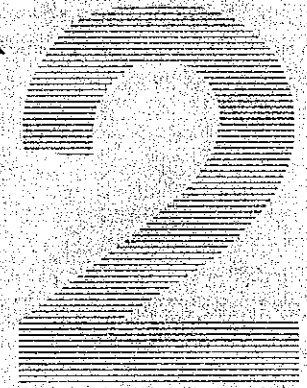


CHAPTER



PRESENT CONDITIONS

2.1 GENERAL CONDITIONS

2.1.1 TOPOGRAPHY

GKS Region is divided into 3 topographic areas; low plain area, rolling hills and mountain areas as shown in Fig. 2.1.1.

The low plain areas with a height of less than 25 m above sea level, are located in the river basins (Bengawan Sala, Brantas and Lamong Rivers). These areas include the centre of Lamongan, the centre to north of Gresik, the whole of Sidoarjo, in and around Mojokerto and Bangkalan cities, and most of Surabaya city. Outside the towns the areas are mainly used for rice production, except for the coastal areas of Gresik, Surabaya and Sidoarjo, which have tidal influence and are used for fish and salt ponds.

The rolling hill areas (elevation between 25 m and 300 m) are located to the north and south of Lamongan city, the north of Mojokerto city and south-west of Gresik city, the central area of Kabupaten Bangkalan and the south-west of Surabaya city. These areas afford little opportunity for crop cultivation due to the lack of water, and are unused or used for forestry, husbandry, mining, etc.

The mountain area in GKS Region is to the south of Mojokerto, where it rises up to the peak of the Boklorahabuh mountain (EL = 2,206 m).

Observing the topographical conditions in the city of Surabaya from the 50 cm interval contour map, Fig. 2.1.2., the following significant points are found;

- The alluvium from Kali Surabaya forms a very large plain with little difference of height except for the tongue shaped terrace located in the western part of Surabaya. The alluvial area is less than 1.0 m above the sea and covers most of the eastern and northern areas. These conditions cause floods and drainage problems in the city, and are also an obstruction to the development of the low laying area.
- The major transportation axis in the north-south direction, Surabaya to Malang, is located on the linear terrace with a height of more than 4.0 m above sea level. The geological condition is comparatively good.
- In the western terrace, new housing is currently rapidly developing but according to information, the geological condition of this terrace requires care for urban development due to ground cracking in the dry season. Rainforced foundation with 2 to 5 m piles is required for housing construction.

2.1.2 SOILS AND GEOLOGY

The soils in the region can be divided into 7 categories as shown in Fig. 2.1.3. Alluvium is deposited widely along the major rivers (Bengawan Sala, Brantas, Porong, Lamong) and agricultural use is common with irrigation. Surabaya, Sidoarjo, Mojokerto, Lamongan and Bangkalan cities are located on this deposit. Pliocene (limestone strata) and miocene (sedimentary strata) are distributed along the north coast of Lamongan and Gresik and most of Bangkalan.

In the central area from the south of Lamongan and Gresik axis and to the west of Surabaya, Pleistocene (both of sedimentary and volcanic strata) is widely spread but Pliocene (sedimentary strata) is located in the higher portion of the hill around Watugede. In the southern part of Mojokerto, Quaternary volcanic products are widely distributed toward Mt. Ajasmoro and Welirang.

2.1.3 OTHERS

CLIMATE

GKS Region experiences a tropical climate with the dry season generally lasting from May to October, and the wet season from November to April. The wettest period is normally December and January.

WIND AND RAINFALL

The northerly monsoon, which prevails from November to February, is responsible for the heavy rain during the wet season. The southeast tradewinds maintain a slightly cooler dry season by carrying milder air from the Australian continent. Wind velocity normally ranges from 3 to 20 knots and is relative constant throughout the year. Only once has 50 knots been recorded and destructive winds are rare with hurricanes and typhoons never being recorded.

The mean annual rainfall is 1,321 mm, of which about 90% is concentrated in the rainy season from November to May. The maximum mean monthly rainfall is 261.8 mm in January and the minimum 5.6 mm in August.

HUMIDITY AND TEMPERATURE

Relative humidity and temperature vary only slightly throughout the year. As relative humidity is temperature dependent, a greater variation is recorded during the day rather than monthly. The relative humidity is greatest in the cooler early morning hours, dropping off to a low between noon and 3:00 p.m. The annual temperature variation has a tendency to two cycles. The first peak of mean air temperature is 27.4°C in April and the second one is 28.1°C in October. The average annual temperature is 26.9°C.

