15.16
December	1,995.25	1,981.50	1,988.38	15.51	15.17	15.34
1992 January	2,004.60	1,990.60	1,997.60	16.02	15.56	15.79
February	2,013.75	1,999.75	2,006.75	15.80	15.39	15.60
March	2,021.80	2,007.80	2,014.80	15.23	14.90	15.07
April	2,026.80	2,030.80	2,028.80	15.15	14.80	14.98
May	2,031.50	2,017.50	2,024.50	15.54	15.18	15.36
June	2,037.60	2,023.60	2,030.60	16.07	15.71	15.89
July	2,040.60	2,026.60	2,033.60	16.22	15.89	16.06
August	2,041.25	2,027.75	2,034.50	16.13	15.81	15.97
September	2,046.20	2,029.20	2,037.70	16.69	16.32	16.51
October	2,053.80	2,033.80	2,043.80	16.98	16.61	16.80
November	2,063.00	2,043.00	2,053.00	16.65	16.32	16.49
December	2,064.60	2,051.20	2,057.90	16.66	16.27	16.47
1993 January	-	-	2,064.78	-	-	16.55
February	-	-	2,066.63	-	-	17.12
March	-	-	2,069.13	-	-	17.70
April	-	-	2,070.76	-	-	18.45
May	-	-	2,076.67	-	-	18.88
June	-	-	2,083.83	-	-	19.48
July	-	-	2,093.00	-	-	19.47
August	-	-	2,097.38	-	-	20.25
September	-	-	2,115.00	-	-	20.01
October	-	-	2,113.50	-	-	19.46
November	-	-	2,115.00	-	-	19.38
December	-	-	2,118.00	-	-	18.96
1994 January	-	-	2,126.25	-	-	18.99
February	-	-	2,133.75	-	-	20.06
March	-	-	2,161.60	-	-	20.53
April	-	-	2,170.25	-	-	20.93
May	-	-	2,173.25	-	-	20.67
June	2,181.25	2,157.25	2,169.25	21.43	21.27	21.35
July	2,165.50	2,165.50	2,163.00	21.97	21.81	21.89
August	2,180.00	2,174.50	2,177.25	21.93	21.75	21.84

Sources: 1. Kurs Valuta Asing dan Harga Emas di Jakarta 1989 - 1990, 1991 and 1992, Biro Pusat Statistik, Jakarta, written information from Bank Indonesia to August 1993 and Indikator Ekonomi Mei 1994 from September 1993 to May 1994.

Note: For 1993 and 1994, monthly average from January 1993 to May 1994.



Table 19 LAND USE IN THE STUDY AREA

(unit : ha as of 1990)													
Administrative Units	Total area	Rice field						Dry land				State forest and others	
		Irrigated		Non-irrigated		Rain-fed	Under non-use	Total	Upland crops		Housing area		Total
	x 2	x 1	x 2	x 1								Under use	
<b>Jakarta</b>	66,173	1,860	1,204	1,115	10	1,690	142	6,021	5,412	2,621	27,053	35,086	25,066
<i>Selatan</i>	14,298	0	0	25	0	2	0	27	1,096	161	4,328	5,585	8,686
Keb.Lama	2,011	0	0	0	0	0	0	0	0	8	302	310	1,701
Pesangrahan	1,236	0	0	0	0	0	0	0	100	85	488	673	563
Psr.Minggu	1,940	0	0	0	0	0	0	0	304	13	518	835	1,105
Jagakarsa	2,709	0	0	25	0	2	0	27	556	47	547	1,150	1,532
Mpg.Prapatan	766	0	0	0	0	0	0	0	2	3	91	96	670
Pancoran	816	0	0	0	0	0	0	0	2	2	102	106	710
Keb.Baru	1,250	0	0	0	0	0	0	0	62	2	717	781	469
Setia Budi	877	0	0	0	0	0	0	0	2	1	397	400	477
Tebet	878	0	0	0	0	0	0	0	5	0	702	707	171
Cilandak	1,815	0	0	0	0	0	0	0	63	0	464	527	1,288
<i>Timur</i>	18,423	1,150	235	290	10	685	0	2,370	2,960	7	5,959	8,926	7,127
Psr.Rebo	1,235	0	0	0	0	90	0	90	355	0	135	490	655
Cipayung	2,673	0	210	275	0	225	0	710	1,212	0	459	1,671	292
Ciracas	1,594	0	0	0	0	95	0	95	220	0	980	1,200	299
Kramat Jati	1,308	0	0	0	0	0	0	0	580	0	135	715	593
Makasar	2,158	0	0	0	0	60	0	60	178	0	1,255	1,433	665
Jatinegara	1,054	0	0	0	0	0	0	0	5	0	164	169	885
Duren Sawit	2,141	0	0	15	10	0	0	25	100	0	240	340	1,776
Matraman	481	0	0	0	0	0	0	0	0	7	425	432	49
Pulo Gadung	1,557	0	0	0	0	0	0	0	0	0	158	158	1,399
Cakung	4,222	1,150	25	0	0	215	0	1,390	310	0	2,008	2,318	514
<b>Pusat</b>	4,867	0	0	0	0	0	0	0	36	0	143	179	4,688
Tanah Abang	924	0	0	0	0	0	0	0	2	0	16	18	906
Menteng	647	0	0	0	0	0	0	0	0	0	12	12	635
Senen	418	0	0	0	0	0	0	0	3	0	12	15	403
Cpk.Putih	443	0	0	0	0	0	0	0	4	0	22	26	417
Johor Baru	235	0	0	0	0	0	0	0	0	0	13	13	222
Sawah Besar	615	0	0	0	0	0	0	0	10	0	16	26	589
Gambir	772	0	0	0	0	0	0	0	0	0	33	33	139
Kemayoran	813	0	0	0	0	0	0	0	17	0	19	36	777
<b>Barat</b>	12,637	710	344	0	0	276	32	1,362	932	2,001	6,425	9,358	1,917
Kebon Jeruk	1,738	0	0	0	0	0	0	0	10	8	1,720	1,738	0
Kembangan	2,442	0	0	0	0	0	0	0	187	211	1,874	2,272	170
Cengkareng	2,794	130	0	0	0	0	0	130	507	1,773	384	2,664	0
Kali Deres	2,725	580	344	0	0	276	0	1,200	221	0	518	739	786
Ggl.Petamburan	1,167	0	0	0	0	0	0	0	4	2	200	206	961
Palmerah	755	0	0	0	0	0	0	0	3	7	745	755	0
Tambora	580	0	0	0	0	0	0	32	32	0	548	548	0
Taman Sari	436	0	0	0	0	0	0	0	0	0	436	436	0
<b>Utara</b>	15,948	0	625	800	0	727	110	2,262	388	452	10,198	11,038	2,648
Penjaringan	4,253	0	0	0	0	25	0	25	23	115	2,726	2,864	1,364
Pademaran B.	746	0	0	0	0	0	0	0	6	50	690	746	0
Tjg.Priyok	2,458	0	0	0	0	0	0	0	0	90	2,304	2,394	64
Koja	1,441	0	0	0	0	30	35	65	8	0	1,312	1,320	56
Kelapa Gading	1,600	0	0	0	0	250	75	325	8	156	817	981	294
Kpl.Seribu	1,145	0	0	0	0	0	0	0	151	41	207	399	746
Cilincing	4,305	0	625	800	0	422	0	1,847	192	0	2,142	2,334	124
<b>Bogor</b>	276,966	47,914	17,018	1,083	748	15,394	4,496	86,653	109,243	12,134	49,902	171,279	19,034
Citeureup	13,710	1,179	762	17	9	492	414	2,873	5,894	729	2,878	9,501	1,334
Cibinong	4,271	759	70	0	0	167	207	1,203	953	419	1,594	2,966	101
Gunung Putri	5,626	319	424	25	49	311	91	1,219	1,338	534	2,389	4,261	1,402
Cimanggis	5,028	624	156	20	40	193	258	1,291	482	170	2,905	3,557	1,806
Kedungbalang	5,745	1,026	543	89	32	212	100	2,002	1,763	69	1,807	3,639	1,004
Jonggol	22,448	4,812	1,473	115	67	1,617	127	8,211	8,449	1,007	3,784	13,240	999
Cariu	15,674	3,049	1,296	0	0	1,554	0	5,899	8,811	201	693	9,705	70
Citeungsi	16,136	1,258	486	79	15	1,421	148	3,407	7,632	1,704	3,101	12,437	291
Lewuliang	10,169	1,812	781	145	143	746	87	3,714	5,098	153	893	6,144	313
Rumplin	12,305	752	1,453	0	6	548	80	2,839	6,651	916	1,053	8,620	844
Ciampea	5,597	2,836	440	50	45	167	179	3,717	836	186	697	1,719	16
Cibungbulang	9,726	5,065	118	26	5	121	27	5,362	2,901	110	1,164	4,175	18
Jasinga	14,369	1,627	668	38	13	400	189	2,935	8,348	543	1,494	10,385	1,047
Cigudeg	22,920	4,547	593	0	0	744	529	6,413	14,152	1,004	1,275	16,431	7
Parungpanjang	11,745	110	43	0	4	2,518	0	2,675	5,437	657	2,353	8,447	623
Nangraung	19,719	2,941	709	9	8	751	315	4,733	4,007	426	1,638	6,071	8,91

(unit : ha as of 1990)														
Administrative Units	Total area	Rice field							Dry land			State forest and others		
		Irrigated		Non-irrigated		Rain-fed field	Under non-use	Total	Upland crops		Housing area		Total	
		Cultivation	x 1	Cultivation	x 1				Under use	Non-use				
Ciawi	4,002	1,389	220	3	8	111	199	1,930	979	48	896	1,923	149	
Cijeruk	5,803	2,164	124	42	0	261	201	2,792	1,572	160	1,149	2,881	130	
Cisarua	18,662	1,390	2,007	19	0	877	292	4,585	9,792	729	3,034	13,555	522	
Caringin	5,767	1,542	266	42	3	37	4	1,894	3,164	32	482	3,678	195	
Ciomas	8,503	2,620	855	81	37	332	192	4,117	1,304	536	2,066	3,906	480	
Parung	7,120	1,184	1,286	2	113	363	71	3,019	1,575	236	2,063	3,874	227	
Gunungsindur	5,055	520	103	72	44	301	53	1,093	1,583	298	1,721	3,602	360	
Sawangan	7,340	852	1,062	0	0	389	9	2,312	2,131	292	2,568	4,991	37	
Semplak	6,259	2,109	335	70	29	268	218	3,029	1,112	182	1,235	2,529	701	
Bojonggede	6,690	1,152	395	131	44	468	93	2,283	2,040	358	1,825	4,223	184	
Pancoran Mas	1,972	204	43	8	7	5	308	575	230	259	877	1,366	31	
Beji	1,481	10	25	0	27	20	28	110	289	57	730	1,076	295	
Sukmajaya	3,124	62	282	0	0	0	77	421	720	119	1,538	2,377	326	
<b>Kot. Bogor</b>	2,156	1	0	0	0	0	0	1	87	180	1,844	2,111	44	
Bogor Utara	762	0	0	0	0	0	0	0	46	42	660	748	14	
Bogor Selatan	274	1	0	0	0	0	0	1	14	8	247	269	4	
Bogor Timur	447	0	0	0	0	0	0	0	11	19	411	441	6	
Bogor Barat	356	0	0	0	0	0	0	0	16	25	308	349	7	
Bogor Tengah	317	0	0	0	0	0	0	0	0	86	218	304	13	
<b>Tangerang</b>	130,107	28,496	4,979	542	235	18,851	4,505	57,608	28,524	4,088	36,140	68,752	3,747	
Tangerang	2,435	7	13	0	0	76	27	123	156	108	1,748	2,012	300	
Batu Ceper	3,345	852	72	0	0	74	2	1,000	609	116	1,605	2,330	15	
Teluk Naga	7,238	3,439	0	0	0	0	0	3,439	1,531	144	2,008	3,683	116	
Mauk	11,505	6,806	562	105	0	630	112	8,215	1,647	91	1,374	3,112	178	
Rajeg	5,216	2,134	600	68	10	522	60	3,394	934	21	822	1,777	45	
Sepatan	9,118	5,252	297	7	29	215	61	5,861	954	216	1,837	3,007	250	
Pasar Kemis	6,158	1,743	547	0	7	751	403	3,451	1,000	155	1,232	2,387	320	
Balaraja	7,311	2,159	380	0	0	1,227	481	4,247	1,304	396	1,301	3,001	63	
Kresik	5,659	2,161	927	30	5	729	48	3,900	736	101	898	1,735	24	
Kronjo	6,793	2,344	416	40	1	1,841	26	4,668	1,483	85	446	2,014	111	
Cung	3,906	0	0	0	0	1,150	106	1,256	1,004	74	1,483	2,561	89	
Cikupa	7,870	97	10	0	0	1,743	836	2,686	2,257	393	2,274	4,924	260	
Legok	9,529	0	312	0	0	2,424	107	2,843	3,975	363	2,198	6,536	150	
Tiga Raksa	7,793	112	0	0	0	2,626	0	2,738	3,981	262	716	4,959	96	
Serpong	9,124	119	285	12	44	978	230	1,668	2,895	388	3,174	6,457	999	
Ciputat	6,453	147	64	65	30	35	666	1,007	828	455	3,943	5,226	220	
Ciledug	2,517	23	0	0	0	10	30	162	30	11	2,098	2,139	153	
Cisoka	7,657	621	361	159	26	2,631	262	4,060	2,087	295	1,171	3,553	44	
Jatiuwung	3,599	71	6	0	0	111	235	423	71	161	2,848	3,080	96	
Cipondoh	3,917	234	53	48	1	966	349	1,651	676	95	1,310	2,081	185	
Pondok Aren	2,964	175	74	8	72	92	332	753	366	158	1,654	2,178	33	
<b>Bekasi</b>	131,394	43,501	9,053	212	963	18,708	2,683	75,120	22,841	2,440	28,982	54,263	2,011	
Pondokgede	7,243	209	203	12	1	745	106	1,276	2,258	71	3,524	5,853	114	
Bantar Gebang	5,040	55	95	0	0	1,147	0	1,297	1,286	107	2,254	3,647	96	
Setu	6,737	150	0	5	0	2,195	0	2,350	2,970	0	1,274	4,244	143	
Cibarusah	9,153	1,343	1,032	4	0	2,863	129	5,371	1,212	110	2,351	3,673	109	
Serang	8,714	464	1,029	20	42	4,063	0	5,618	1,268	54	1,760	3,082	14	
Lemahabang	10,454	4,558	475	0	730	1,614	189	7,566	677	189	1,839	2,705	183	
Cikarang	8,170	6,240	39	0	0	160	14	6,453	138	18	1,289	1,445	272	
Cibitung	8,833	3,038	470	79	5	704	533	4,829	1,073	180	2,621	3,874	130	
Tambun	6,317	2,847	444	6	0	202	134	3,633	627	577	1,480	2,684	0	
Taruma Jaya	5,126	2,830	749	25	13	451	130	4,198	474	58	347	879	45	
Babelan	5,710	2,765	733	0	0	304	230	4,032	840	6	603	1,449	229	
Tambelang	8,513	4,224	1,772	56	32	1,281	5	7,370	550	45	448	1,043	100	
Sukatani	7,372	6,645	0	0	0	5	11	6,661	32	11	605	648	63	
Pebayuran	8,113	6,359	172	0	0	7	17	6,555	408	48	966	1,422	136	
Cabangbungin	5,890	671	1,493	0	0	1,550	617	4,331	450	390	643	1,483	76	
Muara Gembor	10,382	0	311	0	125	1,293	20	1,749	7,678	6	942	8,626	7	
Bekasi Timur	3,594	30	0	5	5	124	507	671	351	473	1,980	2,804	119	
Bekasi Selatan	2,602	380	0	0	10	0	20	410	287	18	1,725	2,030	162	
Bekasi Barat	1,807	250	36	0	0	0	21	307	8	38	1,445	1,491	9	
Bekasi Utara	1,624	443	0	0	0	0	0	443	254	41	886	1,181	0	
<b>Jabotabek</b>	606,796	121,772	32,254	2,952	1,956	54,643	11,826	225,403	166,107	21,463	143,921	331,491	49,901	

(unit : ha as of 1990)													
Administrative Units	Total area	Rice field						Dry land				State forest and others	
		Irrigated		Non-irrigated		Rain-fed	Under non-use	Total	Upland crops		Housing area		Total
		Cultivation x 2	x 1	Cultivation x 2	x 1				Under use	Under non-use			
<b>Serang</b>	178,132	22,980	14,338	796	1,203	27,765	1,641	68,723	77,062	2,671	22,574	102,307	7,102
Cinangka	12,302	311	506	26	248	382	4	1,477	9,735	27	945	10,707	118
Padarincang	7,440	1,118	1,375	0	0	152	0	2,645	3,476	0	1,109	4,585	210
Ciomas	5,712	339	416	0	0	0	0	755	4,064	0	796	4,860	97
Pabuaran	7,696	1,359	223	0	0	74	7	1,663	5,438	115	388	5,941	92
Baros	3,394	1,383	373	0	2	91	1	1,850	1,222	4	296	1,522	22
Petir	9,200	425	1,058	0	199	1,364	135	3,181	3,986	220	1,291	5,497	522
Cikeusal	9,613	643	939	0	0	1,858	0	3,440	4,665	0	1,485	6,150	23
Pamarayan	7,167	1,056	1,442	0	0	1,622	63	4,183	1,443	193	1,056	2,692	292
Kopo	8,730	0	213	0	95	1,352	437	2,097	4,212	203	1,789	6,204	429
Cikande	8,270	456	530	0	0	3,860	0	4,846	1,832	0	1,327	3,159	265
Kragilan	4,033	712	1,215	0	0	463	0	2,390	531	100	681	1,312	331
Walanataka	4,583	843	451	83	29	744	0	2,150	1,413	0	619	2,032	401
Serang	5,992	373	543	0	0	1,472	0	2,388	1,930	95	1,502	3,527	77
Taktaka	6,200	0	0	0	0	1,912	60	1,972	1,878	16	2,192	4,086	142
Wr. Kurung	4,390	0	7	0	0	399	0	406	2,969	0	1,010	3,979	5
Mancak	9,103	287	200	0	0	770	48	1,305	5,737	488	302	6,527	1,271
Anyar	5,885	0	56	375	0	577	0	1,008	4,011	232	339	4,582	295
Bojonegara	6,658	604	243	0	39	1,615	70	2,571	3,273	206	544	4,023	64
Kramit Watu	5,158	1,923	84	5	0	845	9	2,866	1,778	106	371	2,255	37
Kasemen	6,055	2,626	359	0	4	290	5	3,284	1,559	188	756	2,503	268
Ciruas	3,619	2,008	766	5	0	391	23	3,193	13	51	300	364	62
Pontang	7,565	2,867	1,275	216	86	401	86	4,931	2,348	94	192	2,634	0
Carenang	6,346	1,340	25	65	486	2,927	0	4,843	735	0	424	1,159	344
Tirtayasa	9,069	2,110	1,635	18	15	1,250	372	5,400	2,993	155	342	3,490	179
Ciwandan	4,347	37	256	2	0	988	101	1,384	1,658	60	623	2,341	622
Cilegon	3,970	143	148	1	0	940	23	1,255	1,729	11	816	2,556	159
Pulomerak	5,635	17	0	0	0	1,026	197	1,240	2,434	107	1,079	3,620	775
<b>Lebak</b>	138,575	9,309	3,416	1,054	537	11,610	708	26,634	81,238	11,538	8,135	100,911	11,030
Rangkasbitung	11,785	362	238	27	34	3,116	319	4,096	4,024	269	2,499	6,792	897
Maja	11,788	312	55	605	2	1,579	7	2,560	4,936	190	417	5,543	3,685
Sajira	10,716	1,202	623	342	221	1,324	241	3,953	4,742	736	1,059	6,537	226
Wrung Gunung	12,395	410	583	20	250	2,478	0	3,741	7,166	9	1,356	8,531	123
Cipanas	10,233	2,320	21	0	0	247	0	2,588	6,512	3	321	6,836	809
Lewidamar	16,749	1,420	198	0	0	464	0	2,082	12,382	1,330	412	14,124	543
Muncang	14,814	1,166	156	60	0	902	1	2,285	5,988	5,454	363	11,805	724
Cimarga	19,653	471	263	0	30	682	135	1,581	13,447	1,938	444	15,829	2,243
Bojongmanik	15,718	600	1,204	0	0	713	0	2,517	11,311	1,255	424	12,990	211
Cileles	14,724	1,046	75	0	0	105	5	1,231	10,730	354	840	11,924	1,569
<b>Pandeglang</b>	25,269	3,099	562	158	56	875	8,000	12,750	8,711	241	1,685	10,637	1,882
Pandeglang	11,591	534	332	0	0	126	8,000	8,992	1,738	11	699	2,448	151
Cadasari	6,162	1,137	182	30	30	480	0	1,859	3,483	13	623	4,119	184
Banjar	7,516	1,428	48	128	26	269	0	1,899	3,490	217	363	4,070	1,547
<b>North Banten</b>	341,976	35,388	18,316	2,008	1,796	40,250	10,349	108,107	167,011	14,450	32,394	213,855	20,014
<b>Study Area</b>	948,772	157,160	50,570	4,960	3,752	94,893	22,175	333,510	333,118	35,913	176,315	545,346	69,916

Source:  
Potensi Desa, Hasil Sensus Penduduk 1990 for DKI Jakarta, Kab. Bogor, Kotamadya Bogor, Kab. Tangerang, Kab. Bekasi, Kab. Serang, Kab. Lebak and Kab. Pandeglang, edited by each Kantor Statistik as branch office of Central Statistic Bureau.