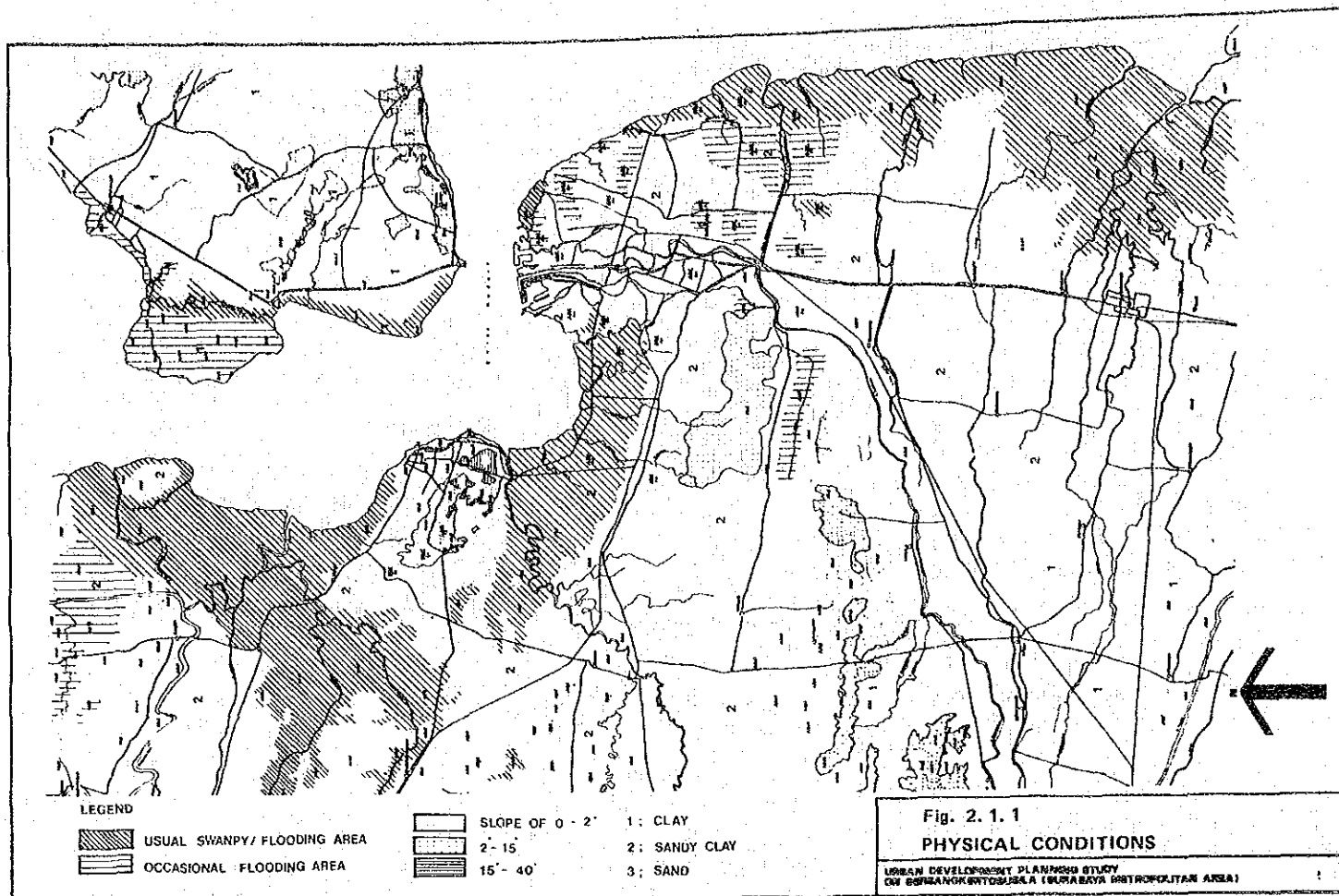


Fig. 2. 1. 1
PHYSICAL CONDITIONS

URBAN DEVELOPMENT PLANNING STUDY
ON GERSANGKERTOSUSA (SURABAYA METROPOLITAN AREA)

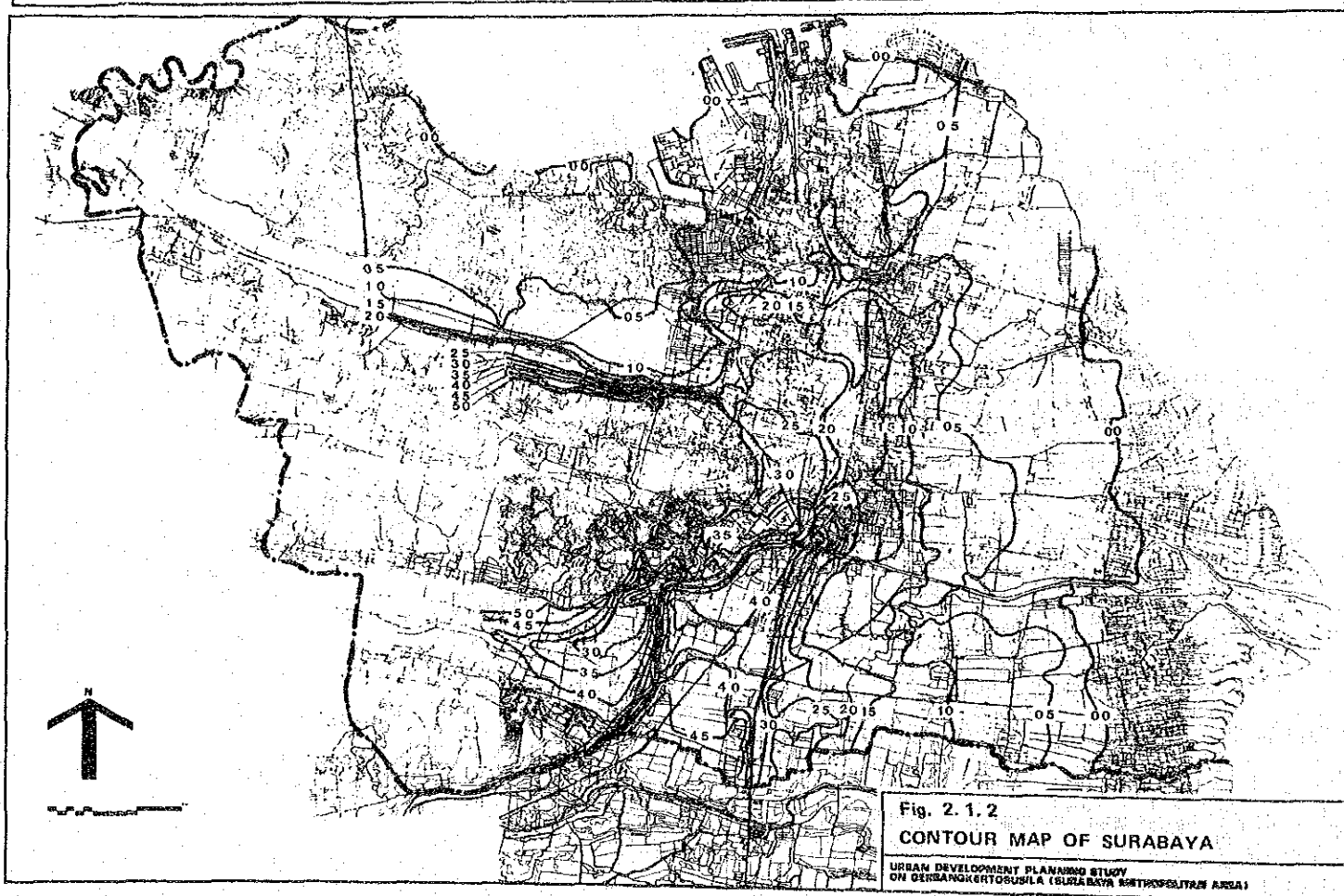


Fig. 2. 1. 2
CONTOUR MAP OF SURABAYA

URBAN DEVELOPMENT PLANNING STUDY
ON GERSANGKERTOSUSA (SURABAYA METROPOLITAN AREA)

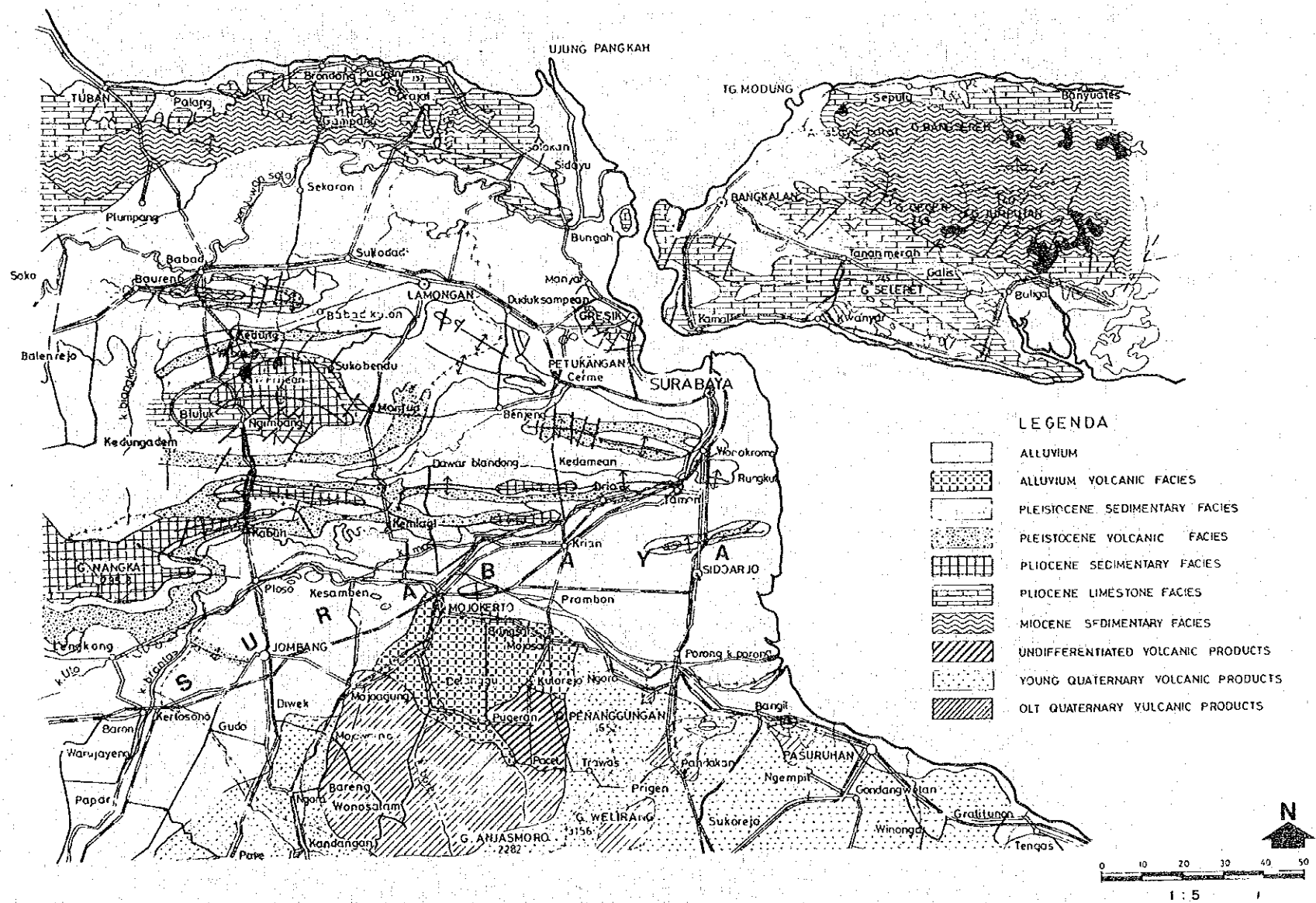


Fig. 2.1.3 GEOLOGICAL MAP

2.2 SOCIO-ECONOMY

2.2.1 POPULATION

POPULATION AND ITS GROWTH IN JAVA AND EAST JAVA

Population in Java was 91,269,528 in 1980, with 62% of the total population of Indonesia concentrated in this island. By consideration of the population increase from 1971 to 1980, most islands outside Java have a higher growth rate than the average growth rate in Indonesia.

Annual growth rate in East Java is decreasing from 1.58% (from 1961 to 1971) to 1.50% (from 1971 to 1980).

With respect to population density, East Java is nearly equivalent to the average density in Java, excluding DKI Jakarta.

DISTRIBUTION OF POPULATION IN EAST JAVA

Fig. 2.2.1 shows the distribution of population in East Java by kabupaten according to the 1980 National Census. Major areas with a population of more than 2 million are Surabaya, Malang and Jember. Kediri and Banyuwangi are middle sized areas with more than 1 million population.

The 5 areas as above are assumed to function themselves as regional socio-economic cores.

GKS REGION AND SURABAYA CITY

(1) Population and its growth in GKS

Population in GKS was 4,108 thousand in 1961, 5,041 thousand in 1971, and 6,111 thousand in 1980. Accordingly, the annual growth rate in GKS was 2.07% from 1961 to 1971 and 2.16% from 1971 to 1980. These figures are slightly lower than the national

average. The share of each Kabupaten and Kotamadya to GKS, is approximately the same, 11 – 14% except for Kod. Surabaya and Kab. Lamongan. Kod. Surabaya has 2,018 thousand which is 33.2% and Kab. Lamongan has 1,050 thousand which is 17.2%. The gradual urbanization expands to most parts of Kab. Sidoarjo, the central part of Kab. Gresik, and Kec. Kamal in Kab. Bangkalan.