Note :  
North Banten area consists of Kab. Serang, Kab. Lebak and Kab. Pandeglang

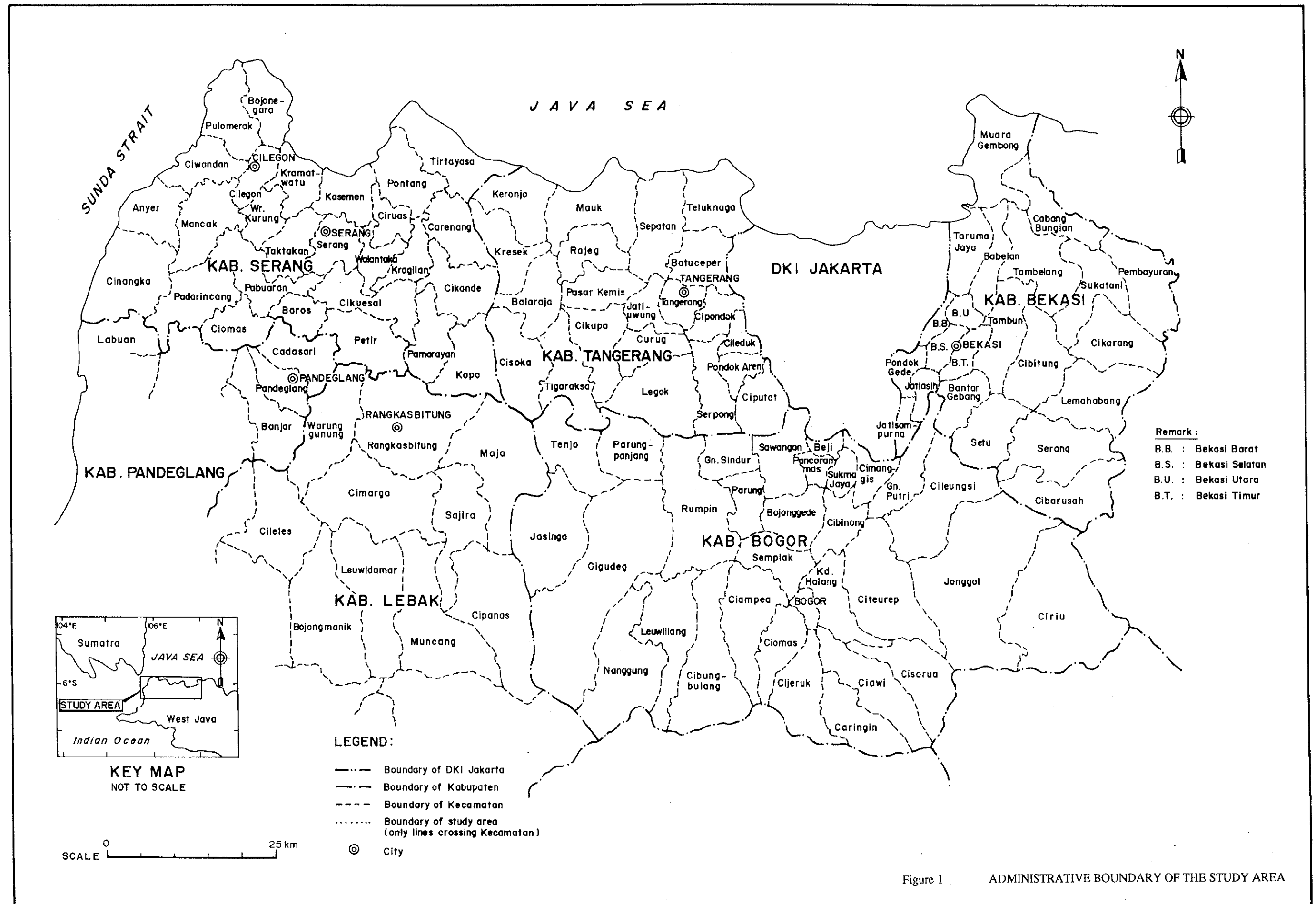


# ***FIGURES***





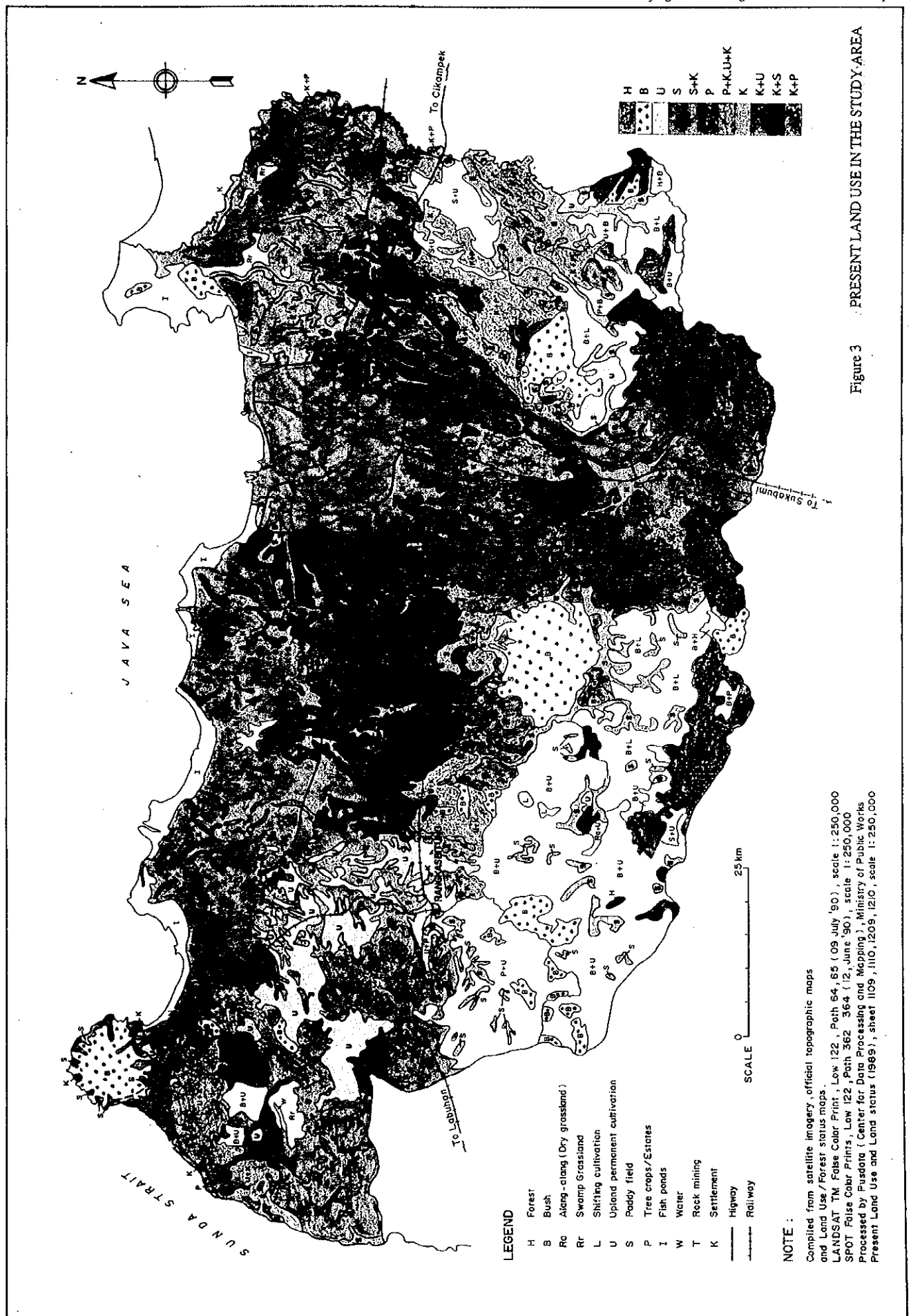














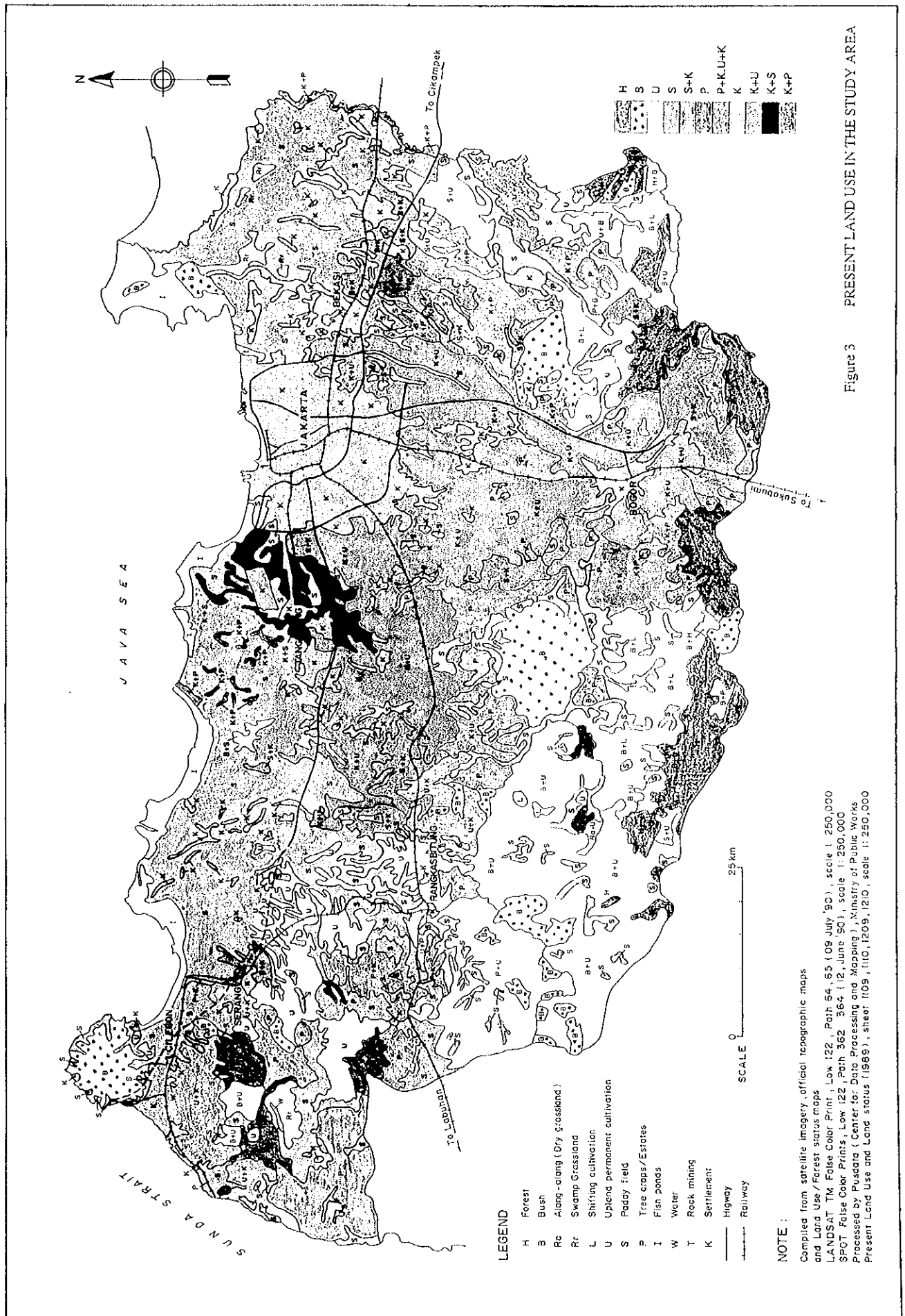
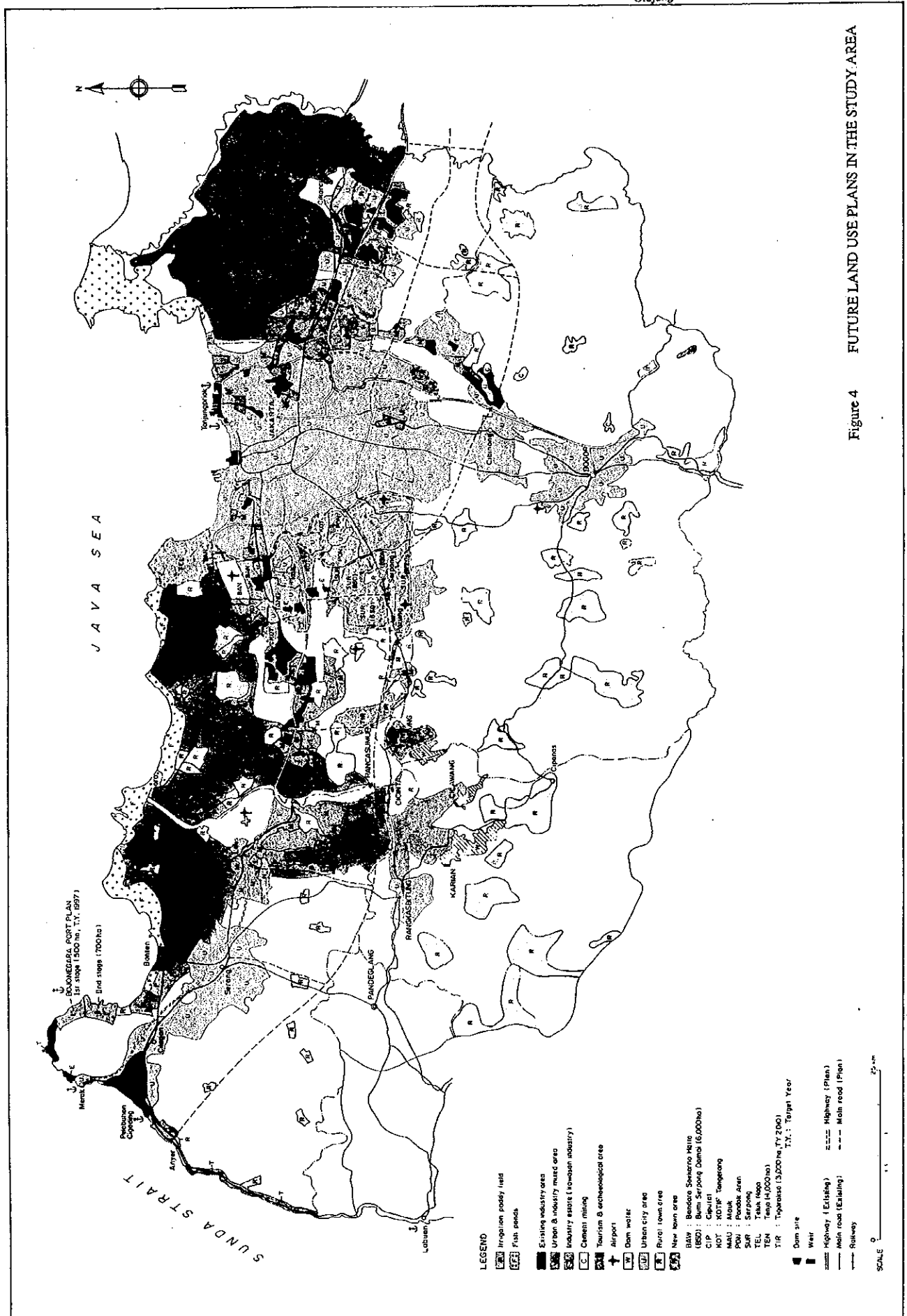
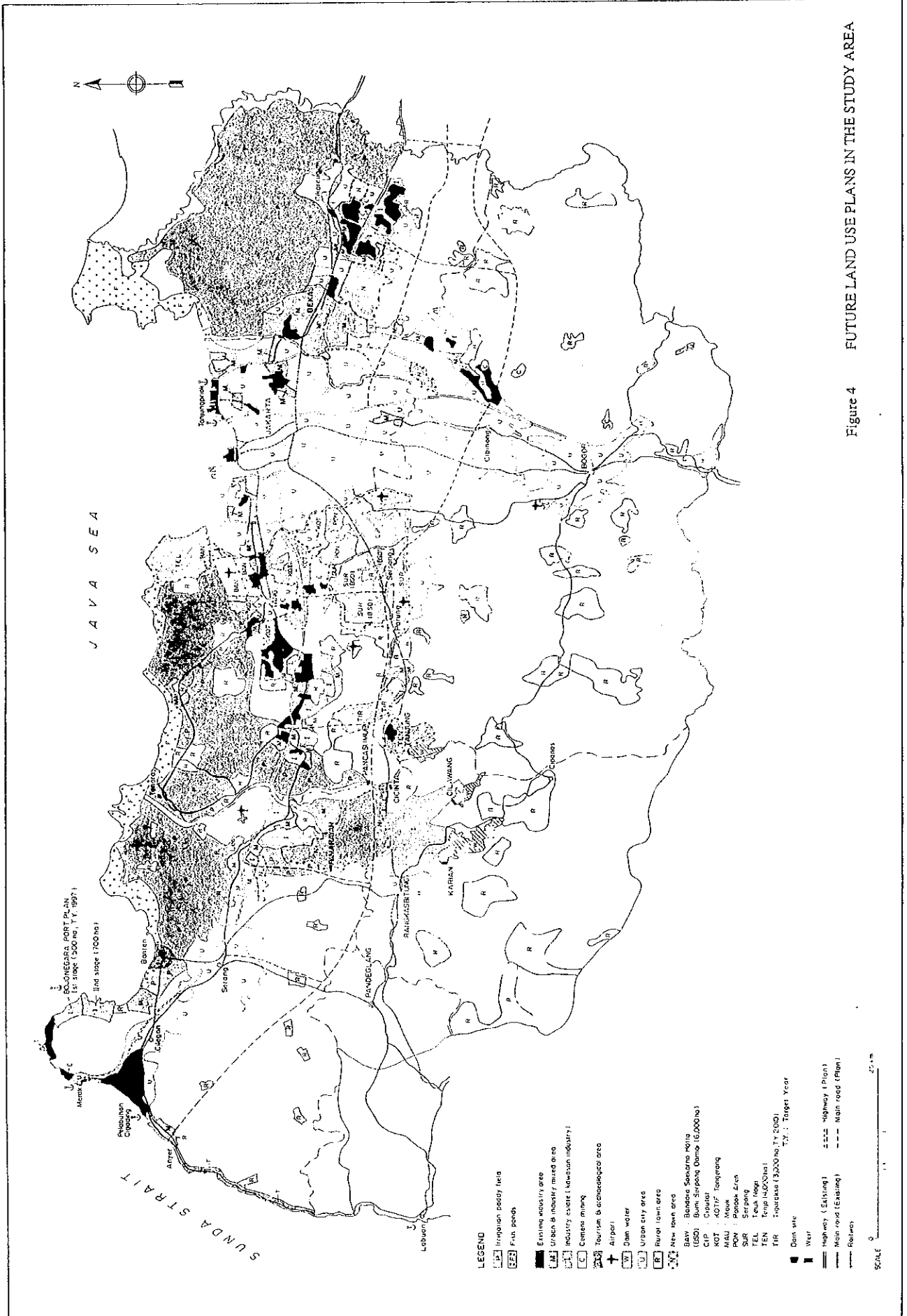


Figure 3 PRESENT LAND USE IN THE STUDY AREA











## ***ANNEX 2***

# ***HYDROLOGICAL STUDY***







**THE STUDY  
ON  
CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES**

**Annex 2 : Hydrological Study**

Table of Contents

	Page
1. INTRODUCTION .....	1
2. RIVER SYSTEM OF THE CIUJUNG AND CIDURIAN RIVER BASINS .....	1
3. METEO-HYDROLOGICAL DATA .....	2
4. METEO-HYDROLOGICAL CONDITION IN THE CIUJUNG AND CIDURIAN RIVER BASINS .....	4
4.1 Climate .....	4
4.2 River Flow Conditions .....	5
5. LOW FLOW ANALYSIS .....	7
5.1 Procedure of Low Flow Analysis .....	7
5.2 Review of Discharge Rating Curve.....	7
5.3 Double Mass Curve Analysis and Runoff Coefficient .....	8
5.4 Flow Discharges at the Envisaged Damsites and Base Points .....	9
6. FLOOD FLOW ANALYSIS .....	10
6.1 Procedure of Flood Flow Analysis .....	10
6.2 Flood Flow Analysis .....	10
6.2.1 Cross drain of Karian-Serpong Conveyance System .....	10
6.2.2 Bridge structure .....	11
6.2.3 Pasir Kopo dam .....	12
7. SEDIMENT ANALYSIS .....	14
7.1 Sediment Survey .....	14
7.1.1 Riverbed material .....	14
7.2.2 Wash and suspended loads.....	14
7.2 Sediment Analysis for Pasir Kopo Dam .....	15