For the annual growth rate from 1971 to 1980, the areas which have the highest growth level, are Kod. Surabaya (2.85%) and Kab. Sidoarjo (2.77%). Those with medium growth are Kab. Gresik (1.98%) and Kab. Mojokerto (1.89%). Those with a lower growth rate are Kab. Lamongan (1.61%), Kod. Mojokerto (1.48%) and Kab. Bangkalan (0.96%). The annual growth rates for each region in GKS, show the population concentration to Kod. Surabaya which has the highest growth rate. Kab. Sidoarjo and Kab. Gresik which are neighboring to Kod. Surabaya, also have high growth rates under the influence on the growth of Surabaya. In other words, Kod. Surabaya, Kab. Sidoarjo and Kab. Gresik can be considered as combined.

(2) Urbanization of GKS and Kod. Surabaya

From the distribution of population, the urbanization in GKS is shown distinctly. Kod. Surabaya, Kab. Gresik and Kab. Mojokerto have density higher than 5,000 person/km². In Kod. Surabaya, 67.2 km² has a density higher than 10,000 persons/km² and 13 km² has a density higher than 30,000 persons/km². Kec. Pabean Catran which is adjoining the harbour is the most densely inhabited district with 75,534 persons/km². The central parts of Kab. Gresik and Kab. Mojokerto have about 1,000 persons/km².

According to the above description, the concentration of population in GKS shows the central core pattern, with two sub cores in Kab. Gresik and Kab. Mojokerto. Population growth in GKS is nearly equivalent to that of the national level. The annual growth rate of GKS from 1971 to 1980 was about 2.2%, while that of Indonesia was about 2.4%. The areas which have higher growth rate than the national average are Kod. Surabaya, Kab. Sidoarjo, Kab. Gresik, Kec. Sooko in Kab. Mojokerto, Kec. Ujung Pangkam in Kab. Gresik, and Kec. Kamal in Kab. Bangkalan. Moreover, the areas which have a

Table 2.2.1 POPULATION AND ANNUAL GROWTH

	A R E A (km ²)	Population by Census (persons)			Annual Growth Rate(%)	
		Oct '61	Sep '71	Oct '80	61 - 71	71 - 80
Indonesia	1,919,443 (100.0)	97,085,348 (100.0)	119,208,229 (100.0)	147,490,298 (100.0)	2.07	2.39
Jawa	132,187 (6.9)	63,059,575 (65.0)	76,086,327 (63.8)	91,269,528 (61.9)	1.90	2.04
Jawa Timur	47,922 (2.5) (100.0)	21,823,020 (22.5) (100.0)	25,516,999 (21.4) (100.0)	29,188,852 (19.8) (100.0)	1.58	1.50
G.K.S	5,679.22 (11.9) (100.0)	4,108,169 (18.8) (100.0)	5,041,529 (19.8) (100.0)	6,111,935 (21.0) (100.0)	2.07	2.16
Gresik	1,136.43 (20.0)	592,309 (14.4)	610,944 (12.1)	728,570 (11.9)	0.31	1.98
Bangkalan	1,244.71 (21.9)	574,348 (14.0)	631,455 (12.5)	688,291 (11.3)	0.95	0.96
Kod. Mojokerto	7.25 (0.1)	51,732 (1.3)	60,013 (1.2)	68,507 (1.0)	1.50	1.48
Surabaya	291.78 (5.1)	1,165,306 (28.4)	1,566,255 (31.1)	2,017,527 (33.2)	3.00	2.85
Sidoarjo	614.27 (10.8)	457,385 (11.1)	667,639 (13.2)	853,685 (14.0)	3.85	2.77
Lamongan	1,555.18 (27.4)	772,599 (18.8)	909,038 (18.0)	1,049,808 (17.2)	1.64	1.61
Kab. Mojokerto	829.60 (14.6)	494,492 (12.0)	596,185 (11.8)	705,547 (11.5)	1.89	1.89

Source : National Census 1961, 1971, 1980.

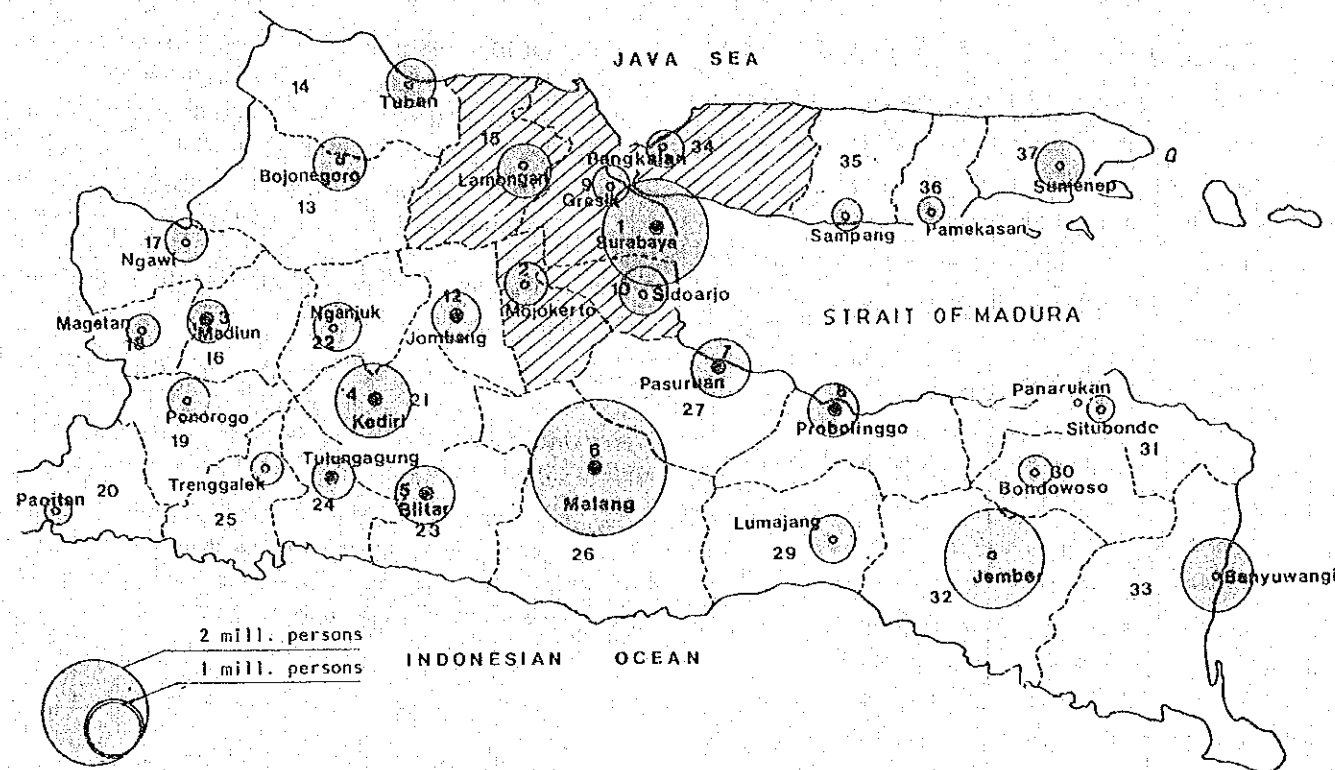


Fig. 2.2.1 DISTRIBUTION OF POPULATION IN EAST JAVA, 1980

growth rate higher than 5%, are the areas around the centre of Kod. Surabaya, and in Kab. Sidoarjo. On the other hand, there are low growth areas in the centre of Kod. Surabaya. For example the population of Kec. Krembangan, which includes the harbour, recently decreased. According to the above description, the urbanization in GKS transfers from the central area of Kod. Surabaya to the surroundings of the central area, and continues toward Kab. Sidoarjo along the Surabaya – Malang axis.

(3) Household and Family Size

Number of households in GKS was approximately 1.27 million in 1980 according to the results of the national census, and this figure is equivalent to 19.6% of the total in East Java.

Of these 1.27 million, about 418 thousand households are concentrated in Surabaya.

Table 2.2.2 NUMBER OF HOUSEHOLD AND FAMILY SIZE

	Number of Households (thousand)		Family Size	
	1971	1980	1971	1980
Surabaya	328.5	417.5	4.70	4.87
Gresik	121.1	146.5	5.10	4.90
Bangkalan	133.6	151.0	4.68	4.55
Mojokerto	141.1	169.1	4.63	4.58
Sidoarjo	131.9	170.7	5.05	5.00
Lamongan	182.8	212.7	5.01	4.94
G K S	1,039.1	1,267.5	4.83	4.83
EAST JAVA	5,622.2	6,478.5	4.55	4.50
INDONESIA		39,244.5		3.76

SOURCE : NATIONAL CENSUS

Average family size in GKS was 4.83 persons per household in 1980. This figure is higher than the national average of 3.76. Generally, judging from the experiences in more developed countries, it is expected that the family size in an agricultural society is higher than in an urbanized society.

However, considering that the family size of Surabaya which has been remarkably urbanized is lower than the average of GKS and East Java, there must exist some particular social factors in the structure of urbanization in East Java.

STRUCTURE OF POPULATION GROWTH IN GKS REGION

(1) Age Group Structure

According to the composition by age group in 1980, young people increased notably. Each "5 year" age group from 0 to 19 has a population of more than 700 thousand; groups from 20 to 29 are between 500 thousand and 600 thousand; and those from 30 to 44 are about 350 thousand. The composition of population by age shows the character of the "Pyramid Pattern".

Comparing the composition in 1970 with that of 1980, there is a gradual tendency to transfer from the "Pyramid Pattern" to the "Bell Pattern", which seems to be an intermediate stage in the progress to a developed country.

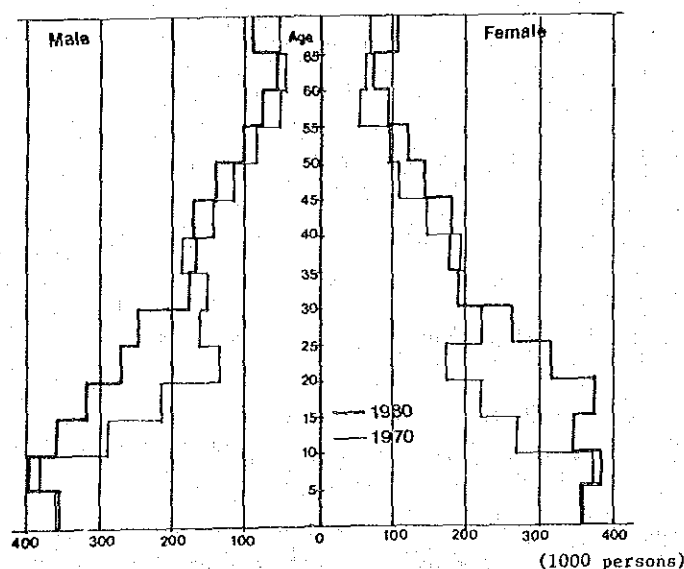
In 1970, population under 15 years old was remarkably high. Toward the year 2000, the share of 25 – 49 years old population is going to increase remarkably, and this is assumed to play an important role in the regional economic activity.

The compositions of age group population for each Kotamadya and Kabupaten, show the "Pyramid Pattern" similar to that of GKS, but there is slight difference between Kotamadya and Kabupaten. The difference is shown clearly by comparing Kod. Surabaya with Kab. Bangkalan and Kod. Mojokerto with Kab. Mojokerto. The age groups from 15 to 50 in Kotamadya are larger than in the Kabupaten, while the age groups from 0 to 15 and over 50 in the Kabupaten are larger than in the Kotamadya.