### List of Tables

1. Availability of Collected Rainfall Data (1/2)
2. Availability of Collected Rainfall Data (2/2)
3. Water Level Gauging Stations and Availability of Data
4. Climatic Record at Serang
5. Monthly Basin Mean Rainfall (1/3)
6. Monthly Mean Basin Rainfall (2/3)
7. Monthly Mean Basin Rainfall (3/3)
8. Coefficient of Thiessen Polygon
9. Annual Minimum Daily Mean Discharge Series at Rangkasbitung and Kopomaja
10. Annual Maximum Flood Peak Discharge Series at Rangkasbitung, Kopomaja and Batubulah
11. Result of Discharge Measurement Carried Out by the Previous Studies and Projects
12. Result of Discharge Measurement Carried Out by JICA Study Team
13. Half-Monthly Mean Discharge at Key Gauging Stations
14. Design Discharge for Drainage Structure of Water Conveyance System with Excess Probability Once in 5 Years (1/2)
15. Design Discharge for Drainage Structure of Water Conveyance System with Excess Probability Once in 5 Years (2/2)
16. Result of Grain Size Analysis of Riverbed Material Made by JICA Study Team
17. Sediment Concentration Record Taken by DPMA and P3SA
18. Result of Sediment Concentration Analysis made by JICA Study Team
19. Result of Grain Size Analysis of WASH and Suspended Loads made by JICA Study Team
20. Annual Sediment Load of Pasir Kopo Dam

### List of Figures

1. Ciujung and Cidurian River Basins
2. Location of Hydrological Observation Stations
3. Isohyetal Map of West Java
4. Isohyetal Map of Annual Rainfall in the Ciujung and Cidurian River Basins
5. Thiessen Polygon
6. Flow Discharge Duration Curve at Rangkasbitung and Kopomaja
7. Frequency Curve for Annual Minimum Daily Mean Discharges at Rangkasbitung and Kopomaja
8. Frequency Curve for Annual Maximum Flood Peak Discharges by Gumbel Method
9. Discharge Rating Curve at Rangkasbitung and Kopomaja
10. Daily Discharge Hydrograph at Rangkasbitung (1/2)



## List of Figures

11. Daily Discharge Hydrograph at Rangkasbitung (2/2)
12. Daily Discharge Hydrograph at Kopomaja (1/2)
13. Daily Discharge Hydrograph at Kopomaja (2/2)
14. Relationship between Annual Rainfall and Runoff
15. Monthly Mean Discharge and Basin Mean Rainfall at Rangkasbitung
16. Monthly Mean Discharge and Basin Mean Rainfall at Kopomaja
17. Catchment of Cross Drainage Areas along the Karian-Serpong Conveyance System
18. Relation between Rainfall Intensity and Duration
19. Annual Maximum Daily Rainfall and its Frequency Curve and Probable Daily Rainfall at Maja
20. Relation between Specific Flood Peak Discharge and Catchment Area and Probable Flood Discharges at River Crossing Sections
21. Annual Maximum Daily Rainfall and its Frequency Curve and Probable Daily Rainfall at Cilaki
22. Relation between Area and Reduction Factor
23. Hourly Rainfall Distribution of Design Storm for Pasir Kopo Dam
24. Relation between Catchment Area and Specific Design Discharge in Indonesia
25. Discharge Hydrographs for PMF and Probable Floods for Pasir Kopo dam
26. Location of Sediment Sampling and Discharge Measurement
27. Grain Size Distribution of Riverbed Material
28. Relation between Sediment and Flow Discharge in Ciujung and Cidurian Rivers
29. Grain Size Distribution of Wash and Suspended Loads
30. Relation between Sediment and Flow Discharge in Small Catchment Area
31. Trap Efficiency as Related to Capacity-Inflow Ratio







## **1. INTRODUCTION**

The hydrological study was carried out in order to clarify the climatic and hydrological conditions in the Ciujung and Cidurian river basins and to provide hydrological data for evaluating potential surface water resources in the aforesaid river basins thereby.

To achieve the mentioned objectives, the following analyses and investigations were undertaken:

- (1) discharge measurement at the existing water level and discharge gauging station sites in the Ciujung and Cidurian rivers,
- (2) sediment sampling and its analysis on wash and suspended loads and riverbed material at the aforesaid gauging stations and damsites,
- (3) low flow analysis for clarification of the drought situation in the Ciujung and Cidurian river basins and to generate available runoff at the envisaged four (4) dam sites,
- (4) flood runoff analysis along the Karian-Serpong conveyance system and for the Pasir Kopo dam scheme, and
- (5) sediment analysis for the Pasir Kopo dam scheme.

## **2. RIVER SYSTEM OF THE CIUJUNG AND CIDURIAN RIVER BASINS**

The Ciujung and Cidurian river basins are located between 106°00' and 106°30' east longitudes, between 5°0 and 6°40' south latitude as shown in Figure 1. The Ciujung river has a total catchment area of 1,850 km<sup>2</sup> at the river mouth and is comprised of three (3) main tributaries, namely the upper Ciujung, Cisimeut and Cibeurang rivers which join at Rangkasbitung. While, the Cidurian river with a catchment area of 865 km<sup>2</sup> at the river mouth is comprised of two (2) main tributaries, the upper Cidurian and Cibeureum rivers which join at Parigi.

The proposed Karian, Pasir Kopo, Cilawang and Tanjung damsites are located on the Ciberang, Cisimeut, Cibeureum and Cidurian rivers, respectively. The catchment areas of the mentioned rivers, the major water level gauging station sites and the envisaged damsites are listed as follows:



River Basin	Catchment Area (km <sup>2</sup> )
Ciujung river:	
a) the river mouth	1,850
b) Rangkasbitung water level gauge	1,383
c) Upper Ciujung river at Rangkasbitung	594
d) Cisimeut river:	
• the confluence with the Ciujung river	458
• Pasir Kopo dam site	172
e) Ciberang river :	
• the confluence with the Ciujung river	331
• Karian dam site	288
Cidurian river:	865
a) the river mouth	
b) Parigi	649
c) Upper Cidurian river at Parigi	394
• Kopomaja water level gauge	280
• Tanjung	
d) Cibeureum river at Parigi	255
• Cilawang	93

### 3. METEO-HYDROLOGICAL DATA

The meteo-hydrological data at the existing climatic and hydrological observation stations in the Ciujung and Cidurian river basins have been accumulated by the DGWRD and other agencies and all the available data at the stations shown in the Figure 2 were collected for the hydrological study as follows:

#### (1) Climatic data

There are four (4) observation stations of climatic data in the Ciujung and Cidurian river basins, which were installed in 1970's and have been operated by Meteorology and Geophysics Center (BMG) and P3SA as follows:

Name of Station	Installed by	Commencement Year of Observation
Serang	BMG	1972
Cikadu	P3SA	1978
Cidasari	P3SA	1978
Cileles	P3SA	1978

#### (2) Rainfall

Presently, about ninety (90) rainfall gauging stations have been operated in and around the Ciujung and Cidurian river basins under the management of the BMG. The data observed at these stations have been compiled into hourly, daily and/or monthly basis as given in Tables 1 and 2.



### (3) Runoff

There exist fifteen (15) water level gauging stations which were installed in the Ciujung and Cidurian river basins as shown in Table 3. Of these stations, the Cileuks, Leuwidamar and Periuk gauging stations were closed down and therefore runoff data observed at twelve (12) gauging stations are available at present.

Of twelve (12) stations, the water level and discharge gauging stations at Rangkasbitung, Kragilan, Kopomaja and Parigi were installed by the DPMA and have long-term record from 1970 up to the present. The discharge record of these station has been provided by use of water level record and discharge rating curve by the DPMA. These rating curves have been changed several times by use of historical discharge measurement record taking into account flow condition.

The existing Pamarayan weir locates between Rangkasbitung and Kragilan in the Ciujung river, and the existing Rancasumur weir locates between Kopomaja and Parigi in the Cidurian river. The discharge record have estimated by use of discharge record to the irrigation canal and to the downstream.

### (4) Sediment

Sampling and analysis for wash and suspended loads in the Ciujung and Cidurian river basins have been carried out by the previous studies and projects and several organizations since 1975.

The suspended load sampling and analysis at Rangkasbitung, Kragilan, Kopomaja and Parigi were carried out from 1975 to 1981 by the Agency for Research and Development, Ministry of Public Works. From 1982 to 1983, the study of water quality and sediment transportation in West Java carried out sediment analysis for samples taken at Rangkasbitung, Leuwidamar, Cileles, Sajira, Rancasumur and Tanjung gauging stations by Directorate General of Irrigation. In the Cisadane Basin Development Feasibility Study done thereafter, sediment sampling and analysis were carried out at Kopomaja, Tanjung in April and May in 1986. In 1988, Directorate General of Irrigation had carried out the discharge measurement and sediment sampling as the field work of C.J.C. Project which established sediment discharge rating curves at Neglasari on the Cibeureum river, Kopomaja on the Cidurian river and Parigi on the Cidurian river. The sediment data have been accumulated by the DGWRD concerned.



#### 4. METEO-HYDROLOGICAL CONDITION IN THE CIUJUNG AND CIDURIAN RIVER BASINS

##### 4.1 Climate

The study area belongs to typically humid tropical zone and the weather patterns are characterized by the monsoons. The wet season is defined as a period from November to April and the dry season from May to October in general.

The monthly mean climatic data for a period from 1984 to 1993 at Serang located in the northern coastal plain are given in Table 4 and summarized as follows :

Climatic Data	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
Temperature (°C)	26.1	26.2	26.5	26.7	26.7	26.3	26.3	26.2	26.4	26.9	26.8	26.4	26.5
Relative humidity (%)	84	84	83	83	83	81	79	79	79	77	79	82	81
Wind velocity (knots)	5	5	6	5	5	5	5	5	5	5	5	5	5.1
Sunshine hours (%)	38	44	54	63	69	62	76	72	72	61	52	41	59

The monthly mean temperatures are rather stable throughout a year ranging between 26° and 27°. The monthly mean relative humidity is generally high, ranging from about 80% in the dry season to 85% in the wet season throughout a year. The monthly mean wind velocity at Serang ranges between 4 knots and 5 knots or 2.1 m/sec and 2.6 m/sec. The monthly mean sunshine duration at Serang ranges between 5 and 6 hours per day in the dry season and 3 to 4 hours per day in the wet season.

The isohyetal map and monthly rainfall distribution based on the long term rainfall records in West Java Province are shown in Figure 3. The variation in the annual rainfall is ranging from 1,500 mm in the coastal plain to 4,000 mm in the mountainous area around Bogor. On the other hand, the rainfall amount during the dry season from May to October is from 500 mm to 1,750 mm, while that in the wet season during the other calendar months is 1,250 mm to 2,750 mm. It is judged that the definition of wet and dry seasons in the mountainous area is unclear but the rainfall characteristics in the coastal area is dominated by tropical monsoon.

The annual rainfalls in the Ciujung and Cidurian river basins also range from 4,000 mm in the mountainous area to 1,500 mm in the coastal area according to the isohyetal map of annual rainfall shown in Figure 4. The monthly basin mean rainfall at Rangkasbitung, Pamarayan, Keragilan, Kopomaja, Rancasumur and Parigi were estimated by the Thiessen's method and the results are shown in Tables 5 to 7. The coefficient of Thiessen polygon is shown in Table 8 and its division is shown in Figure 5. According to the monthly basin mean rainfall estimated, the rainfall amount of the dry season from May to October in drought years of 1972, 1976, 1982 and 1991 was quite little as compared with the rainfall amount of the wet season from November to April. The following table shows the rainfall amount during dry season at the existing Pamarayan and Rancasumur weir sites in these drought years:



Drought Year	(unit : mm)	
	Pamarayan in the Ciujung River	Rancasumur in the Cidurian River
1972	620	675
1976	569	946
1982	791	700
1991	416	648

The rainfall amount in the above table corresponds to only 40 % to 70 % of the dry season rainfall in the normal year.

## 4.2 River Flow Conditions

### (1) Drought discharge

Flow discharges at the several excess percents based on the daily mean discharge record at Rangkasbitung and Kopomaja water level gauging stations are illustrated in Figure 6 and given as follows:

Station	River Basin	Period (years)	Catchment Area (km <sup>2</sup> )	(unit : m <sup>3</sup> /s)						
				Max.	25 %	50 %	75 %	97 %	Min.	Mean
Rangkasbitung	Ciujung	24	1,383	1,010	118	68.5	37.5	10.1	2.3	94.2
Kopomaja	Cidurian	24	304	302	26.6	14.9	7.9	2.0	0.1	21.1

According to the daily mean discharge records at the Rangkasbitung and Kopomaja water level gauging stations, the severe drought years are identified at 1972, 1982, 1983 and 1991, judging from the average runoff during the dry season as follows:

Year	(unit : m <sup>3</sup> /s)	
	Rangkasbitung	Kopomaja
1972	29.6	9.7
1976	34.0	11.6
1982	22.2	7.6
1983	30.3	12.1
1991	16.5	4.3
Mean of 24 years	66.5	16.7

The annual minimum daily mean discharge series for 24 years from 1970 to 1993 at Rangkasbitung and Kopomaja were shown in Table 9. Among those, the least daily mean discharges are as follows:

Sites	River Basin	Catchment Area (km <sup>2</sup> )	(unit:m <sup>3</sup> /s)				
			1972	1976	1982	1983	1991
Rangkasbitung	Ciujung	1,383	2.30	7.60	3.30	4.30	4.80
Kopomaja	Cidurian	304	0.80	1.90	0.70	1.50	0.10

The probable drought discharges at these stations were estimated by means of the Gumbel method using the aforesaid drought discharge series for 24 years. The frequency curve for



the annual minimum flow discharges at Rangkasbitung and Kopomaja are shown in Figure 7. Also, the probable drought discharges at the existing Pamarayan and Rancasumur weir sites were derived by using the probable drought discharges at Rangkasbitung and Kopomaja based on a ratio of catchment area to annual basin mean rainfall between the weir sites and the gauging stations as shown in the aforesaid figure. Result is given as follows:

Return Period (years)	Rangkasbitung	Pamarayan	Kopomaja	(unit : m <sup>3</sup> /sec)	
				Rancasumur	
2	14.9	15.5	2.7	3.2	
5	7.0	4.3	1.3	1.6	
10	3.5	3.6	0.9	1.1	
20	2.4	2.5	0.4	0.5	

## (2) Flood runoff

The recorded annual maximum flood discharges at Rangkasbitung in the Ciujung river, Kopomaja in the Cidurian river and Batubeulah in the Cisadane river are listed in Table 10. According to this table, the large floods occurred in the following years:

Year	Rangkas-bitung	Year	Kopomaja	Year	Batubeulah
1981	1,277	1981	388	1972	968
1982	1,672	1985	474	1986	1,098
1990	1,512	1986	490	1988	822
1993	1,712	1993	406	1990	1,327

The probable flood discharges were analyzed by means of the Gumbel method, and the result is shown in Figure 8 and summarized as below:

Return Period (years)	(unit : m <sup>3</sup> /sec)		
	Probable Flood Peak Discharges		
	Rangkasbitung	Kopomaja	Batubeulah
2	760	300	640
5	1,140	380	890
10	1,390	430	1,050
20	1,630	480	1,210
50	1,940	550	1,410
100	2,170	600	1,560
200	2,400	650	1,710

The flood peak discharge of 1,712 m<sup>3</sup>/s in December 1993 at Rangkasbitung was the recorded maximum flood and corresponds to the flood with a return period of 25 years.

While, the feasibility study on the Karian Multi-purpose Dam Construction Project estimated the 10-year probable flood peak discharge of 1,300 m<sup>3</sup>/s at Rangkasbitung under the condition without retardation effect by the envisaged dam/reservoir, which was the basic discharge for flood control planning in the study. Based on the updated frequency curve for the flood discharge records at Rangkasbitung, flood peak discharge of 1,300 m<sup>3</sup>/s is also evaluated to correspond to that with a return period of 10 years.



## **5. LOW FLOW ANALYSIS**

### **5.1 Procedure of Low Flow Analysis**

The low flow analysis aims at providing long-term discharge data for evaluating water resources in the Ciujung and Cidurian river basins and for planning its development. In the water resources development planning, safety level of water supply for municipal and industrial and irrigation is set at the probability once in 10 years and 5 years, respectively.

In the low flow analysis, the long-term discharges with an available period of longer than 10 years was required in order to meet the study criteria above. While, among the existing water level gauging stations, Rangkasbitung in the Ciujung river and Kopomaja in the Cidurian river both which have observation period of 24 years met this requirement.

From the above, the low flow analysis was carried out in accordance with the following procedures:

- (1) review of discharge rating curve at the aforesaid gauging stations,
- (2) double mass curve analysis and estimation of runoff coefficient for examination of consistency between runoff and rainfall
- (3) estimation of runoff data at the envisaged damsites and balance points based on the above mentioned runoff data.

### **5.2 Review of Discharge Rating Curve**

In order to review the discharge record available in the Ciujung and Cidurian river basins, the discharge rating curves and measurement record were collected from the related agencies. Also, the JICA Study Team carried out discharge measurement at the gauging station sites in the objective river basins for about one year from August 1993 to August 1994.

The discharge rating curves at the existing water level gauges at Rangkasbitung and Kopomaja have been periodically established based on the measurement result taking into account the river channel condition. The discharge measurement record carried out by the related agencies and by the JICA Study Team is shown in Tables 11 and 12. Figure 9 shows the existing rating curves established and discharge measurement records. The figure indicates that the current discharge rating curves fit well to discharge measurement data and that the rating curves is consistent with these data. Through this comparison, the current discharge rating curves are applicable for converting water level to discharge at Rangkasbitung and Kopomaja.



### 5.3 Double Mass Curve Analysis and Runoff Coefficient

#### (1) Interpolation of missing data

The missing data in the daily mean discharge records at Rangkasbitung and Kopomaja gauging stations for 24 years from 1970 to 1993 were interpolated by using the discharge record at other DPMA's stations and the Pamarayan and Rancasumur weirs and a ratio of catchment area and annual basin mean rainfall between the gauging station and weir sites by the following equation:

$$Q_{\text{Rang or Kopo}} = Q_{\text{available}} \cdot (R_{\text{Rang or Kopo}} / R_{\text{available}}) \cdot (A_{\text{Rang or Kopo}} / A_{\text{available}})$$

where,  $Q_{\text{Rang or Kopo}}$  : daily mean discharge at Rangkasbitung or Kopomaja  
 $Q_{\text{available}}$  : available daily mean discharge at Pamarayan or Rancasumur weirs  
 $R_{\text{Rang or Kopo}}$  : annual basin mean rainfall at Rangkasbitung or Kopomaja  
 $R_{\text{available}}$  : annual basin mean rainfall at Pamarayan or Rancasumur weirs  
 $A_{\text{Rang or Kopo}}$  : catchment area at Rangkasbitung or Kopomaja  
 $A_{\text{available}}$  : catchment area at DPMA's station, Pamarayan or Rancasumur

Water Level Gauging Station	Catchment Area (km <sup>2</sup> )	Annual Basin Mean Rainfall (mm)
Rangkasbitung	1,383	2,988
Pamarayan	1,451	2,957
Keragilan	1,812	2,785
Kopomaja	304	3,553
Rancasumur	376	3,445
Parigi	649	3,111

The hydrograph of the daily mean discharge series at these stations are illustrated in Figures 10 to 13 and their half-monthly discharges are given in Table 13.

#### (2) Relation between runoff and rainfall

In order to review the runoff data in the above-mentioned, the consistency of runoff data with the basin mean rainfall at the gauge sites were examined by means of; a) double mass plotting, b) runoff coefficient, and c) comparison of actual monthly rainfall pattern and runoff hydrograph.

The double mass curves illustrated in Figure 14 indicated the linear relationship between the basin mean rainfall and runoff at the aforesaid gauge sites. Also, the average runoff coefficient for 24 years were derived at reasonable ones of 0.72 at Rangkasbitung and 0.63 at Kopomaja, considering the annual rainfall around 4,000 mm and assuming the annual loss of 900 mm to 1,200 mm in Indonesia. Figures 15 and 16 show the monthly rainfall and runoff at the Rangkasbitung and Kopomaja.