Table 2.2.3 POPULATION BY AGE GROUP IN THE GKS 1980

by Age Group	by Sex		Total
	Male	Female	
0 - 4	371,400	356,809	728,209
5 - 9	399,290	387,819	787,109
10 - 14	364,673	347,207	711,880
15 - 19	321,670	375,664	697,334
20 - 24	271,289	316,828	588,117
25 - 29	250,100	251,447	511,547
30 - 34	180,189	188,364	368,553
35 - 39	171,166	178,931	350,097
40 - 44	172,507	180,334	352,841
45 - 49	140,1805	146,541	286,721
50 - 54	102,062	118,760	220,822
55 - 59	81,276	94,575	175,851
60 - 64	61,754	71,860	133,614
65 -	92,086	107,1535	199,240
			6,111,935

Source : National Census 1980.



Source; National Census 1971,1980
Note; Population of 1970 is revised from 1971.

Fig. 2.2.2 COMPOSITION OF AGE GROUP POPULATION IN GKS REGION, 1970/1980

(2) Natural and Social Increase

The indicators for the natural growth and the social growth are forecast by the Study Team. The method used is the Cohort Analysis which calculates the population in a closed system, as follows:

$$\begin{aligned}
 (1970 - 1980) \text{ Natural growth} &= (1980) \text{ Closed population} - (1970) \text{ Population} \\
 (1970 - 1980) \text{ Social growth} &= (1980) \text{ Population} - (1980) \text{ Closed Population} \\
 (1970 - 1980) \text{ Natural growth} &+ (1970 - 1980) \text{ Social growth} = (1980) \text{ Population} - (1970) \text{ Population}
 \end{aligned}$$

According to this forecast, the share of the natural growth to the total population growth, is very large, at 84.5%.

The migration is estimated to be 181 thousand and the social growth by age group shows that the young people in-migrate to GKS, while middle-aged and old people out-migrate from GKS. Composition of natural and social increase between 1970 and 1980 is estimated as illustrated on Fig. 2.2.3.

According to this calculation, the natural growth rate in GKS Region is assumed to be about 1.86% per annum, which is less than the national average increase rate of 2.39% per annum. This fact is conceivably an effect of the family planning programme processed strongly by the Government.

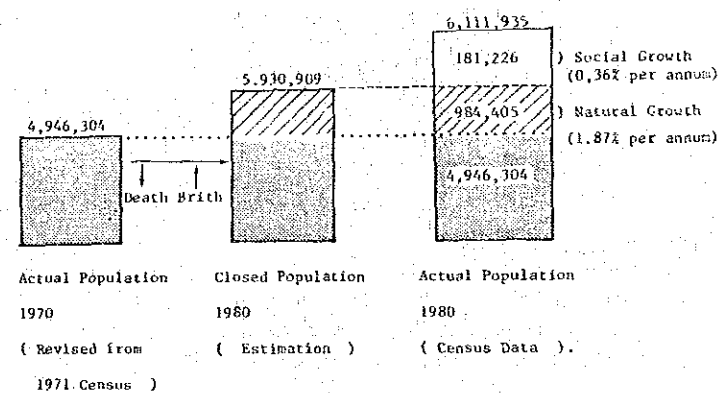


Fig. 2.2.3 COMPOSITION OF NATURAL GROWTH AND SOCIAL GROWTH

Table 2.2.4 POPULATION BY AGE GROUPS IN CLOSED SYSTEM IN THE GKS/1980

by Age Group	by Sex		Total
	Male	Female	
0 - 4	371,525	347,997	719,522
5 - 9	317,920	293,635	611,555
10 - 14	325,261	318,697	643,958
15 - 19	371,619	362,255	733,874
20 - 24	287,306	263,476	550,782
25 - 29	214,187	216,126	430,314
30 - 34	132,943	169,520	302,463
35 - 39	159,114	212,418	371,532
40 - 44	152,033	190,061	342,094
45 - 49	179,145	184,057	363,202
50 - 54	133,756	136,842	270,598
55 - 59	108,325	98,882	207,207
60 - 64	77,136	83,943	161,079
65	90,737	131,792	222,529
			5,930,709

Remark : This population in closed system is forecast by Cohort Analysis.

Table 2.2.5 NATURAL INCREASE OF POPULATION IN THE GKS 1970-1980

by Age Group	by Sex		Total
	Male	Female	
0 - 4	8,467	-13,578	-5,111
5 - 9	-62,450	-77,338	-139,788
10 - 14	32,439	51,102	83,541
15 - 19	152,497	142,145	294,642
20 - 24	150,788	90,355	241,143
25 - 29	50,959	-3,984	46,976
30 - 34	-22,865	-30,311	-53,176
35 - 39	-29,340	17,533	-11,807
40 - 44	7,601	44,145	51,746
45 - 49	60,928	75,733	136,661
50 - 54	48,680	42,367	91,047
55 - 59	55,400	42,494	97,894
60 - 64	30,146	21,125	51,271
65 -	36,822	62,544	99,366
			984,405

Remark : Natural Increase 1970-1980 = (Population in Closed System/ 1980) - (Population/1970).

Table 2.2.6 MIGRATION OF POPULATION IN THE GKS/1970-1980

by Age Group	by Sex		Total
	Male	Female	
0 - 4	- 125	8,812	8,687
5 - 9	81,370	94,184	175,554
10 - 14	39,412	28,510	67,922
15 - 19	-49,949	13,409	-36,540
20 - 24	-16,017	53,352	37,335
25 - 29	35,913	45,321	81,233
30 - 34	47,246	18,844	66,090
35 - 39	12,052	-33,487	-21,435
40 - 44	20,474	-9,727	10,747
45 - 49	-38,965	-37,516	-76,481
50 - 54	-31,694	-18,082	-49,776
55 - 59	-27,049	-4,307	-31,356
60 - 64	-15,382	-12,083	-27,465
65	1,349	-24,638	-23,289
			181,226

2.2.2 REGIONAL DOMESTIC PRODUCT

ECONOMIC GROWTH OF EAST JAVA

(1) Economic Growth

As shown in Table 2.2.7, the economic growth in East Java is less than the national average, e.g. growth in GRDP at current prices was 26% p.a., and at constant prices 3.2% p.a., during the last ten years.