Through the mentioned analyses, it was judged that the discharge data at these stations were well consistent with the rainfall in the basins and that the discharge data at the aforesaid gauging stations were applicable for evaluating availability of water resources in the Ciujung and Cidurian river basins.

#### 5.4 Flow Discharges at the Envisaged Damsites and Base Points

The flow discharge at the envisaged damsites and base points was estimated based on the discharge data at Rangkasbitung and Kopomaja gauging stations, applying a ratio of the average annual rainfall for 24 years and catchment area between the aforesaid key gauging stations and sites. The ratios for estimating flow discharges at the envisaged dam sites and base points are as follows:

Base Points	Catchment Area (km <sup>2</sup> )	Annual Mean Rainfall (mm)	Conversion Ratio
Rangkasbitung	1,383	2,988	-
Pamarayan weir	1,451	2,957	1.038
Karian dam	288	3,498	0.244
Pasir Kopo dam	172	3,101	0.129
Kopomaja	304	3,553	-
Rancasumur weir	376	3,445	1.199
Cilawang dam	93	3,558	0.306
Tanjung dam	280	3,673	0.952

The estimated flow discharge at the above sites are compiled into Annex 3 : Water Resources Study and their flow discharges for several excess percents based on flow discharge duration curve are summarized as follows:

Base Points	(unit : m <sup>3</sup> /s)						
	Max.	25 %	50 %	75 %	97 %	Min.	Mean
Rangkasbitung	1,010	118	68.5	37.5	10.1	2.3	94.2
Pamarayan	1,048	122	71.1	38.9	10.5	2.4	97.8
Karian dam	246	28.8	16.7	9.2	2.5	0.6	23.0
Pasir Kopo dam	130	15.2	8.8	4.8	1.3	0.3	12.2
Kopomaja	302	26.6	14.9	7.9	2.0	0.1	21.1
Rancasumur	362	31.9	17.9	9.5	2.4	0.1	25.3
Cilawang dam	92.4	8.1	4.6	2.4	0.6	0.0	6.5
Tanjung dam	287	25.3	14.2	7.5	1.9	0.1	20.1



## 6. FLOOD FLOW ANALYSIS

### 6.1 Procedure for Flood Flow Analysis

Flood flow analysis was made for providing probable flood discharges for preliminary design of cross drain and bridge structures of the Karian-Serpong conveyance system (KSCS) crossing over the existing rivers, and review of spillway capacity of the proposed Pasir Kopo dam at the master plan level.

Design scale of these structures was set at the following probability based on the standard in Indonesia and the following procedures were utilized for estimating those floods taking into account the scale of catchment areas, availability of data and result of the previous studies:

Structures	Standard	Method Applied
1) Cross drain	5-year probable flood peak discharge	The rational formula using rainfall data
2) Bridge structure	Probable flood peak discharge with a return period of 100 years	Equation presenting relationship between probable flood peak discharges and catchment areas established by the statistical analysis for the available flood data.
3) Spillway for Pasir Kopo dam	Probable maximum flood discharge hydrograph to examine retarding effect in a reservoir.	Storage function model using rainfall data to obtain flood hydrograph flowing into a reservoir

### 6.2 Flood Flow Analysis

#### 6.2.1 Cross drain of Karian-Serpong conveyance system

Since there is no data on flood discharge from the drainage area less than 10 km<sup>2</sup> in the study area, the following rational equation is applied for estimating the probable flood peak discharges:

$$Q_p = (1/3.6) \cdot f \cdot r \cdot A$$

Where ;  $Q_p$  : flood peak discharge (m<sup>3</sup>/sec),  
 $f$  : runoff coefficient,  
 $r$  : average rainfall intensity for concentration time (t) (mm/hour),  
 $t = 1.67 \times 10^{-3} \times \{L \cdot S^{0.5}\}^{0.7}$   
 $t$  : concentration time (hours)  
 $L$  : length of catchment area (m)  
 $S$  : average gradient of catchment area  
 $A$  : catchment area (km<sup>2</sup>).

Rainfall intensity of drainage areas illustrated in Figure 17 were estimated by applying relation between probable rainfall for 24 hours and its intensity and duration time, which has



been established by the DGWRD, Ministry of Public Works using Jakarta storm intensity data (Nedeco, 1972) and recorded storm intensity data for about 600 station-years for locations throughout Indonesia (Walker/Schenck, 1981). The relationship is shown in Figure 18. Maja rainfall gauging station (36A), which is located at the center of the route of the KSCS with an altitude of 40 m to 50 m similar to that of the KSCS, was adopted for estimate of probable rainfall for 24 hours and rainfall intensity by return period. The annual maximum rainfall series at Maja (36A), the estimated probable one day rainfall, and the frequency curve of the annual maximum daily rainfall by Gumbel method are shown in Figure 19. The probable flood discharges with an excess probability once in 5 years for drainage areas crossing the KSCS are shown in Tables 14 and 15. These design discharges for drainage structure range from 0.3 m<sup>3</sup>/s to 52.7 m<sup>3</sup>/s against drainage area from 0.017 to 9.872 km<sup>2</sup>.

### 6.2.2 Bridge structure

The structure type to cross over the Cisadane, Cimanceuri, Cimatuk, Cidurian and Cibeureum rivers were planned. Probable flood discharge with excess probability once in 100 years at the crossing site of the aforesaid rivers was estimated in order to select and design the structure type, aqueduct or siphon.

The relationship between catchment area and specific flood peak discharges was established by plotting probable flood peak discharges in Figure 7 and Creager's curve except the peak discharge at Kopomaja which has been affected by flood retardation for large scale flood in the upstream flat plane. The result is illustrated in Figure 20 and it is indicated that Creager's curve well presents the relationship between specific flood peak discharges and catchment areas. Therefore, the following Creager's equation was applied for estimating the probable flood peak discharges at the structure sites with a catchment area more than about 10 km<sup>2</sup> and its result is also shown in the aforesaid figure:

$$q = 46 \cdot C \cdot A^{a-1}, \quad a = 0.894 \cdot A^{-0.048}$$

Where;      $q$  : specific peak discharge (ft<sup>3</sup>/sec/mile<sup>2</sup>)  
                $A$  : catchment area (mile<sup>2</sup>)  
                $C$  : Creager's coefficient

The Creager's coefficients of probable flood peak discharges are shown as follows:

Return Period (years)	Creager's Coefficient
2	9
5	14
10	17
20	20
50	23
100	26
200	29



### 6.2.3 Pasir Kopo Dam

Discharge hydrographs for probable flood and probable maximum flood (PMF) at the Pasir Kopo damsite were generated by using the probable maximum rainfall (PMR) estimated from the long-term daily rainfall at Cilaki rainfall gauging station (43B) located in the river basin of the Pasir Kopo dam. The annual maximum daily rainfall of Cilaki rainfall gauging station (43B), probable 1-day rainfall of the station and frequency curve of the annual maximum daily rainfall by the Gumbel method are given in Figure 21.

The PMR at this station was estimated at 620 mm by means of the Hershfield's approach based on the result of the frequency analysis. Basic equation of Hershfield's approach is described as follows:

$$PMR = X_n + K_m \cdot S_n$$

where ; PMR	:	Possible maximum 1-day rainfall (mm)
X <sub>n</sub>	:	Average annual maximum 1-day rainfall (94.6 mm)
K <sub>m</sub>	:	K-value (15.2)
S <sub>n</sub>	:	Standard deviation (34.7)

To convert the PMR at Cilaki to basin mean PMR in the Pasir Kopo dam basin, the area reduction factor of 0.9 was applied to the aforesaid PMR of 620 mm at Cilaki based on the relationship between area and area reduction factor as shown in Figure 22, which was established by the Ministry of Public Works. Thus, the basin mean PMR with one day duration was estimated at 560 mm for the Pasir Kopo dam.

The hourly distribution of the PMR as shown in Figure 23 was derived by adopting the aforesaid relationship between rainfall amount, intensity and duration established by Ministry of Public Works.

As for the flood runoff model in the Cisimeut river basin, the feasibility study on the Karian Multipurpose Dam Construction Project in 1985 established the model using the Storage Function through calibration of the model. In estimation of the discharge hydrographs of probable flood and PMF at the Pasir Kopo damsite, this storage function model was applied for generation of the flood hydrograph since there are no sufficient data to further verify the runoff model. Basic equations of the storage function of the basin model is described as follows:

$$S = K \cdot Q^P$$

$$ds/dt = (1/3.6) \cdot f \cdot r \cdot A - Q$$

where, S	:	basin storage (m <sup>3</sup> )
Q	:	runoff from basin except base flow (cms)
K and P	:	constants
t	:	time(sec)
f	:	runoff coefficient
r	:	basin mean rainfall(mm/hr)



A : catchment area ( $\text{km}^2$ )

Constants K and P in the equation, primary run-off coefficient  $f_1$  and saturation rainfall  $R_{sa}$  of the Cisimeut river basin are given as follows:

K = 76.7  
P = 0.333  
 $f_1$  = 0.83  
 $R_{sa}$  = 170.0

The peak discharge of the PMF for Pasir Kopo dam was estimated at  $3,300 \text{ m}^3/\text{s}$  with the Creager's coefficient of 120 and specific discharge of  $19.2 \text{ m}^3/\text{s}/\text{km}^2$ . The peak discharge at each return period for Pasir Kopo dam are shown as follows:

Return Period (years)	Peak Discharge ( $\text{m}^3/\text{s}$ )	Specific Discharge ( $\text{m}^3/\text{s}$ )
PMF	3300	19.2
200	730	4.2
100	610	3.5
50	530	3.1
25	420	2.4
20	400	2.3
10	320	1.8
5	280	1.6

Comparing the result for the Karian, Cilawang and Tanjung dam schemes, it was judged to be reasonable from relationship between the specific discharge and catchment area in Indonesia as shown in Figure 24.

Description	Karian	Cilawang	Tanjung	Pasir Kopo
Flood Runoff	3,400	1,700	3,098	3,300
Catchment Area ( $\text{km}^2$ )	288	93	280	172
Specific Discharge ( $\text{m}^3/\text{s}/\text{km}^2$ )	11.8	18.3	11.1	19.2

The derived hydrographs of the PMF and probable flood with several return periods are illustrated in Figure 25.



## 7. SEDIMENT ANALYSIS

### 7.1 Sediment Survey

The sediment survey was undertaken from August in 1993 to January in 1994 by the JICA Study Team in order to obtain the physical characteristics of sediment load in the Ciujung and Cidurian rivers. The result is described as follows:

#### 7.1.1 Riverbed material

The riverbed material sampling was carried out at Rangkasbitung, Kopomaja, Sabagi and Gadeg water level gauging station sites and Tanjung damsite twice during the study in order to grasp the grain size distribution of the riverbed material by using dredging sampler. The locations of sediment sampling are shown in Figure 26. The grain size distributions of the riverbed material are shown in Table 16 and Figure 27. Their average grain sizes are summarized as follows:

Location	River	D50 (mm)
Gadeg	Cibeureum	2.05
Rangkasbitung	Ciujung	0.34
Sabagi	Ciberang	0.38
Kopomaja	Cidurian	0.18
Tanjung 1	Cidurian	0.75
Tanjung 2	Cipangaur	0.58

#### 7.1.2 Wash and suspended loads

The existing suspended load sampling record in the Ciujung and Cidurian rivers was collected as shown in Table 17. The additional suspended load sampling was carried out by the JICA Study Team at the aforesaid 6 stations 9 times during the study by using depth-integrated hand sampler in order to review the existing sediment rating curve.

In sampling, three (3) samples were taken in a section, that is at the center in a section and left and right bank sides. Then, sediment concentration in a section was derived as a mathematical average. The average sediment concentration of the samples in a section are shown in Table 18.

The sediment rating curve at Rangkasbitung in the Ciujung river and at Kopomaja in Cidurian river were established by using the measurement records as shown in Figure 28 and the equations applied are given below:

$$\text{Ciujung river} : Q_s = 2.301 \cdot Q^{1.513}$$

$$\text{Cidurian river} : Q_s = 3.011 \cdot Q^{1.626}$$

where  $Q_s$  : Sediment Yield (ton/day)  
 $Q$  : Flow discharge ( $\text{m}^3/\text{sec}$ )



The grain size distribution of wash and suspended loads are shown in Table 19 and Figure 29. The average grain size of wash and suspended loads at each location is summarized below:

Location	River	D50 (mm)
Gadeg	Cibeureum	0.002 - 0.050
Rangkasbitung	Ciujung	0.008 - 0.060
Sabagi	Ciberang	0.010 - 0.150
Kopomaja	Cidurian	0.010 - 0.100
Tanjung 1	Cidurian	0.014 - 0.070
Tanjung 2	Cipangaur	0.012 - 0.080

The average grain size of the suspended load at each river ranging from 0.002 mm to 0.15 mm is very fine and classified into silt.

## 7.2 Sediment Analysis for Pasir Kopo Dam

Based on the result of sediment analysis on the wash and suspended loads at Leuwidamar, Cileles, Sabagi and Sajira water level gauging stations which are located in the mountainous area and have the catchment areas within 300 km<sup>2</sup>, a sediment rating curve was established at the Pasir Kopo dam site with a catchment area of 172 km<sup>2</sup> by enveloping the observed data. Figure 30 shows the observed data and the established equation as given below:

$$Q_s = 3.0 \cdot Q^{2.07}$$

Where :  $Q_s$  : sediment discharge (ton/day)  
 $Q$  : flow discharge (m<sup>3</sup>/sec)

The annual average wash and suspended loads flowing into the Pasir Kopo reservoir was estimated at 393,000 ton/year by using above rating curve and daily discharge data at Pasir Kopo damsite estimated from the daily mean discharge at Rangkasbitung by multiplying a ratio of 0.129 of the annual basin mean rainfall and catchment area as shown in Table 20. Assuming the bed load of 10% for wash and suspended loads, the annual total sediment load was derived at 432,000 ton/year in average for 24 years from 1970 to 1993.

The annual average reservoir sedimentation volume was estimated at 380,000 m<sup>3</sup>/year by assuming the trap efficiency of 95% based on Brune's relation between storage capacity and inflow runoff shown in Figure 31 and soil density of 1.1 ton/m<sup>3</sup>. The sediment storage volume occupied by 100 year sediment transport in the proposed reservoir was estimated at about 38 x 10<sup>6</sup> m<sup>3</sup>.



# ***TABLES***



1





Table 2 AVAILABILITY OF COLLECTED RAINFALL DATA (2/2)

Station Code	Name of Station	Year																																																	
		1950's												1960's												1970's												1980's												1990's	
		0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3						
38A	Lewuidamar																																																		
38D	G. Tunggul																																																		
38E	Bantarjaya																																																		
40	Bojongmanik																																																		
40A	Pasirmaung																																																		
42A	Sajira																																																		
43	Muncang																																																		
43	Cimulang																																																		
43A	Panggarangan (Cisih)																																																		
43B	Cilaki Muncang																																																		
44	Cipanas																																																		
44A	Banjar Irigasi																																																		
45A	Cirotan Bayak																																																		
45B	Lebak Sembada																																																		
46B	G. Mandur																																																		
46C	Cikotok																																																		

## Remarks:

- Daily Rainfall Data
- ▨ Monthly Rainfall Data



Table 3 WATER LEVEL GAUGING STATIONS AND AVAILABILITY OF DATA

## (A) Existing Water Level Gauging Stations

River System	Location	Catchment Area (km <sup>2</sup> )	Type	Installed by	Established Date
Ciberang	Cileuksa	58	A	T.A	1929
Ciberang	Sajira	233	S	P3SA	1977
Ciberang	Sabagi	301	A&S	DPMA	1984
Cisimeut	Leuwidamar	183	A&S	P3SA	1979
Cisimeut	Pariuk	458	S	P3SA	1977
Ciujung	Cileles	216	A&S	P3SA	1978
Ciujung	Rangkasbitung	1,383	A&S	DPMA	1969
Ciujung	Pamarayan	1,451	S	DPU	
Ciujung	Kragilan	1,812	A&S	DPMA	1969
Cibeureum	Gadeg	117	A&S	P3SA	1982
Cibeureum	Neglasari	127	S	DPMA	1985
Cidurian	Tanjung	265	S	P3SA	1978
Cidurian	Kopomaja	304	A&S	DPMA	1969
Cidurian	Rancasumur	376	A&S	DPU	1978
Cidurian	Parigi	649	A&S	DPMA	1969

Note : Type of Gauge    A ; Automatic gauge    S ; Manual gauge

## (B) Availability of Runoff Data

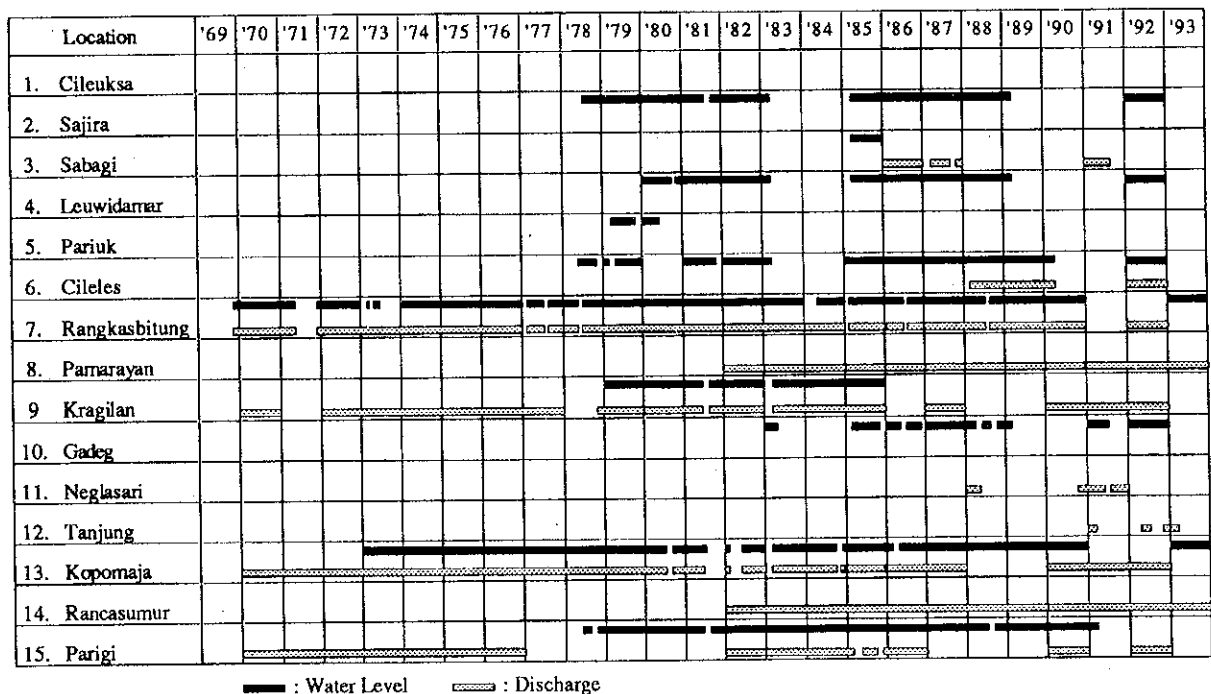




Table 4 CLIMATIC RECORD AT SERANG

(1) Mean temperature (Unit : °C)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Mean
1984	25.9	26.3	26.1	26.9	26.7	26.4	26.3	26.3	26.1	27.2	26.9	26.3	26.5
1985	26.3	26.9	26.6	26.5	27.1	26.1	25.6	26.4	26.4	26.7	27.4	26.6	26.6
1986	25.9	26.1	26.3	26.9	26.8	26.4	25.9	25.5	25.9	26.5	26.1	26.7	26.3
1987	26.1	26.0	26.6	27.0	26.7	27.0	26.6	26.4	26.9	27.9	27.9	26.7	26.8
1988	26.8	26.7	26.8	27.0	26.9	26.6	26.5	26.3	26.9	26.9	26.7	25.9	26.7
1989	26.3	25.4	26.4	26.6	26.7	26.2	26.5	26.3	26.5	27.1	26.9	26.4	26.4
1990	25.7	26.3	26.4	27.2	26.9	26.6	26.0	26.2	26.7	27.1	27.3	26.3	26.6
1991	26.4	27.3	26.5	26.4	26.1	25.1	26.5	26.3	26.7	27.1	26.2	26.7	26.4
1992	26.0	25.3	26.8	26.7	26.6	26.6	26.4	26.0	26.0	25.6	25.8	26.1	26.2
1993	25.9	25.7	26.7	26.2	26.9	26.4	26.4	26.1	26.0	26.7	26.5	26.5	26.3
Mean	26.1	26.2	26.5	26.7	26.7	26.3	26.3	26.2	26.4	26.9	26.8	26.4	26.5

(2) Mean relative humidity (Unit : %)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Mean
1984	83	83	84	82	83	79	80	79	81	76	80	80	81
1985	83	80	81	84	81	82	83	77	79	79	75	78	80
1986	84	82	83	83	81	82	79	79	82	81	82	83	82
1987	85	85	83	83	84	81	77	75	75	73	73	81	80
1988	82	83	84	84	85	81	78	79	77	78	79	83	81
1989	85	87	80	81	83	81	78	80	80	77	79	85	81
1990	87	86	85	82	83	82	81	82	80	79	79	83	82
1991	82	83	84	83	80	83	77	73	72	67	75	82	78
1992	83	83	82	80	83	77	77	80	82	82	84	81	81
1993	83	84	83	85	83	83	80	82	81	78	82	82	82
Mean	84	84	83	83	83	81	79	79	79	77	79	82	81

(3) Mean wind velocity (Unit : Knots)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Mean
1984	5	4	5	4	4	4	5	4	4	4	6	6	5
1985	6	7	7	6	5	5	5	5	6	6	6	6	6
1986	6	6	6	6	5	5	5	5	5	5	6	5	5
1987	6	5	6	5	5	5	5	6	6	6	6	5	6
1988	5	5	5	5	4	4	5	5	5	5	6	5	5
1989	5	5	5	5	4	5	5	5	5	5	5	5	5
1990	6	5	6	6	6	5	5	6	6	6	5	6	6
1991	5	7	5	5	5	5	5	6	6	5	4	5	5
1992	4	5	5	4	7	4	5	5	5	5	5	5	5
1993	5	5	6	5	5	5	5	5	5	5	5	6	5
Mean	5	5	6	5	5	5	5	5	5	5	5	5	5

(4) Sunshine hours (Unit : % 08:00 - 18:00)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Mean
1984	27	28	45	58	65	73	73	71	55	58	55	35	54
1985	56	57	60	60	76	55	61	85	78	53	53	47	62
1986	21	52	50	68	73	55	74	65	62	53	47	61	57
1987	27	39	73	62	73	58	81	89	75	76	62	32	62
1988	40	55	37	68	66	68	85	66	83	50	43	37	58
1989	52	21	58	63	61	65	77	68	73	53	45	45	57
1990	18	50	53	70	68	55	76	58	80	69	67	34	58
1991	32	38	58	58	74	75	78	84	71	79	45	42	61
1992	59	50	39	65	73	76	73	69	67	48	47	48	60
1993	48	53	70	58	64	42	77	69	78	71	53	31	60
Mean	38	44	54	63	69	62	76	72	72	61	52	41	59



Table 5 MONTHLY BASIN MEAN RAINFALL (1/3)

*(1) Rangkasbitung* (unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Wet season	Dry season	Annual Rainfall
1970	365	415	368	447	486	264	110	83	166	168	273	516	-	1,277	3,661
1971	420	435	462	122	128	236	149	144	191	301	181	189	2,228	1,149	2,958
1972	406	199	282	158	238	54	56	105	66	112	181	197	1,416	631	2,055
1973	262	178	282	241	291	225	76	231	332	322	277	390	1,340	1,476	3,105
1974	444	431	341	240	238	140	141	290	403	182	263	242	2,122	1,396	3,356
1975	307	361	292	329	247	59	210	208	304	246	194	429	1,793	1,273	3,184
1976	589	199	301	154	90	106	74	106	40	154	218	200	1,866	569	2,232
1977	311	287	398	395	374	176	100	53	44	88	164	294	1,808	835	2,683
1978	444	191	450	172	153	223	194	204	282	200	199	269	1,715	1,256	2,980
1979	366	317	260	228	117	83	152	78	145	192	336	277	1,638	768	2,551
1980	552	198	289	253	264	162	220	308	302	227	371	567	1,904	1,482	3,712
1981	549	329	375	280	347	420	453	260	436	389	607	493	2,471	2,304	4,937
1982	639	308	206	443	174	106	164	34	121	198	419	350	2,696	797	3,161
1983	374	221	259	283	270	130	162	33	153	327	569	313	1,905	1,076	3,095
1984	366	341	410	441	296	128	180	196	321	171	240	217	2,440	1,292	3,307
1985	285	350	299	335	261	155	281	134	275	201	196	259	1,724	1,307	3,030
1986	465	234	264	328	292	166	183	79	267	190	269	250	1,747	1,177	2,988
1987	417	259	353	241	264	154	106	37	41	161	108	226	1,789	762	2,366
1988	294	322	393	263	192	67	113	176	259	204	234	260	1,604	1,011	2,777
1989	329	562	124	106	239	88	137	209	181	190	232	276	1,615	1,044	2,672
1990	628	205	320	200	272	104	233	186	232	191	192	335	1,861	1,217	3,098
1991	280	445	192	159	65	57	91	17	64	132	299	282	1,603	426	2,082
1992	256	280	287	313	151	98	132	174	188	263	292	226	1,717	1,006	2,660
1993	339	285	173	324	326	112	95	314	263	160	222	449	1,639	1,269	3,061
Mean	404	306	307	269	241	146	159	152	212	207	272	313	1,854	1,117	2,988
Min.	256	178	124	106	65	54	56	17	40	88	108	189	1,340	426	2,055
Max.	639	562	462	447	486	420	453	314	436	389	607	567	2,696	2,304	4,937

*(2) Pamaruyan* (unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Wet season	Dry season	Annual Rainfall
1970	361	410	362	442	481	260	108	82	163	166	268	509	-	1,259	3,610
1971	416	429	453	126	127	234	145	144	189	304	178	186	2,200	1,142	2,930
1972	407	197	283	156	237	53	54	104	63	110	179	195	1,407	620	2,037
1973	259	179	274	236	285	222	75	226	327	318	272	381	1,322	1,452	3,054
1974	437	425	336	238	235	141	142	284	399	179	262	236	2,089	1,380	3,315
1975	303	354	287	325	246	59	205	207	300	242	192	420	1,767	1,259	3,140
1976	588	197	301	156	93	105	73	108	40	151	215	196	1,854	569	2,222
1977	313	281	389	388	363	175	96	52	44	86	162	292	1,782	816	2,640
1978	440	189	442	173	150	223	194	200	276	198	194	267	1,697	1,242	2,947
1979	367	310	254	226	118	81	151	76	148	190	329	275	1,618	763	2,524
1980	543	197	284	252	259	161	218	301	295	224	368	560	1,880	1,458	3,662
1981	548	330	374	274	341	413	446	255	427	384	607	488	2,454	2,265	4,885
1982	634	307	204	439	175	107	162	34	119	195	410	343	2,679	791	3,128
1983	366	219	257	282	269	129	160	32	151	325	563	313	1,877	1,065	3,065
1984	366	345	409	438	296	126	179	198	317	168	239	218	2,433	1,284	3,298
1985	285	343	296	330	261	157	275	132	277	203	194	254	1,711	1,304	3,007
1986	463	232	261	320	285	163	182	79	262	187	267	250	1,724	1,157	2,950
1987	415	259	347	236	262	153	104	37	40	158	108	223	1,775	753	2,341
1988	292	320	390	261	190	65	111	173	253	204	230	257	1,596	996	2,748
1989	325	564	122	107	236	90	138	210	179	187	231	273	1,606	1,040	2,662
1990	621	204	317	198	268	101	227	185	227	191	189	332	1,844	1,199	3,059
1991	279	441	191	159	64	56	88	17	62	128	295	280	1,590	416	2,060
1992	254	278	283	312	150	100	131	174	188	263	291	226	1,702	1,007	2,650
1993	338	289	171	321	323	112	93	310	258	158	220	442	1,636	1,253	3,034
Mean	401	304	304	267	238	145	157	151	208	205	269	309	1,837	1,104	2,957
Min.	254	179	122	107	64	53	54	17	40	86	108	186	1,322	416	2,037
Max.	634	564	453	442	481	413	446	310	427	384	607	560	2,679	2,265	4,885

Remarks : Dry season : May to October  
Wet season : November to April



Table 6 MONTHLY BASIN MEAN RAINFALL (2/3)

(3) Kragilan (unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Wet season	Dry season	Annual Rainfall
1970	341	385	327	397	460	250	105	86	143	158	254	500		1,203	3,408
1971	384	405	420	132	116	218	131	137	170	300	168	184	2,095	1,070	2,762
1972	433	196	296	148	223	45	42	88	51	94	171	199	1,425	542	1,986
1973	280	201	264	227	283	217	81	205	302	305	245	328	1,342	1,392	2,937
1974	398	411	312	224	231	144	133	246	367	176	257	234	1,917	1,298	3,132
1975	297	336	261	297	229	62	179	181	258	229	181	381	1,681	1,139	2,892
1976	564	197	300	167	97	97	73	105	46	144	217	192	1,791	562	2,199
1977	335	281	356	347	309	186	84	46	45	81	145	283	1,727	751	2,498
1978	414	190	399	166	138	211	189	191	249	189	176	257	1,597	1,166	2,769
1979	393	281	242	216	121	79	134	76	143	168	295	268	1,564	720	2,414
1980	506	208	253	238	228	153	190	269	259	212	334	503	1,768	1,311	3,352
1981	514	310	337	239	305	351	382	226	366	353	543	435	2,235	1,984	4,360
1982	604	280	215	406	166	92	140	37	98	167	367	298	2,481	699	2,868
1983	340	213	250	284	267	115	143	29	125	299	517	306	1,752	978	2,888
1984	347	319	388	398	285	119	169	192	299	159	222	227	2,275	1,222	3,124
1985	275	302	296	315	232	160	249	121	252	197	173	234	1,638	1,212	2,806
1986	451	210	241	288	256	147	176	76	235	179	271	248	1,596	1,068	2,776
1987	410	260	328	223	249	148	91	31	36	149	116	210	1,740	704	2,250
1988	291	325	364	241	179	63	101	157	210	202	227	254	1,546	912	2,614
1989	297	556	117	109	216	88	126	196	167	171	205	265	1,560	963	2,512
1990	588	199	290	182	242	96	196	175	199	187	178	321	1,729	1,094	2,851
1991	276	419	186	163	64	50	78	15	54	121	270	267	1,542	381	1,962
1992	250	294	263	287	146	97	122	181	183	262	264	228	1,631	992	2,577
1993	340	296	161	312	294	124	84	271	234	150	222	406	1,602	1,158	2,895
Mean	389	295	286	250	222	138	142	139	187	194	251	293	1,749	1,014	2,785
Min.	250	190	117	109	64	45	42	15	36	81	116	184	1,342	381	1,962
Max.	604	556	420	406	460	351	382	271	367	353	543	503	2,481	1,984	4,360

(4) Kopomaja (unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Wet season	Dry season	Annual Rainfall
1970	493	336	389	342	731	223	81	275	273	182	340	532		1,765	4,198
1971	382	466	434	262	383	425	71	210	177	374	237	180	2,417	1,640	3,600
1972	468	237	370	293	391	82	14	95	14	96	137	192	1,784	692	2,388
1973	186	194	361	430	460	525	71	243	274	360	341	588	1,500	1,931	4,031
1974	759	340	303	212	343	123	336	395	493	341	438	298	2,541	2,031	4,380
1975	500	533	255	620	341	117	260	288	536	257	386	357	2,645	1,799	4,451
1976	965	232	396	193	196	90	124	202	78	255	204	156	2,529	945	3,090
1977	245	564	320	727	504	226	247	136	81	141	150	274	2,215	1,334	3,613
1978	328	147	382	134	167	180	211	68	202	268	294	369	1,415	1,096	2,751
1979	493	319	367	518	246	187	168	174	200	194	626	355	2,360	1,169	3,846
1980	605	206	340	212	355	185	254	429	348	330	384	454	2,343	1,901	4,101
1981	524	339	541	404	359	680	586	244	521	416	299	483	2,644	2,805	5,395
1982	351	285	222	502	194	140	135	47	73	117	256	363	2,142	706	2,684
1983	588	323	284	204	243	118	85	39	172	414	612	385	2,018	1,072	3,468
1984	340	259	303	199	99	55	91	246	344	214	252	251	2,099	1,048	2,653
1985	372	437	286	256	351	211	293	163	391	313	246	184	1,854	1,721	3,502
1986	300	329	352	593	307	209	179	103	357	234	329	317	2,003	1,389	3,608
1987	542	301	167	371	387	151	128	41	53	296	74	198	2,027	1,056	2,708
1988	377	494	396	379	441	171	145	272	352	287	260	403	1,918	1,666	3,975
1989	492	366	74	73	262	27	175	372	350	334	293	401	1,667	1,519	3,217
1990	633	310	343	231	390	260	332	308	321	379	388	416	2,210	1,990	4,311
1991	249	403	162	217	174	75	105	58	125	143	340	267	1,836	680	2,319
1992	307	358	596	480	288	119	250	72	246	374	455	194	2,348	1,349	3,738
1993	418	305	186	519	328	153	160	190	140	214	180	457	2,077	1,184	3,248
Mean	455	337	326	349	331	197	188	194	255	272	313	336	2,113	1,423	3,553
Min.	186	147	74	73	99	27	14	39	14	96	74	156	1,415	680	2,319
Max.	965	564	596	727	731	680	586	429	536	416	626	588	2,645	2,805	5,395

Remarks : Dry season : May to October  
Wet season : November to April



Table 7 MONTHLY BASIN MEAN RAINFALL (3/3)

(5) *Rancasumur* (unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Wet season	Dry season	Annual Rainfall
1970	484	329	372	331	699	218	79	260	262	178	320	503		1,696	4,033
1971	370	455	414	252	357	400	66	197	168	380	224	173	2,313	1,568	3,455
1972	455	229	364	285	383	78	13	95	13	94	130	185	1,731	675	2,324
1973	182	196	340	416	441	505	69	231	283	345	339	556	1,450	1,874	3,903
1974	724	334	299	222	334	124	329	374	497	324	423	286	2,473	1,982	4,268
1975	481	504	247	601	330	110	247	285	515	249	374	356	2,542	1,736	4,299
1976	930	227	392	194	193	88	123	207	81	254	195	153	2,474	946	3,037
1977	250	529	305	690	479	222	231	131	77	136	150	265	2,121	1,276	3,465
1978	328	147	373	138	160	184	205	71	197	263	279	364	1,400	1,080	2,709
1979	494	308	347	501	239	174	162	165	199	187	592	349	2,292	1,126	3,715
1980	588	205	326	216	346	179	257	406	335	324	367	437	2,276	1,846	3,984
1981	520	345	522	381	342	651	550	225	493	408	305	469	2,571	2,669	5,210
1982	347	295	226	489	199	139	131	46	71	115	247	351	2,130	700	2,655
1983	556	311	293	208	249	115	86	37	164	410	581	372	1,966	1,061	3,383
1984	338	257	297	198	115	52	91	237	332	205	248	265	2,043	1,032	2,634
1985	358	419	278	259	354	223	277	155	375	310	239	181	1,826	1,695	3,428
1986	303	314	334	560	291	198	174	104	338	221	317	310	1,931	1,327	3,464
1987	522	292	163	348	375	146	127	38	54	284	78	188	1,952	1,024	2,615
1988	355	469	401	379	424	162	137	256	328	276	248	387	1,870	1,581	3,821
1989	470	372	78	82	253	28	169	359	333	313	281	393	1,636	1,456	3,132
1990	616	303	337	225	371	245	316	300	307	370	367	404	2,156	1,911	4,163
1991	245	393	160	218	172	72	97	53	118	136	322	256	1,788	648	2,242
1992	301	337	560	453	276	114	232	80	237	360	436	201	2,228	1,299	3,586
1993	410	306	187	490	311	159	150	182	133	209	179	439	2,030	1,144	3,155
Mean	443	328	317	339	320	191	180	187	246	265	302	327	2,052	1,390	3,445
Min.	182	147	78	82	115	28	13	37	13	94	78	153	1,400	648	2,242
Max.	930	529	560	690	699	651	550	406	515	410	592	556	2,571	2,669	5,210

(6) *Parigi* (unit : mm)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Wet season	Dry season	Annual Rainfall
1970	453	318	322	301	604	204	74	215	230	171	266	425		1,497	3,582
1971	338	428	368	220	295	333	55	161	142	379	188	155	2,085	1,364	3,062
1972	428	207	348	258	353	65	11	91	10	83	109	171	1,697	612	2,131
1973	179	209	290	370	385	439	62	202	292	299	322	461	1,520	1,677	3,508
1974	625	321	284	239	301	126	302	308	490	274	375	257	1,831	1,802	3,902
1975	425	423	221	531	290	89	209	267	442	223	334	347	2,100	1,521	3,801
1976	826	211	374	194	178	80	115	211	82	242	169	147	2,281	908	2,830
1977	269	435	263	582	404	215	183	114	67	119	144	238	1,922	1,101	3,032
1978	317	143	338	141	137	185	185	75	177	244	236	339	1,931	1,003	2,516
1979	476	273	293	443	213	138	145	139	187	167	491	333	1,513	988	3,297
1980	528	214	281	222	312	160	251	339	295	300	313	385	2,309	1,657	3,600
1981	501	347	459	316	312	555	451	173	409	374	318	428	1,944	2,273	4,639
1982	348	312	229	438	204	130	117	41	64	107	219	319	2,366	662	2,526
1983	466	274	305	218	252	106	87	30	137	387	503	333	1,864	998	3,099
1984	327	257	277	187	146	44	90	208	296	184	231	290	2,100	969	2,538
1985	321	364	253	258	342	242	237	135	336	294	216	176	1,569	1,586	3,173
1986	306	278	284	466	247	168	163	104	286	190	283	286	1,588	1,158	3,061
1987	469	272	158	287	336	128	119	30	52	245	85	168	1,903	910	2,348
1988	299	407	396	370	375	137	114	210	258	243	216	344	1,438	1,338	3,370
1989	406	393	87	105	226	31	151	319	282	253	245	369	2,033	1,262	2,867
1990	569	279	316	208	316	206	269	273	261	334	305	371	1,606	1,659	3,707
1991	239	366	156	218	162	61	74	41	96	117	270	224	2,047	550	2,023
1992	289	290	460	378	235	101	182	99	214	316	384	214	1,473	1,147	3,162
1993	382	307	179	404	263	168	121	165	122	193	184	403	2,015	1,031	2,890
Mean	408	305	289	306	287	171	157	165	218	239	267	299	1,875	1,236	3,111
Min.	179	143	87	105	137	31	11	30	10	83	85	147	1,438	550	2,023
Max.	826	435	460	582	604	555	451	339	490	387	503	461	2,366	2,273	4,639

Remarks : Dry season : May to October  
Wet season : November to April



Table 8 COEFFICIENT OF THIESSEN POLYGON

(unit : %)							
Rainfall Station No.	Name of Station	Rangkas- bitung	Pamarayan	Kragilan	Kopomaja	Parigi	Rancasmur
18	Ciomas			0.1			
21	Mandalawangi	0.5	0.5	0.4			
22	Cimanuk	5.0	4.8	3.7			
23	Serang						
23C	Kramatwetan			2.2			
23F	Ciruas			0.3			
24	Baros			4.7			
26	Pandeglang	4.7	4.5	6.2			
26B	Cileles	9.9	9.5	7.3			
26C	Warunggung	4.8	4.6	6.7			
27	G. Kencana	6.4	6.1	4.7			
33	Parigi			0.7		5.1	
35	Pamarayan		0.8	7.4		0.1	
36A	Maja	1.5	2.4	2.9	17.4	36.6	23.8
37	Rangkasbitung	7.0	8.8	8.1			
38A	Sampang Peudeuy	14.5	13.9	10.7			
43B	Cilaki Muncang	31.5	30.3	23.3			
44	Cipanas	14.3	13.7	10.6	82.6	58.1	76.2
Total		100.0	100.0	100.0	100.0	100.0	100.0



Table 9 ANNUAL MINIMUM DAILY MEAN DISCHARGE SERIES  
AT RANGKASBITUNG AND KOPOMAJA

Year	(unit: cu.m/sec)			
	Rangkasbitung		Kopomaja	
	Discharge (cu.m/s)	Order	Discharge (cu.m/s)	Order
1970	15.0	15	0.6	2
1971	12.8	13	3.4	16
1972	2.3	1	0.8	4
1973	24.4	20	5.0	22
1974	27.0	22	4.0	19
1975	18.0	18	3.8	18
1976	7.6	5	1.9	9
1977	7.6	6	2.3	11
1978	17.7	17	4.4	20
1979	12.8	14	5.6	23
1980	18.1	19	3.7	17
1981	28.2	23	3.1	14
1982	3.3	2	0.7	3
1983	4.3	3	1.5	6
1984	10.3	8	2.0	10
1985	10.9	9	2.4	12
1986	11.5	11	3.0	13
1987	34.7	24	1.5	7
1988	15.6	16	1.5	5
1989	24.7	21	1.7	8
1990	12.6	12	4.4	21
1991	4.8	4	0.1	1
1992	11.0	10	3.1	15
1993	7.9	7	6.3	24



Table 10 ANNUAL MAXIMUM FLOOD PEAK DISCHARGE SERIES  
AT RANGKASBITUNG, KOPOMAJA AND BATUBULAH

Year	Rangkasbitung		Kopomaja		Batubulah	
	Discharge (cu.m/s)	Order	Discharge (cu.m/s)	Order	Discharge (cu.m/s)	Order
1970	643	15	272	15	766	6
1971	659	14	308	12	448	19
1972	637	16	264	18	968	3
1973	510	22	380	5	747	8
1974	552	20	338	8	564	14
1975	534	21	267	17	652	10
1976	688	13	356	6	391	20
1977	697	12	322	10	501	17
1978	712	11	271	16	562	15
1979	772	8	335	9	545	16
1980	599	17	295	13	620	12
1981	1,277	4	388	4	469	18
1982	1,672	2	316	11	754	7
1983	596	18	238	19	645	11
1984	731	10	231	22	338	22
1985	1,032	5	474	2	734	9
1986	764	9	490	1	1,098	2
1987	478	23	354	7	802	5
1988	590	19	202	24	822	4
1989	802	7	217	23	390	21
1990	1,512	3	236	20	1,327	1
1991	994	6	233	21	616	13
1992	388	24	289	14	-	-
1993	1,712	1	406	3	-	-

Note: Instantaneous discharges at Rangkasbitung in 1991 and at Kopomaja in 1982 are estimated from daily mean discharge.