As a result of this the share of East Java in GDP diminished to 12.0% in 1980 from 17.9% in 1979.

Table 2.2.7 COMPARISON OF ECONOMIC GROWTH (GDP)

		(Billion Rp.)					
		1971	1975	1980	Annual Growth Rate (%)		
					75/71	80/75	80/71
Current Price	Indonesia	3,672.0	12,642.5	43,765.0	36.2	28.2	31.7
	East Java	656.8	1,808.6	5,249.3	28.8	23.8	26.0
Constant price in 1973	Indonesia	5,544.7	7,610.8	10,953.9	8.3	7.5	7.9
	East Java	992.1	1,091.5	1,314.0	2.4	3.8	3.2
	Share(%)	17.9	14.3	12.0	-	-	-

Source : National Income of Indonesia, Biro Pusat Statistik, Statistik Jawa Timur 1980, Kantor Statistik Propense Dan Bappeda Tingkat I Jawa Timur

(2) Industrial Structures

In 1978, the GDP of East Java was 3.2 trillion Rupiah with the primary sector such as agriculture, forestry and fishery having the largest share at 1.3 trillion Rupiah or about 41% of the total. Among others the manufacturing industry and the wholesale and retail trade were 18.4% and 18.3% respectively. It can be said that together these three industries are the fundamental supporters of the East Java economy.

Table 2.2.8 COMPOSITION OF THE GROSS REGIONAL DOMESTIC PRODUCT IN EAST JAVA AND INDONESIA

(at 1978 current market price)

SECTOR	EAST JAVA		INDONESIA		Special-ization Coefficient
	Billion Rp	Share (%)	Billion Rp	Share (%)	
1. Agriculture, Livestock, Forestry and Fishery	1,304.19	40.66	6,706.0	30.53	133
1-1 Farm Foods Crops	935.13	29.15	3,911.4	17.81	164
1-2 Farm non Food Crops	51.12	1.59	801.1	3.63	44
1-3 Estate Crops	177.02	5.52	404.5	1.84	300
1-4 Livestock & products	102.25	3.14	462.5	2.11	151
1-5 Forestry (6 Hunting)	8.78	0.27	653.2	2.97	9
1-6 Land fishery and marine fishery	29.96	0.93	393.2	1.79	52
2. Mining & Quarrying	4.49	0.14	3,869.2	17.61	0.8
3. Manufacturing Industries	589.68	18.38	2,184.7	9.95	185
4. Electricity, Gas & Water Supply	15.73	0.49	115.8	0.53	92
5. Construction	11.49	0.39	1,242.1	5.65	6
6. Wholesale & Retail Trade	588.08	18.33	3,450.2	15.71	117
7. Transport & Communication	166.02	5.18	979.6	4.46	116
8. Financial Intermediaries	35.12	1.09	395.6	1.80	61
9. Ownership of dwelling	136.37	4.25	670.6	3.05	139
10. Public administration and Defence	304.70	9.50	1,685.4	7.67	124
11. Services	51.64	1.61	668.2	3.04	53
12. Gross Domestic Product	3,207.52	100.0	21,967.4	100.0	100

They are compared with the national economy as shown in Fig. 2.2.4, by the production of specialization coefficients. From Fig. 2.2.4 it is possible to comment as follows:

- Primary sector is higher by 30% and in particular the estate crops were three times the national average.
- Manufacturing industry was 1.8 times the national average.
- Mining and Quarrying, and Construction, were significantly small contributors to the East Java economy.

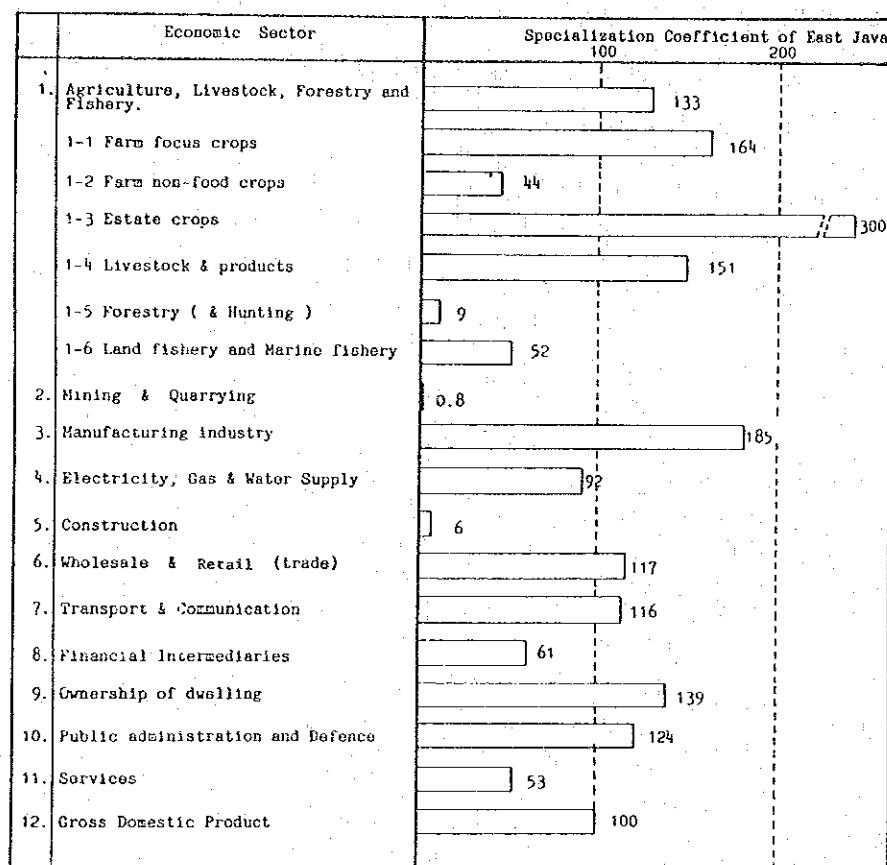


Fig. 2.2.4 SPECIALIZATION COEFFICIENT OF EAST JAVA (GRDP IN 1978) (NATIONAL ECONOMY BASE 100)

ECONOMIC GROWTH AND INDUSTRIAL STRUCTURE IN GKS REGION

(1) Industrial Structure in GKS Region

Fig. 2.2.5 shows the comparison of industrial structure between East Java and GKS Region by GRDP Component.