Table 11 RESULT OF DISCHARGE MEASUREMENT CARRIED OUT BY THE PREVIOUS STUDIES AND PROJECTS

## (1) Rangkasbitung in the Cijung River

No.	Date	Discharge (cu.m/s)	Water Level (m)	No.	Date	Discharge (cu.m/s)	Water Level (m)	No.	Date	Discharge (cu.m/s)	Water Level (m)
1.	26/10/1969	45.0	1.11	38.	29/09/1975	110.0	1.83	75.	12/02/1981	66.3	1.43
2.	26/10/1969	46.0	1.10	39.	22/11/1975	57.3	1.35	76.	07/03/1981	93.0	1.72
3.	30/03/1970	50.3	1.38	40.	08/01/1976	273.0	3.27	77.	15/03/1981	64.9	1.37
4.	23/03/1970	50.4	1.38	41.	29/06/1976	16.5	0.66	78.	22/03/1981	104.0	1.90
5.	02/03/1971	59.2	1.40	42.	25/08/1977	10.7	0.52	79.	22/05/1981	115.0	1.97
6.	02/03/1971	56.4	1.40	43.	08/01/1977	33.9	1.00	80.	25/05/1981	56.4	1.39
7.	03/03/1971	56.3	1.33	44.	07/03/1977	183.0	2.64	81.	27/05/1981	47.3	1.28
8.	03/03/1971	56.4	1.33	45.	24/04/1977	65.8	1.45	82.	28/05/1981	41.4	1.12
9.	07/03/1971	394.0	3.94	46.	17/06/1977	66.1	1.49	83.	26/06/1981	56.9	1.40
10.	07/03/1971	362.0	3.99	47.	27/07/1977	39.7	1.05	84.	24/08/1981	94.0	1.84
11.	18/09/1971	15.7	0.69	48.	05/08/1977	11.8	0.66	85.	11/09/1981	122.0	2.27
12.	18/09/1971	16.1	0.71	49.	22/09/1977	14.4	0.65	86.	11/09/1981	111.0	2.09
13.	17/12/1971	63.5	1.37	50.	18/10/1977	9.6	0.54	87.	18/09/1981	58.0	1.34
14.	17/12/1971	63.6	1.37	51.	13/11/1977	22.6	0.88	88.	30/11/1981	68.8	1.40
15.	09/03/1972	315.0	3.44	52.	17/11/1977	16.3	0.69	89.	15/02/1982	34.6	1.36
16.	09/06/1972	21.2	0.83	53.	04/01/1978	47.7	1.20	90.	12/01/1983	142.0	2.63
17.	09/08/1972	14.7	0.64	54.	08/01/1978	45.5	1.12	91.	13/09/1983	41.2	0.80
18.	26/09/1972	5.9	0.47	55.	09/02/1978	61.3	1.23	92.	25/01/1984	35.9	1.50
19.	12/11/1972	31.9	0.92	56.	03/04/1978	86.2	1.89	93.	03/04/1984	95.4	2.16
20.	13/01/1972	88.3	1.75	57.	14/08/1978	23.3	0.60	94.	23/06/1984	31.4	1.49
21.	10/03/1973	212.0	3.27	58.	15/08/1978	30.9	1.00	95.	24/08/1984	139.5	2.49
22.	12/04/1973	179.0	2.44	59.	14/12/1978	64.1	1.37	96.	25/09/1984	56.7	1.72
23.	20/06/1973	86.8	1.58	60.	11/10/1979	27.4	0.96	97.	08/07/1985	29.4	1.40
24.	31/07/1973	21.0	0.77	61.	17/10/1979	13.1	0.67	98.	17/10/1985	102.2	2.30
25.	29/09/1973	114.0	1.86	62.	21/09/1979	25.8	0.90	99.	17/12/1985	28.0	1.00
26.	03/11/1973	71.2	1.56	63.	22/12/1979	286.0	3.40	100.	14/05/1986	70.3	1.83
27.	12/17/1973	76.3	1.48	64.	08/02/1980	55.6	1.30	101.	10/09/1986	38.3	1.35
28.	01/02/1974	66.9	1.40	65.	16/02/1980	85.5	1.77	102.	21/06/1988	23.0	0.86
29.	05/03/1974	145.0	2.22	66.	04/03/1980	93.8	1.71	103.	21/10/1988	92.1	1.80
30.	03/07/1974	79.8	1.43	67.	08/03/1980	87.7	1.71	104.	01/05/1989	24.5	0.77
31.	27/08/1974	65.3	1.33	68.	19/03/1980	127.0	2.06	105.	18/09/1989	25.8	0.84
32.	04/10/1974	110.0	1.79	69.	23/03/1980	29.2	0.94	106.	17/01/1990	150.4	2.64
33.	06/12/1974	139.0	2.34	70.	06/07/1980	15.4	0.69	107.	14/06/1990	42.1	1.20
34.	16/01/1975	46.4	1.20	71.	21/07/1980	18.1	0.84	108.	23/07/1992	17.6	0.84
35.	25/02/1975	117.0	1.72	72.	29/08/1980	18.8	0.83	109.	07/09/1992	38.8	1.45
36.	15/06/1975	65.7	1.40	73.	14/11/1980	83.6	1.62	110.	13/10/1992	59.4	1.65
37.	10/08/1975	95.8	1.73	74.	04/01/1981	111.0	1.84	111.	20/11/1992	0.5	2.37

## (2) Kopomaja in the Cidurian river

No.	Date	Discharge (cu.m/s)	Water Level (m)	No.	Date	Discharge (cu.m/s)	Water Level (m)	No.	Date	Discharge (cu.m/s)	Water Level (m)
1.	17/06/1977	37.0	2.34	30.	08/03/1981	27.7	2.18	59.	10/02/1985	19.6	1.81
2.	05/08/1977	2.8	0.88	31.	11/03/1981	19.7	1.82	60.	08/07/1985	4.3	0.94
3.	22/08/1977	2.2	0.78	32.	22/03/1981	21.5	1.85	61.	10/09/1985	21.6	1.77
4.	17/10/1977	2.9	0.84	33.	03/04/1981	43.6	2.76	62.	17/10/1985	22.9	1.79
5.	18/10/1977	3.0	0.83	34.	21/05/1981	33.2	2.38	63.	18/12/1985	5.5	0.20
6.	14/11/1977	7.9	1.20	35.	14/06/1981	29.9	2.19	64.	22/01/1986	81.6	2.58
7.	01/12/1977	5.3	0.93	36.	08/07/1981	6.2	1.26	65.	20/03/1986	27.1	1.14
8.	05/12/1977	8.3	0.98	37.	14/08/1981	7.0	1.26	66.	17/05/1986	10.7	0.50
9.	07/02/1978	12.3	1.61	38.	25/08/1981	44.2	2.66	67.	27/08/1986	2.8	1.10
10.	11/02/1978	12.9	1.64	39.	17/09/1981	22.6	1.98	68.	10/09/1986	8.6	0.62
11.	15/08/1978	5.4	1.11	40.	27/10/1981	25.2	2.11	69.	22/06/1988	6.2	0.89
12.	19/08/1978	38.7	2.43	41.	18/11/1981	25.1	2.09	70.	21/10/1986	17.2	1.73
13.	14/12/1978	9.3	1.32	42.	19/11/1981	19.2	1.71	71.	25/05/1989	19.4	1.59
14.	04/09/1979	2.3	0.37	43.	01/12/1981	6.6	1.23	72.	17/01/1990	26.9	1.83
15.	10/10/1979	7.5	0.75	44.	06/12/1981	4.4	1.09	73.	24/09/1990	59.1	3.00
16.	16/10/1979	4.2	0.70	45.	15/02/1982	60.2	3.01	74.	20/11/1990	8.1	0.55
17.	18/12/1979	30.9	2.27	46.	10/04/1982	16.3	1.60	75.	26/01/1991	14.0	0.82
18.	03/01/1980	10.8	1.43	47.	22/09/1982	1.7	0.87	76.	13/03/1991	20.8	1.25
19.	08/02/1980	10.1	1.36	48.	31/10/1982	2.5	0.91	77.	19/06/1991	3.4	0.30
20.	04/03/1980	23.1	1.85	49.	13/01/1983	11.8	1.52	78.	26/07/1991	1.9	0.09
21.	08/03/1980	48.3	2.44	50.	02/09/1983	3.7	0.69	79.	28/09/1991	1.3	-0.30
22.	23/03/1980	7.4	1.20	51.	22/11/1983	7.0	1.13	80.	20/10/1991	7.3	0.18
23.	19/03/1980	14.4	1.55	52.	21/03/1984	13.7	1.48	81.	16/12/1991	14.5	0.59
24.	21/08/1980	7.2	0.80	53.	24/06/1984	6.0	1.10	82.	20/01/1992	23.9	1.62
25.	31/08/1980	3.7	0.98	54.	25/08/1984	31.5	1.94	83.	08/02/1992	9.6	0.79
26.	08/11/1980	19.4	1.80	55.	30/09/1984	12.9	1.40	84.	19/06/1992	3.9	0.40
27.	16/11/1980	39.3	2.45	56.	16/10/1984	18.0	1.50	85.	13/10/1992	17.9	1.61
28.	14/01/1981	31.2	2.20	57.	25/11/1984	6.2	0.75	86.	20/11/1992	18.9	1.54
29.	01/02/1981	19.4	1.81	58.	04/03/1985	16.9	1.67				



Table 12 RESULT OF DISCHARGE MEASUREMENT CARRIED OUT BY JICA STUDY TEAM

No.	Date of Measurement	Water Level (m)	Discharge (m <sup>3</sup> /s)	No.	Date of Measurement	Water Level (m)	Discharge (m <sup>3</sup> /s)
(1) Gadeg water level gauge in the Cibeureum river				(4) Kopomaja water level gauge in the Cidurian river			
1	August 19, 1993	0.13	2.01	59	August 20, 1993	2.23	46.85
2	September 6, 1993	0.23	2.74	60	September 7, 1993	1.02	17.02
3	September 20, 1993	0.20	2.73	61	September 20, 1993	0.86	13.72
4	September 21, 1993	0.19	2.51	62	September 22, 1993	0.95	12.53
5	September 22, 1993	0.50	6.22	63	September 23, 1993	2.14	43.92
6	October 6, 1993	-0.01	0.85	64	October 7, 1993	0.57	6.75
7	October 7, 1993	0.01	0.94	65	October 8, 1993	0.51	5.86
8	October 29, 1993	0.12	1.99	66	October 28, 1993	0.76	10.75
9	November 13, 1993	0.25	3.38	67	November 12, 1993	0.90	13.38
10	November 25, 1993	0.39	5.15	68	November 26, 1993	1.70	36.62
11	December 10, 1993	0.22	3.03	69	December 9, 1993	1.00	17.29
12	December 23, 1993	1.57	26.73	70	December 22, 1993	0.78	11.43
13	January 5, 1994	0.42	5.87	71	January 6, 1994	1.19	21.83
14	June 8, 1994	0.12	1.52	72	June 9, 1994	0.50	8.86
15	June 21, 1994	0.07	0.96	73	June 22, 1994	0.47	6.33
16	July 12, 1994	-0.15	0.14	74	July 13, 1994	0.06	2.02
17	August 2, 1994	-0.15	0.10	75	August 3, 1994	0.01	3.40
18	August 3, 1994	-0.16	0.07	76	August 9, 1994	0.01	1.83
19	August 10, 1994	-0.08	0.18	77	August 10, 1994	-0.02	1.77
20	August 11, 1994	-0.09	0.17				
(2) Rangkasbitung water level gauge in the Ciujung river				(5) Tanjung dams site in the Cidurian river			
21	September 6, 1993	3.33	248.96	78	August 20, 1993	-	33.38
22	September 20, 1993	1.54	68.05	79	September 7, 1993	-	15.79
23	September 21, 1993	1.71	74.05	80	September 21, 1993	-	10.56
24	September 22, 1993	1.94	89.09	81	September 22, 1993	-	11.12
25	October 7, 1993	1.19	38.30	82	September 23, 1993	-	29.52
26	October 29, 1993	1.85	94.79	83	October 7, 1993	-	5.94
27	November 12, 1993	1.48	62.73	84	October 8, 1993	-	5.75
28	November 26, 1993	2.34	148.14	85	October 28, 1993	-	8.82
29	December 10, 1993	1.63	84.84	86	November 12, 1993	-	11.61
30	December 22, 1993	1.86	102.59	87	November 25, 1993	-	14.14
31	January 5, 1994	1.97	104.43	88	December 9, 1993	-	14.43
32	June 8, 1994	1.47	69.90	89	December 22, 1993	-	7.53
33	June 21, 1994	0.60	16.82	90	January 6, 1994	-	13.39
34	July 12, 1994	0.30	7.66	91	June 9, 1994	-	8.03
35	August 2, 1994	0.29	6.40	92	June 22, 1994	-	5.22
36	August 3, 1994	0.28	5.14	93	July 13, 1994	-	1.87
37	August 9, 1994	0.55	11.24	94	August 3, 1994	-	0.98
38	August 10, 1994	0.50	9.33	95	August 9, 1994	-	1.57
				96	August 10, 1994	-	0.97
(3) Sabagi water level gauge in the Ciujung river				(6) Tanjung dams site in the Cipangaur river			
39	August 20, 1993	3.89	120.90	97	August 20, 1993	-	7.36
40	September 6, 1993	0.92	27.76	98	September 7, 1993	-	2.86
41	September 20, 1993	0.63	23.14	99	September 21, 1993	-	1.64
42	September 21, 1993	1.12	29.92	100	September 22, 1993	-	1.93
43	September 24, 1993	1.01	27.56	101	September 23, 1993	-	9.47
44	October 6, 1993	0.36	14.34	102	October 7, 1993	-	0.96
45	October 8, 1993	0.16	8.23	103	October 8, 1993	-	0.69
46	October 29, 1993	0.77	24.76	104	October 28, 1993	-	0.91
47	November 13, 1993	0.43	17.46	105	November 12, 1993	-	1.80
48	November 26, 1993	1.35	41.82	106	November 25, 1993	-	2.79
49	December 10, 1993	0.70	26.99	107	December 9, 1993	-	1.80
50	December 23, 1993	2.32	79.43	108	December 22, 1993	-	1.89
51	January 6, 1994	0.87	30.09	109	January 6, 1994	-	3.62
52	June 8, 1994	0.53	19.10	110	June 9, 1994	-	0.66
53	June 21, 1994	0.11	8.96	111	June 22, 1994	-	0.71
54	July 12, 1994	-0.15	3.70	112	July 13, 1994	-	0.20
55	August 2, 1994	-0.17	2.72	113	August 3, 1994	-	0.04
56	August 3, 1994	-0.17	2.73	114	August 9, 1994	-	0.24
57	August 10, 1994	-0.04	3.95	115	August 10, 1994	-	0.14
58	August 11, 1994	-0.06	3.06				



Table 13 HALF-MONTHLY MEAN DISCHARGE AT KEY GAUGING STATIONS

(1) Rangkasbitung (unit:cu.m/s)

Year	Jan.		Feb.		Mar.		Apr.		May		Jun.		Jul.		Aug.		Sep.		Oct.		Nov.		Dec.		Annual
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	Mean
1970	66.1	80.6	272.7	118.6	192.7	228.3	131.7	310.8	148.5	145.7	139.7	131.9	66.9	112.1	30.1	33.7	36.2	73.1	51.4	48.9	55.2	172.4	114.4	296.7	127.4
1971	141.8	211.5	355.5	158.4	214.7	120.7	97.8	84.8	62.0	61.7	63.8	61.8	91.4	31.6	51.6	101.7	60.6	40.4	50.3	172.2	164.6	76.8	87.9	92.3	110.7
1972	313.4	209.5	161.5	114.5	245.0	132.2	58.4	103.1	108.2	99.0	26.9	21.5	16.3	11.0	16.8	24.7	6.7	5.8	3.5	14.8	31.4	36.8	56.3	67.7	78.5
1973	170.7	162.3	108.6	113.4	109.8	161.7	167.4	178.3	260.7	121.5	155.0	56.9	51.2	46.0	63.9	63.2	101.5	148.0	82.9	133.5	81.7	120.2	105.2	155.0	121.6
1974	329.2	58.4	141.1	144.8	184.3	98.6	122.0	108.4	140.3	115.5	49.4	67.0	86.6	46.0	85.2	96.3	205.7	162.5	121.1	72.6	56.2	103.9	122.7	55.8	115.6
1975	109.3	96.6	167.7	156.0	100.8	110.6	60.3	50.4	47.4	92.5	56.6	28.1	35.3	87.1	106.0	76.2	141.4	129.2	62.8	86.0	163.5	90.5	206.4	191.8	102.2
1976	218.9	325.5	114.6	87.0	154.4	104.0	63.0	126.8	86.2	32.4	53.8	21.5	28.9	18.2	20.0	28.4	14.9	15.0	65.9	23.3	55.4	96.6	58.7	42.5	77.3
1977	79.3	194.9	115.2	105.9	193.0	120.6	162.5	126.8	163.2	104.6	80.9	69.3	36.9	23.1	15.3	16.0	11.4	19.5	17.7	17.8	33.8	22.2	38.8	53.7	75.9
1978	80.8	278.5	97.1	80.5	151.6	127.3	74.4	97.3	90.9	58.9	68.1	73.4	58.1	63.8	70.9	95.3	64.5	83.3	48.5	103.9	118.0	71.2	74.1	80.8	92.1
1979	100.0	163.8	146.6	155.4	138.6	104.7	185.8	143.5	73.6	54.2	59.2	22.7	51.6	38.0	28.4	25.0	30.2	35.1	37.3	29.2	92.5	100.9	61.4	99.3	82.4
1980	204.1	249.1	136.6	102.6	79.0	65.8	126.2	103.1	120.1	79.8	48.8	45.4	42.2	56.2	127.0	62.1	91.0	103.8	75.7	70.1	87.7	100.4	88.5	179.9	101.9
1981	200.7	228.3	139.7	152.2	105.4	167.0	82.3	145.8	119.6	142.5	145.2	155.7	51.8	176.2	70.9	83.9	117.9	79.2	94.9	122.0	135.0	189.3	80.3	185.2	132.1
1982	288.9	237.4	101.7	71.5	64.1	27.5	82.2	86.4	80.4	40.4	26.0	25.4	12.0	21.1	11.3	6.7	4.1	7.9	7.6	23.4	95.0	74.7	62.2	149.2	67.0
1983	101.0	81.2	54.0	78.7	62.0	47.5	58.8	36.1	57.5	79.6	49.4	15.2	13.4	31.8	12.1	8.6	10.1	16.8	17.9	51.4	77.8	132.0	67.7	87.0	52.0
1984	156.6	82.4	103.3	140.7	199.4	83.0	72.1	216.0	185.7	89.3	56.5	33.0	75.6	80.5	64.3	101.0	138.4	99.9	94.9	49.4	46.7	50.8	47.5	51.5	96.6
1985	88.4	60.3	209.4	84.1	259.8	27.5	45.5	103.4	82.1	69.1	26.4	26.1	32.0	73.5	48.3	34.2	84.7	49.3	37.9	62.3	114.9	45.0	203.2	52.6	80.0
1986	100.7	314.8	149.2	87.5	125.5	122.0	128.5	175.4	119.1	71.4	147.7	60.4	20.6	26.1	24.2	27.0	42.8	19.9	39.4	61.1	41.8	86.8	188.9	98.9	95.0
1987	102.5	135.7	168.8	138.9	112.4	108.8	132.4	137.0	167.3	92.6	184.5	78.3	104.6	58.1	59.3	57.2	39.5	36.3	37.3	39.2	50.8	51.6	68.8	51.7	92.2
1988	118.9	181.0	208.1	158.6	169.3	274.8	275.9	151.0	88.0	96.0	58.1	19.9	35.4	49.4	45.8	44.0	46.9	45.3	36.3	59.9	60.4	70.4	109.4	135.6	105.8
1989	60.3	91.7	152.8	392.4	126.9	55.1	56.8	49.8	93.2	79.0	56.2	38.5	44.1	35.1	51.8	54.7	77.2	50.8	49.5	58.5	76.0	59.7	86.9	114.4	83.8
1990	334.1	438.6	110.7	87.2	144.2	112.6	85.6	83.2	90.8	79.1	91.9	54.8	96.7	133.4	111.2	92.4	97.8	147.2	86.4	94.7	91.9	62.8	26.0	82.6	118.2
1991	31.0	50.0	54.0	58.9	44.9	27.5	45.5	18.0	24.5	11.9	10.4	15.0	12.0	11.0	10.4	6.7	4.1	5.8	3.5	14.8	26.6	22.2	26.0	42.5	44.2
1992	85.6	74.3	119.7	58.9	47.3	113.9	66.1	149.3	99.7	69.5	54.1	46.3	25.8	37.4	33.0	46.6	43.5	36.0	126.7	79.6	128.4	96.8	88.5	48.0	74.0
1993	132.3	242.8	209.4	122.6	95.2	100.6	90.8	182.1	227.9	124.2	114.7	108.9	60.3	57.8	32.3	270.3	185.5	109.8	67.0	153.4	100.4	134.3	96.1	186.3	133.5
Mean	150.6	177.1	155.0	128.8	138.3	113.3	104.5	123.6	114.0	83.8	76.0	53.2	48.0	55.2	49.6	60.8	69.7	63.6	55.8	69.1	82.7	86.7	91.5	109.1	94.2
Min	31.0	50.0	54.0	58.9	44.9	27.5	45.5	18.0	24.5	11.9	10.4	15.0	12.0	11.0	10.4	6.7	4.1	5.8	3.5	14.8	26.6	22.2	26.0	42.5	44.2
Max	334.1	438.6	355.5	392.4	259.8	274.8	275.9	310.8	260.7	145.7	184.5	155.7	104.6	176.2	127.0	270.3	205.7	162.5	126.7	172.2	164.6	189.3	206.4	296.7	133.5

## (2) Kopomaja

Year	Jan.		Feb.		Mar.		Apr.		May		Jun.		Jul.		Aug.		Sep.		Oct.		Nov.		Dec.		Mean
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	Annual
1970	15.3	29.4	48.8	22.1	24.5	20.6	26.7	14.8	51.8	28.1	22.7	15.7	4.4	10.5	4.7	9.4	16.2	20.4	7.3	7.6	22.8	34.8	7.6	20.6	20.3
1971	17.9	24.6	69.3	26.0	23.7	25.3	27.3	30.0	17.0	16.1	19.3	17.2	19.7	7.6	12.0	16.3	7.1	5.5	9.9	42.5	13.8	14.2	19.9	18.7	20.9
1972	50.8	72.2	41.6	20.7	60.6	34.0	20.7	33.9	35.1	30.3	14.9	4.4	2.4	2.2	9.9	5.7	1.7	1.5	6.6	10.5	14.2	20.1	31.2	21.9	
1973	33.1	23.5	56.0	37.9	31.7	30.1	47.7	54.7	33.5	33.6	26.9	20.4	14.2	16.6	14.1	21.1	37.3	45.3	24.5	30.7	23.9	16.4	22.4	24.3	30.0
1974	81.3	19.1	31.7	33.0	31.4	15.7	28.7	30.1	42.6	28.5	13.3	20.6	17.9	13.2	25.3	20.7	61.5	49.9	28.2	21.9	24.4	16.6	10.7	11.8	28.3
1975	13.9	35.2	31.7	34.0	23.8	16.9	32.3	33.2	42.7	33.5	21.0	6.4	9.2	20.3	34.6	17.1	33.7	31.7	24.1	18.9	28.6	16.1	15.1	14.6	24.5
1976	56.8	107.8	34.8	22.7	41.9	16.4	22.2	28.1	31.6	7.3	15.2	6.8	5.4	3.2	8.0	9.1	7.6	4.8	30.5	9.9	17.5	27.2	10.6	12.8	22.4
1977	26.0	59.1	28.0	29.9	38.2	28.1	47.8	37.4	65.1	26.6	28.4	16.1	13.6	17.5	14.3	4.6	4.2	10.8	4.2	10.8	22.4	7.6	14.1	36.1	24.6
1978	32.0	42.5	17.2	12.0	49.9	16.9	14.3	26.5	14.3	10.9	8.6	17.7	11.2	14.4	10.4	19.8	28.8	23.6	17.4	25.4	23.2	13.1	14.7	21.7	20.3
1979	19.2	44.6	28.7	19.4	29.8	24.1	34.8	27.7	15.9	16.9	22.7	8.2	22.5	12.5	20.9	8.4	8.2	14.5	21.5	16.0	63.0	32.2	14.0	22.7	22.9
1980	42.1	51.2	26.2	36.2	23.1	16.7	23.6	24.6	37.5	30.5	12.7	11.8	11.0	14.6	33.1	16.1	34.7	18.3	15.6	23.8	26.0	29.3	21.1	24.7	25.2
1981	32.9	55.1	24.2	21.7	32.1	38.5	27.5	43.7	31.2	37.2	37.8	40.6	13.5	45.9	18.5	21.9	30.7	20.6	24.7	31.8	16.2	21.1	5.4	62.6	30.6
1982	49.4	49.3	16.9	10.5	8.3	6.5	19.8	26.4	23.0	21.0	12.1	6.9	4.4	7.0	3.4	1.9	1.0	1.6	4.3	4.3	12.3	17.0	5.8	17.0	13.8
1983	18.7	18.0	25.5	19.0	19.6	19.1	29.2	14.4	24.9	22.6	14.4	5.8	8.3	9.1	8.1	2.8	5.1	10.4	7.4	26.2	40.1	13.9	10.3	17.2	16.3
1984	39.8	17.6	25.3	27.6	32.7	22.5	19.7	43.3	44.0	22.1	25.8	7.2	11.0	16.3	17.2	15.9	32.5	22.1	13.6	9.3	23.9	22.7	21.3	12.5	22.7
1985	23.0	21.3	46.2	16.1	28.0	8.2	14.5	15.2	23.6	24.4	15.1	8.8	14.2	23.3	15.2	14.2	23.2	13.2	11.9	11.6	28.8	11.0	17.5	10.4	18.3
1986	28.4	45.5	28.7	10.8	31.1	27.5	46.7	26.8	40.5	18.9	18.4	12.1	9.1	12.2	16.4	8.5	9.9	24.7	9.5	9.4	21.4	16.4	36.7	21.5	22.1
1987	25.4	28.3	26.5	16.3	40.1	27.7	34.1	19.6	29.6	13.8	18.8	9.4	14.7	7.5	4.8	1.9	3.2	2.9	4.2	4.7	9.4	5.9	9.6	7.8	15.3
1988	8.3	17.7	29.4	11.5	35.2	30.5	25.1	26.4	34.3	24.2	10.0	4.0	4.4	5.3	10.9	3.3	6.7	12.1	8.1	9.9	9.5	4.7	4.7	14.5	14.6
1989	22.0	27.7	44.3	40.2	11.6	8.5	13.2	7.0	29.5	22.8	13.6	6.8	5.4	4.8	4.4	11.5	13.4	5.7	4.7	8.1	11.5	4.0	9.4	14.7	14.4
1990	29.0	46.6	17.2	32.5	15.5	15.5	15.5	12.1	26.4	20.0	14.7	8.8	8.0	14.3	23.9	12.9	26.1	12.9	12.2	13.2	14.7	10.1	12.9	19.4	18.1
1991	20.2	19.9	33.9	36.6	22.0	17.6	31.2	12.6	19.1	5.9	3.5	3.4	2.7	2.7	3.8	1.2	1.8	1.3	1.0	5.3	8.7	8.9	14.1	16.9	12.7
1992	13.2	13.0	19.0	11.7	8.3	32.1	12.6	15.5	27.0	6.4	15.2	8.2	10.7	8.7	7.1	8.5	15.7	9.5	34.2	19.6	23.6	28.0	38.0	17.7	16.8
1993	30.1	41.7	52.9	22.7	24.6	24.9	18.9	30.7	35.0	36.3	26.3	35.6	15.2	15.6	11.7	42.5	38.4	25.6	24.4	28.7	20.4	43.6	33.5	56.6	30.7
Mean	30.4	38.0	33.5	23.8	28.7	22.3	26.4	26.4	32.3	22.4	18.0	12.6	10.5	12.7	13.9	12.3	18.7	16.2	14.4	16.5	21.5	17.9	16.2	22.0	21.1
Min	8.3	13.0	16.9	10.5	8.3	6.5	12.6	7.0	14.3	5.9	3.5	3.4	2.4	2.2	3.4	1.2	1.0	1.3	1.0	4.3	8.7	4.0	4.7	7.8	12.7
Max	81.3	107.8	69.3	40.2	60.6	38.5	47.8	54.7	65.1	37.2	37.8	40.6	22.5	45.9	34.6	42.5	61.5	49.9	34.2	42.5	63.0	43.6	38.0	62.6	30.7



Table 14 DESIGN DISCHARGE FOR DRAINAGE STRUCTURE OF WATER CONVEYANCE SYSTEM WITH EXCESS PROBABILITY ONCE IN 5 YEARS (1/2)

Drainage Area No.	Drainage Area (km <sup>2</sup> )	River Length (m)	Difference of Elevation (m)	Average Gradient	Concentration Time (minutes)	Rainfall Intensity (mm/hour)	Runoff Coefficient	Design Discharge (m <sup>3</sup> /s)	Specific Discharge (m <sup>3</sup> /s/km <sup>2</sup> )
0	99.800							280.0	2.8
1	0.075	500	25.0	0.050	22	90	0.7	1.3	17.4
2	0.497	1,530	55.0	0.036	54	66	0.7	6.3	12.8
3	0.217	620	23.0	0.037	29	84	0.7	3.6	16.4
4	0.103	400	27.5	0.069	17	94	0.7	1.9	18.2
5	0.068	300	27.5	0.092	13	97	0.7	1.3	18.9
6	0.041	250	17.5	0.070	12	98	0.7	0.8	19.0
7	0.078	400	17.5	0.044	20	91	0.7	1.4	17.8
8	0.469	1,100	31.0	0.028	47	70	0.7	6.4	13.6
9	0.209	600	36.0	0.060	24	88	0.7	3.6	17.2
10	2.442	3,900	80.0	0.021	127	37	0.7	17.7	7.2
11	0.196	600	30.0	0.050	25	87	0.7	3.3	16.9
12	0.028	370	12.5	0.034	21	91	0.7	0.5	17.7
13	0.035	200	20.0	0.100	9	100	0.7	0.7	19.4
14	0.035	200	23.5	0.118	9	100	0.7	0.7	19.5
15	0.017	260	22.0	0.085	12	98	0.7	0.3	19.1
16	0.057	250	24.0	0.096	11	99	0.7	1.1	19.2
17	9.872	5,850	77.0	0.013	198	27	0.7	52.7	5.3
18	0.019	210	15.5	0.074	11	99	0.7	0.4	19.2
19	0.067	400	22.5	0.056	18	93	0.7	1.2	18.0
20	0.046	280	19.0	0.068	13	97	0.7	0.9	18.8
21	0.118	500	20.5	0.041	24	88	0.7	2.0	17.2
22	0.047	240	11.5	0.048	13	97	0.7	0.9	18.8
23	3.291	3,420	34.0	0.010	150	34	0.7	21.5	6.5
24	0.488	1,400	25.0	0.018	65	60	0.7	5.7	11.7
25	0.096	400	13.5	0.034	22	90	0.7	1.7	17.5
26	0.254	800	21.5	0.027	38	77	0.7	3.8	14.9
27	0.072	350	7.0	0.020	24	88	0.7	1.2	17.2
28	0.266	1,000	19.0	0.019	51	68	0.7	3.5	13.2
29	0.185	350	12.0	0.034	20	92	0.7	3.3	17.8
30	0.206	1,100	19.5	0.018	55	65	0.7	2.6	12.7
31	30.825							130.0	4.2
32	0.044	300	9.0	0.030	19	92	0.7	0.8	18.0
33	0.519	1,150	19.5	0.017	58	64	0.7	6.4	12.4
34	302.420							530.0	1.8
35	0.239	800	23.5	0.029	37	77	0.7	3.6	15.1
36	0.096	250	21.5	0.086	11	98	0.7	1.8	19.1
37	0.564	1,050	9.5	0.009	68	59	0.7	6.5	11.5
38	0.189	610	19.0	0.031	30	83	0.7	3.1	16.2
39	0.039	200	16.0	0.080	10	99	0.7	0.8	19.3
40	0.125	700	19.0	0.027	35	79	0.7	1.9	15.4
41	0.070	300	22.0	0.073	14	96	0.7	1.3	18.8
42	0.070	270	9.5	0.035	16	94	0.7	1.3	18.3
43	0.180	550	22.0	0.040	26	87	0.7	3.0	16.9
44	6.700	3,750	40.0	0.011	156	33	0.7	42.5	6.3
45	0.530	1,150	24.0	0.021	54	66	0.7	6.8	12.8
46	0.138	650	25.0	0.038	29	84	0.7	2.2	16.3
47	0.189	400	20.0	0.050	19	92	0.7	3.4	17.9
48	0.077	200	12.0	0.060	11	99	0.7	1.5	19.2
49	2.715	2,800	34.0	0.012	121	38	0.7	20.2	7.4
50	0.487	750	12.0	0.016	44	72	0.7	6.8	14.0
51	0.043	100	4.5	0.045	7	101	0.7	0.8	19.7
52	6.108	4,450	35.0	0.008	196	28	0.7	32.8	5.4
53	0.482	1,300	13.0	0.010	76	56	0.7	5.2	10.9
54	0.047	150	12.5	0.083	8	101	0.7	0.9	19.6
55	0.156	450	14.0	0.031	24	88	0.7	2.7	17.1
56	0.032	100	5.0	0.050	7	102	0.7	0.6	19.8
57	2.235	2,800	23.0	0.008	139	35	0.7	15.3	6.9
58	0.282	600	17.0	0.028	31	83	0.7	4.5	16.1
59	0.324	1,100	22.0	0.020	53	66	0.7	4.2	12.9
60	0.126	600	15.0	0.025	32	82	0.7	2.0	15.8



Table 15 DESIGN DISCHARGE FOR DRAINAGE STRUCTURE OF WATER CONVEYANCE SYSTEM WITH EXCESS PROBABILITY ONCE IN 5 YEARS (2/2)

Drainage Area No.	Drainage Area (km <sup>2</sup> )	River Length (m)	Difference of Elevation (m)	Average Gradient	Concentration Time (minutes)	Rainfall Intensity (mm/hour)	Runoff Coefficient	Design Discharge (m <sup>3</sup> /s)	Specific Discharge (m <sup>3</sup> /s/km <sup>2</sup> )
61	0.445	1,300	23.0	0.018	62	62	0.7	5.3	12.0
62	3.809	3,500	31.0	0.009	159	32	0.7	23.8	6.3
63	0.471	1,800	20.0	0.011	92	50	0.7	4.5	9.6
64	19.323							95.0	4.9
65	0.735	2,100	24.0	0.011	101	46	0.7	6.5	8.9
66	5.303	4,500	29.0	0.006	211	27	0.7	27.4	5.2
67	0.039	200	10.0	0.050	12	98	0.7	0.7	19.1
68	0.101	350	20.0	0.057	16	94	0.7	1.8	18.3
69	0.019	150	12.5	0.083	8	101	0.7	0.4	19.6
70	0.178	450	22.0	0.049	21	91	0.7	3.1	17.6
71	0.140	520	16.5	0.032	27	86	0.7	2.3	16.7
72	0.106	350	15.0	0.043	18	93	0.7	1.9	18.0
73	0.336	1,000	30.0	0.030	43	73	0.7	4.7	14.1
74	0.085	400	20.0	0.050	19	92	0.7	1.5	17.9
75	0.086	350	17.0	0.049	17	93	0.7	1.6	18.1
76	0.812	1,500	22.0	0.015	73	57	0.7	9.0	11.1
77	88.247							260.0	2.9
78	0.063	250	15.0	0.060	13	97	0.7	1.2	18.9
79	0.179	600	12.0	0.020	35	79	0.7	2.8	15.4
80	34.251							140.0	4.1
81	0.230	300	13.0	0.043	16	94	0.7	4.2	18.3
82	0.264	700	11.0	0.016	42	73	0.7	3.8	14.3
83	94.348							270.0	2.9
84	0.139	400	3.5	0.009	35	79	0.7	2.1	15.4
85	0.096	400	5.1	0.013	31	83	0.7	1.5	16.1
86	0.084	700	7.0	0.010	49	69	0.7	1.1	13.3
87	0.110	200	6.0	0.030	14	96	0.7	2.1	18.7
88	1.500	1,600	6.0	0.004	124	38	0.7	11.0	7.3
89	1.300	1,400	15.0	0.011	78	55	0.7	13.9	10.7
90	0.336	1,100	10.0	0.009	70	58	0.7	3.8	11.4
91	0.070	350	10.0	0.029	21	90	0.7	1.2	17.6
92	0.209	1,100	6.0	0.005	84	53	0.7	2.2	10.3
93	10.150	3,500	22.0	0.006	179	29	0.7	57.0	5.6
94	0.204	450	13.0	0.029	25	87	0.7	3.5	17.0
95	1.745	2,600	9.0	0.003	179	29	0.7	9.8	5.6
96	0.271	500	8.0	0.016	33	81	0.7	4.3	15.7
97	0.097	400	9.0	0.023	25	87	0.7	1.6	17.0
98	0.096	350	7.5	0.021	23	89	0.7	1.7	17.2
99	1048.000							1005.0	1.0

Note : In the case of catchement area bigger than 10.0 km<sup>2</sup>, design discharges are calculated by using Creager Curve.



Table 16 RESULT OF GRAIN SIZE ANALYSIS OF RIVERBED MATERIAL MADE BY JICA STUDY TEAM

No.	Location	River	Date of Sampling	Specific Gravity	Percent Passing for Sieve Sizes (%)											
					15.00 mm	10.00 mm	5.00 mm	2.00 mm	1.00 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm	0.030 mm	0.020 mm	0.010 mm
1	Gadeg	Cibeureum	19/08/1993	2.62	100.0	84.7	66.0	50.1	33.9	20.4	6.7	0.7	0.3	-	-	-
2	Gadeg	Cibeureum	13/11/1993	2.57	100.0	71.0	63.6	48.2	38.7	29.6	5.7	0.8	0.2	-	-	-
3	Rangkas bitung	Ciujung	19/08/1993	2.55	-	100.0	95.5	84.3	81.5	69.9	31.6	3.6	0.7	-	-	-
4	Rangkas bitung	Ciujung	12/11/1993	2.65	-	100.0	92.0	85.4	81.2	70.2	27.9	7.0	2.8	-	-	-
5	Sabagi	Ciberang	20/08/1993	2.55	-	-	100.0	97.3	95.9	93.5	83.0	31.4	11.5	-	-	-
6	Sabagi	Ciberang	13/11/1993	2.57	-	100.0	97.2	95.0	83.4	40.7	17.3	1.0	0.8	-	-	-
7	Kopomaj	Cidurian	20/08/1993	2.61	-	-	100.0	99.6	99.2	99.1	64.5	17.2	3.4	-	-	-
8	Kopomaj	Cidurian	12/11/1993	2.78	-	-	100.0	99.5	98.5	97.6	88.4	24.5	0.7	-	-	-
9	Tanjung	Cidurian	20/08/1993	2.57	-	100.0	95.1	68.9	56.3	38.0	13.1	3.7	1.7	-	-	-
10	Tanjung	Cidurian	12/11/1993	2.68	-	100.0	97.1	91.1	66.8	32.0	18.8	15.9	6.3	-	-	-
11	Tanjung	Cipangaur	20/08/1993	2.56	-	100.0	96.8	91.1	85.9	76.9	36.9	7.3	2.5	-	-	-
12	Tanjung	Cipangaur	12/11/1993	2.59	-	100.0	96.8	68.4	54.1	36.5	14.8	7.9	6.9	-	-	-



Table 17 SEDIMENT CONCENTRATION RECORD TAKEN BY DPMA AND P3SA

Date	Flow Discharge (m3/sec)	Sediment Concentration (mg/l)	Sediment Load (ton/day)	Date	Flow Discharge (m3/sec)	Sediment Concentration (mg/l)	Sediment Load (ton/day)
<b>(1) Rangkasbitung in the Cijung river</b>				<b>(5) Nglasari in the Cibeureum river</b>			
16/01/1975	46.40	450.79	1,807.20	1988	4.00	110.00	38.02
25/02/1975	117.00	281.96	2,850.28	1988	5.10	129.00	56.84
26/09/1975	110.00	362.10	3,441.40	1988	8.20	162.00	114.77
22/11/1975	57.30	249.48	1,235.11	1988	5.00	103.00	44.50
01/08/1976	273.00	617.11	14,555.90	1988	18.20	180.00	283.05
29/06/1976	16.50	46.84	66.78	1988	14.00	92.00	111.28
25/08/1976	13.20	56.67	64.63	1988	12.30	98.00	104.15
01/08/1977	33.40	216.27	624.10	1988	7.00	60.00	36.29
03/07/1977	183.00	142.84	2,258.47	1988	6.80	101.00	59.34
24/04/1977	65.80	144.00	818.66	1988	5.10	111.00	48.91
17/06/1977	66.10	331.32	1,892.18	1988	4.90	63.00	26.67
04/03/1978	86.20	156.33	1,164.30	1988	5.10	99.00	43.62
14/12/1978	64.10	219.00	1,212.87	1988	4.20	103.00	37.38
15/08/1978	30.90	114.67	306.14	1988	4.00	102.00	35.25
10/06/1978	49.30	60.00	255.57	1988	7.60	113.00	74.20
22/12/1979	286.00	589.33	14,562.58	1988	3.60	67.00	20.84
21/07/1980	18.10	55.33	86.53	1988	6.30	161.00	87.64
14/11/1980	83.60	186.67	1,348.32	<b>(6) Kopomaja in the Cidurian river</b>			
03/07/1981	93.00	390.00	3,133.73	01/12/1976	17.10	215.18	317.92
09/11/1981	122.00	177.00	1,865.72	01/08/1977	1.24	103.26	11.06
09/11/1981	111.00	161.00	1,544.05	03/08/1977	44.00	209.10	794.91
18/09/1981	58.00	161.00	806.80	25/04/1977	33.60	435.33	1,263.78
18/07/1982	17.10	86.00	127.06	17/06/1977	37.00	751.33	2,401.85
14/03/1983	376.60	329.00	10,705.08	15/08/1978	5.40	121.67	56.77
14/03/1983	364.20	253.00	7,961.12	17/09/1981	22.60	82.00	160.12
15/03/1983	211.60	285.00	5,210.44	12/01/1981	6.61	46.00	26.27
15/03/1983	160.80	550.00	7,641.22	12/06/1981	4.37	25.00	9.44
15/03/1983	149.30	992.00	12,796.32	15/02/1982	60.20	819.00	4,259.85
19/08/1993	167.00	1,071.00	15,453.24	1988	9.60	246.00	204.04
09/06/1993	248.96	1,883.00	40,503.60	1988	8.00	218.00	150.68
20/09/1993	68.50	129.00	763.47	1988	8.50	229.00	168.18
<b>(2) Leuwidamar in the Cibeureum river</b>				1988	7.60	226.00	148.40
18/07/1982	6.88	109.00	64.79	1988	10.10	254.00	221.65
03/12/1983	1.82	28.00	4.40	1988	19.60	381.00	645.20
03/12/1983	1.61	41.00	5.70	1988	10.20	288.00	253.81
17/03/1983	3.19	50.00	13.78	1988	12.80	282.00	311.87
17/03/1983	3.71	152.00	48.72	1988	10.20	279.00	245.88
<b>(3) Cileles in the Cijung river</b>				1988	9.60	247.00	204.87
13/03/1983	6.88	47.00	27.94	1988	15.30	305.00	403.19
13/03/1983	7.11	73.00	44.84	1988	9.60	218.00	180.82
16/03/1983	2.81	43.00	10.44	1988	9.30	231.00	185.61
16/03/1983	2.67	47.00	10.84	1988	8.40	224.00	162.57
<b>(4) Sajlra in the Cibeureum river</b>				1988	9.50	240.00	196.99
Karian FS	12.50		520.00	1988	8.50	235.00	172.58
Karian FS	13.50		220.00	1988	8.90	228.00	175.32
Karian FS	17.00		1100.00	1988	7.10	256.00	157.04
Karian FS	17.20		1010.00	1988	20.10	419.00	727.65
Karian FS	20.50		540.00	1988	29.90	688.00	1,777.35
Karian FS	22.00		540.00	1988	27.30	554.00	1,306.73
Karian FS	32.00		3600.00	1988	28.10	526.00	1,277.04
<b>(5) Nglasari in the Cibeureum river</b>				1988	26.60	464.00	1,066.38
1988	3.80	104.00	34.15	1988	14.20	251.00	307.95
1988	4.60	107.00	42.53	1988	12.30	292.00	310.31
1988	4.10	164.00	58.10	1988	11.50	317.00	314.97
1988	1.80	21.00	3.27	1988	9.60	262.00	217.31
1988	3.10	110.00	29.46	1988	11.50	282.00	280.20
1988	4.00	92.00	31.80	1988	12.60	289.00	314.62
1988	4.20	168.00	60.96	1988	8.50	296.00	217.38
1988	4.20	96.00	34.84	1988	7.90	284.00	193.85
1988	3.80	75.00	24.62	<b>(7) Rancasumur in the Cidurian river</b>			
1988	5.10	132.00	58.16	12/07/1982	16.80	88.00	127.73
1988	5.00	118.00	50.98	12/07/1982	15.90	34.00	46.71
1988	5.30	128.00	58.61	12/07/1982	8.90	48.00	36.91
1988	6.20	131.00	70.17	24/01/1983	12.10	171.00	178.77
1988	5.90	109.00	55.56	24/01/1983	10.50	224.00	203.21
				24/01/1983	9.20	247.00	196.34



Table 18 RESULT OF SEDIMENT CONCENTRATION ANALYSIS CARRIED OUT BY JICA STUDY TEAM

No.	Sampling Date	Sediment Concentration (mg/l)	Flow Discharge (m3/sec)	Sediment Flow (ton/day)
<b>(1) Gadeg in the Cibeureum River</b>				
1.	19/08/1993	53	2.01	9.2
2.	09/06/1993	773	2.74	183.0
3.	20/09/1993	59	2.73	13.9
4.	13/11/1993	23	3.38	6.7
5.	10/12/1993	71	3.03	18.6
6.	05/01/1994	50	5.87	25.4
7.	08/06/1994	136	1.52	17.9
8.	12/07/1994	77	0.14	0.9
9.	02/08/1994	105	0.10	0.9
<b>(2) Rangkasbitung in the Ciujung River</b>				
10.	19/08/1993	1,071	167.00	15453.2
11.	09/06/1993	1,883	248.96	40503.6
12.	20/09/1993	129	68.05	758.5
13.	12/11/1993	569	62.73	3083.9
14.	09/12/1993	183	84.84	1341.4
15.	05/01/1994	103	104.43	929.3
16.	08/06/1994	310	69.90	1872.2
17.	12/07/1994	195	7.66	129.1
18.	02/08/1994	119	6.40	65.8
<b>(3) Sabagi in the Cibeureum River</b>				
19.	20/08/1993	729	120.90	7615.0
20.	06/09/1993	915	27.76	2194.6
21.	20/09/1993	104	23.14	207.9
22.	13/11/1993	207	17.46	312.3
23.	10/12/1993	84	26.99	195.9
24.	06/01/1994	76	30.09	197.6
25.	08/06/1994	312	19.10	514.9
26.	12/07/1994	168	3.70	53.7
27.	02/08/1994	157	3.50	47.5
<b>(4) Kopomaja in the Cidurian River</b>				
28.	20/08/1993	955	46.85	3865.7
29.	07/09/1993	202	17.02	297.0
30.	21/09/1993	80	13.72	94.8
31.	12/11/1993	39	13.38	45.1
32.	09/12/1993	89	17.29	133.0
33.	06/01/1994	126	21.83	237.7
34.	09/06/1994	122	8.86	93.4
35.	13/07/1994	89	2.02	15.5
36.	03/08/1994	91	3.40	26.7
<b>(5) Tanjung damsite in the Cidurian River</b>				
37.	20/08/1993	469	33.38	1352.6
38.	07/09/1993	156	15.79	212.8
39.	21/09/1993	75	10.56	68.4
40.	12/11/1993	74	11.61	74.2
41.	09/12/1993	86	14.43	107.2
42.	06/01/1994	101	13.39	116.8
43.	09/06/1994	152	8.03	105.5
44.	13/07/1994	138	1.87	22.3
45.	03/08/1994	110	0.98	9.3
<b>(6) Tanjung damsite in the Cipangaur River</b>				
46.	20/08/1993	1,585	7.36	1007.9
47.	07/09/1993	150	2.86	37.1
48.	21/09/1993	45	1.64	6.4
49.	12/11/1993	64	1.80	10.0
50.	09/12/1993	64	1.80	10.0
51.	06/01/1994	79	3.62	24.7
52.	09/06/1994	67	0.66	3.8
53.	13/07/1994	53	0.20	0.9
54.	03/08/1994	84	0.04	0.3



Table 19 RESULT OF GRAIN SIZE ANALYSIS OF WASH AND SUSPENDED LOAD MADE BY JICA STUDY TEAM

No.	Location	River	Date of Sampling	Specific Gravity	Percent Passing for Sieve Sizes (%)												
					15.00 mm	10.00 mm	5.00 mm	2.00 mm	1.00 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm	0.030 mm	0.020 mm	0.010 mm	
1.	Gadeg	Cibeureum	19/08/1993	2.23	-	-	-	-	100.0	97.8	94.4	91.1	84.8	80.1	68.5	55.0	
2.	Gadeg	Cibeureum	09/06/1993	2.45	-	-	-	100.0	96.6	87.6	63.5	51.1	37.3	28.2	22.4	19.9	
3.	Gadeg	Cibeureum	20/09/1993	2.39	-	-	-	100.0	96.9	92.0	82.3	70.7	49.5	21.5	5.6	3.9	
4.	Gadeg	Cibeureum	13/11/1993	2.29	-	-	100.0	98.0	96.0	94.3	66.6	42.5	39.8	32.6	26.8	13.7	
5.	Gadeg	Cibeureum	10/12/1993	2.62	-	-	100.0	92.9	91.3	69.8	64.1	60.1	55.1	39.2	19.4	1.3	
6.	Gadeg	Cibeureum	05/01/1994	2.28	-	-	-	100.0	95.1	90.1	87.5	76.9	50.5	33.8	21.4	7.1	
7.	Gadeg	Cibeureum	08/06/1994	1.42	-	-	-	100.0	98.6	97.4	91.9	83.6	68.3	44.3	29.1	7.8	
8.	Gadeg	Cibeureum	12/07/1994	2.34	-	-	100.0	96.7	90.0	72.9	56.6	30.9	29.9	25.5	19.7	5.8	
9.	Gadeg	Cibeureum	02/08/1994	2.29	-	-	-	100.0	96.2	85.9	59.5	43.9	23.2	17.0	11.8	4.7	
10.	Rangkas-bitung	Ciujung	19/08/1993	2.36	-	-	-	-	100.0	95.8	88.0	72.7	58.4	38.7	21.9	11.2	
11.	Rangkas-bitung	Ciujung	09/06/1993	2.37	-	-	-	100.0	98.2	94.9	77.8	63.1	62.6	34.4	14.7	8.4	
12.	Rangkas-bitung	Ciujung	20/09/1993	2.41	-	-	-	-	100.0	99.4	91.8	56.2	48.7	38.9	22.0	9.1	
13.	Rangkas-bitung	Ciujung	12/11/1993	2.27	-	-	-	100.0	98.0	93.6	72.1	60.9	49.1	43.6	20.3	12.3	
14.	Rangkas-bitung	Ciujung	09/12/1993	2.54	-	-	-	100.0	99.5	97.9	90.4	80.9	62.8	56.7	28.5	8.1	
15.	Rangkas-bitung	Ciujung	05/01/1994	2.25	-	-	100.0	99.2	98.0	92.3	83.8	73.8	58.5	24.3	11.2	1.2	
16.	Rangkas-bitung	Ciujung	08/06/1994	1.67	-	-	-	100.0	99.2	98.4	94.2	84.1	58.5	34.7	22.5	9.4	
17.	Rangkas-bitung	Ciujung	12/07/1994	2.35	-	-	100.0	98.2	97.3	92.9	49.8	22.5	15.0	4.4	2.3	1.0	
18.	Rangkas-bitung	Ciujung	02/08/1994	2.27	-	-	-	100.0	98.3	85.4	47.6	16.1	13.9	11.5	5.7	4.2	
19.	Sabagi	Ciberang	20/08/1993	2.36	-	-	-	-	100.0	98.9	92.6	83.3	68.8	48.3	26.0	15.3	
20.	Sabagi	Ciberang	09/06/1993	2.45	-	-	-	100.0	95.0	90.7	83.5	78.9	76.3	32.7	12.0	9.1	
21.	Sabagi	Ciberang	20/09/1993	2.49	-	-	-	100.0	96.8	87.5	77.8	62.3	41.9	15.7	7.8	2.8	
22.	Sabagi	Ciberang	13/11/1993	2.17	-	-	100.0	99.4	98.2	92.4	57.4	49.3	36.4	7.4	7.3	2.8	
23.	Sabagi	Ciberang	10/12/1993	2.48	-	-	100.0	99.1	94.0	84.4	68.9	57.4	38.0	17.4	9.3	3.0	
24.	Sabagi	Ciberang	06/01/1994	2.19	-	-	-	100.0	99.0	95.1	74.6	65.4	34.8	22.2	10.6	7.4	
25.	Sabagi	Ciberang	08/06/1994	1.78	-	-	-	100.0	99.0	97.0	82.4	60.6	53.2	33.1	17.4	8.3	
26.	Sabagi	Ciberang	12/07/1994	2.42	-	-	100.0	94.8	68.8	43.6	26.8	18.2	16.8	9.8	5.3	2.0	
27.	Sabagi	Ciberang	02/08/1994	2.37	-	-	-	100.0	97.8	93.5	68.2	43.2	33.0	22.0	14.7	6.0	
28.	Kopomaja	Cidurian	20/08/1993	2.35	-	-	-	-	100.0	98.5	89.0	74.4	58.4	38.2	24.8	13.5	
29.	Kopomaja	Cidurian	09/07/1993	2.26	-	-	-	100.0	95.2	83.3	77.7	59.7	47.5	30.1	16.2	7.5	
30.	Kopomaja	Cidurian	21/09/1993	2.46	-	-	-	-	100.0	98.7	84.9	66.4	52.0	23.8	11.8	4.1	
31.	Kopomaja	Cidurian	12/11/1993	2.00	-	-	-	100.0	98.8	94.0	80.7	63.1	57.6	49.0	33.5	13.3	
32.	Kopomaja	Cidurian	09/12/1993	2.63	-	-	100.0	99.1	97.4	61.2	26.5	23.6	19.8	13.8	5.9	2.2	
33.	Kopomaja	Cidurian	06/01/1994	2.09	-	-	100.0	99.2	97.5	86.4	68.4	54.5	43.2	31.1	12.1	3.9	
34.	Kopomaja	Cidurian	09/06/1994	1.63	-	-	-	100.0	99.2	98.4	94.8	81.1	58.3	35.2	19.0	7.7	
35.	Kopomaja	Cidurian	13/07/1994	2.25	-	-	-	100.0	91.0	66.7	44.4	22.5	12.8	7.8	5.4	3.5	
36.	Kopomaja	Cidurian	03/08/1994	2.42	-	-	100.0	97.7	92.8	56.3	23.7	11.1	9.6	5.9	4.6	1.6	
37.	Tanjung 1	Cidurian	20/08/1993	2.34	-	-	-	-	100.0	99.0	91.0	74.7	58.9	39.7	25.4	12.5	
38.	Tanjung 1	Cidurian	09/07/1993	2.28	-	-	-	100.0	96.5	85.0	65.6	51.1	29.8	21.5	9.7	5.4	
39.	Tanjung 1	Cidurian	21/09/1993	2.31	-	-	-	-	100.0	96.5	82.6	64.5	45.9	19.5	10.5	6.8	
40.	Tanjung 1	Cidurian	12/11/1993	2.36	-	-	100.0	85.9	84.7	82.5	58.2	46.0	42.3	15.4	11.4	7.1	
41.	Tanjung 1	Cidurian	09/12/1993	2.53	-	-	100.0	99.3	93.0	66.1	46.4	34.2	25.6	14.8	6.8	1.4	
42.	Tanjung 1	Cidurian	06/01/1994	2.24	-	-	-	100.0	95.5	89.5	83.1	69.2	55.9	27.5	15.5	12.1	
43.	Tanjung 1	Cidurian	09/06/1994	2.25	-	-	100.0	98.4	95.2	89.9	74.7	62.7	43.8	26.2	17.7	6.0	
44.	Tanjung 1	Cidurian	13/07/1994	2.20	-	-	100.0	96.6	91.0	57.8	51.0	31.5	27.4	14.1	8.4	6.5	
45.	Tanjung 1	Cidurian	03/08/1994	2.42	-	-	100.0	92.5	75.5	47.0	21.3	12.9	10.4	9.7	7.6	3.7	
46.	Tanjung 2	Cipangaur	20/08/1993	2.31	-	-	-	-	100.0	97.3	82.6	66.8	60.0	44.7	31.9	21.0	
47.	Tanjung 2	Cipangaur	09/07/1993	2.13	-	-	-	100.0	90.2	85.3	71.8	54.1	48.7	28.7	15.1	10.3	
48.	Tanjung 2	Cipangaur	21/09/1993	2.32	-	-	100.0	95.7	93.4	90.7	82.4	69.2	47.2	19.9	12.0	3.9	
49.	Tanjung 2	Cipangaur	12/11/1993	2.20	-	-	100.0	99.5	95.3	90.6	70.5	36.7	34.0	29.9	20.9	12.5	
50.	Tanjung 2	Cipangaur	09/12/1993	2.63	-	-	100.0	98.3	92.0	70.6	39.0	33.9	27.6	17.5	7.9	0.5	
51.	Tanjung 2	Cipangaur	06/01/1994	2.20	-	-	-	100.0	97.2	94.8	67.1	43.5	36.3	21.5	11.2	1.1	
52.	Tanjung 2	Cipangaur	09/06/1994	2.21	-	-	100.0	99.6	98.9	96.7	83.8	81.1	52.9	23.9	18.3	6.5	
53.	Tanjung 2	Cipangaur	13/07/1994	2.37	-	-	100.0	97.9	91.9	87.9	52.6	25.5	10.9	7.5	6.8	2.4	
54.	Tanjung 2	Cipangaur	03/08/1994	2.34	-	-	-	100.0	94.7	85.3	53.1	31.8	27.8	19.6	11.1	6.9	



Table 20 ANNUAL SEDIMENT LOAD OF PASIRKOPO DAM

Year	Wash and Suspended Load (ton/year)	Bed Load (ton/year)	Total Sediment Load (ton/year)	Erosion Rate (mm/year)
1970	655,798	65,580	721,378	3.8
1971	497,532	49,753	547,285	2.9
1972	380,157	38,016	418,172	2.2
1973	500,131	50,013	550,144	2.9
1974	477,516	47,752	525,268	2.8
1975	405,426	40,543	445,968	2.4
1976	320,161	32,016	352,178	1.9
1977	322,072	32,207	354,280	1.9
1978	310,906	31,091	341,997	1.8
1979	254,154	25,415	279,570	1.5
1980	368,143	36,814	404,957	2.1
1981	633,934	63,393	697,328	3.7
1982	311,022	31,102	342,124	1.8
1983	118,079	11,808	129,887	0.7
1984	342,076	34,208	376,284	2.0
1985	341,714	34,171	375,885	2.0
1986	399,310	39,931	439,241	2.3
1987	268,567	26,857	295,424	1.6
1988	471,810	47,181	518,991	2.7
1989	302,443	30,244	332,687	1.8
1990	727,426	72,743	800,169	4.2
1991	145,268	14,527	159,795	0.8
1992	204,401	20,440	224,842	1.2
1993	660,505	66,050	726,555	3.8
Mean	392,440	39,244	431,684	2.3

Note : The above annual bed load was estimated by multiplying a ratio of 10% to the annual wash and suspended loads, and the annual erosion ratio is estimated based on soil density of 1.1 ton/m<sup>3</sup>.



# ***FIGURES***