The estimate of GRDP in GKS Region in 1978 was made by the Study Team and the Figure shows that GKS Region was dominated by the commercial sector.

The proportion of manufacturing sector shows no difference between GKS and East Java. On the other hand, the proportion of primary sector in GKS Region is smaller than that of East Java and is expected to diminish more and more in accordance with the development of a modern industrial based economy.

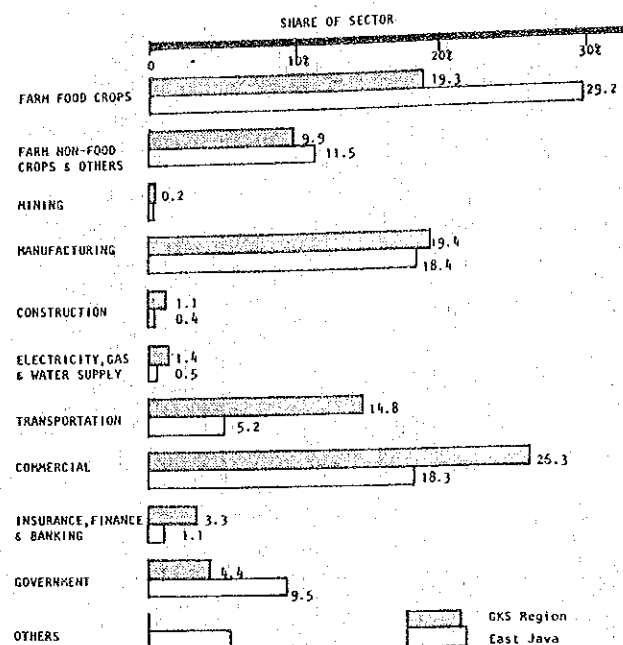


Fig. 2.2.5 COMPARISON OF INDUSTRIAL STRUCTURE, GKS REGION & EAST JAVA (BASED ON GRDP IN 1978)

(2) Characteristics of Industrial Structure by Kabupaten

GKS Region is composed of many areas having various kind of functions. Characteristics of industrial structure for each are shown in Table 2.2.9.

Prominent sectors in each area are as follows:

- Gresik : Agriculture (food), Small Industry
- Bangkalan : Agriculture (food), Other Primary Sector, Government
- Mojokerto : Agriculture (food), Small Industry, Electricity, Gas, Water, Government
- Surabaya : Large Industry, Electricity, Gas, Water, Transportation, Insurance & Finance, Government
- Sidoarjo : Agriculture (food), Other Primary Sector, Large Industry, Small Industry
- Lamongan : Agriculture (food), Other Primary Sector

Fig. 2.2.6 shows that Surabaya City is responsible for about 55% of GRDP in GKS Region although only 33% of population in the region stay in Surabaya. It is also worthy of note that the greatest part of the tertiary sector such as insurance, finance and banking, and transportation concentrates in Surabaya.

(3) Estimated GRDP by Sector

GRDP by Sector was estimated at 1975 constant price. The economic growth of GKS Region was estimated to be 4.3% p.a. at constant price level, while, as shown in Table 1.1.10 the equivalent figures for Indonesia and East Java are 7.9% p.a. and 3.2% p.a. respectively.

Fig. 2.2.7 shows the trends of GRDP index by sector for each Kotamadya/Kabupaten. In every area, both the secondary and tertiary sector show higher growth rates than the primary sector.

Estimated size and composition of GRDP in 1980 is shown in Fig. 2.2.8. It can be seen that the greatest part of the GRDP in GKS Region concentrated to Surabaya and 75% of GRDP of Surabaya is occupied by the tertiary sector.

Table 2.2.9 ESTIMATED GRDP IN GKS REGION - 1978 (AT CURRENT PRICE)

(Million Rupiah)

	Sub Total	Primary Sector		Sub Total	Secondary Sector				Sub Total	Tertiary Sector					Total
		Agriculture (Food)	Others		Mining	Large Industry	Small, Home Industry	Construction		Electricity and Gas	Transportation	Commerce	Insurance Finance Banking	Government	
1. Gresik	36,283.1 (44.4) [13.5]	30,914.0 (43.5) [17.5]	5,369.1 (7.4) [5.9]	12,263.8 (16.9) [6.4]	116.2 (0.2) [5.2]	8,797.5 (12.0) [5.4]	2,753.5 (3.8) [17.6]	646.6 (0.9) [6.2]	24,106.4 (23.2) [5.2]	247.0 (0.3) [2.0]	5,659.7 (7.8) [4.2]	15,097.4 (20.8) [6.3]	196.2 (0.3) [0.7]	2,406.1 (4.9) [7.3]	72,653.3 (100.0) [7.9]
2. Bangkalan	34,328.2 (62.5) [12.8]	28,507.1 (51.9) [16.1]	5,821.1 (10.6) [6.4]	2,894.1 (5.3) [1.5]	5.5 (0.01) [0.2]	2,103.3 (3.5) [1.3]	626.0 (1.1) [4.0]	154.3 (0.3) [1.5]	17,694.0 (32.2) [3.9]	76.9 (0.1) [0.6]	845.7 (1.5) [0.6]	12,861.4 (23.4) [5.3]	120.8 (0.2) [0.4]	3,789.2 (6.9) [9.5]	54,916.3 (100.0) [6.0]
3. Mojokerto	43,847.8 (51.4) [16.4]	35,857.6 (42.0) [20.2]	7,990.2 (9.3) [8.8]	14,078.7 (16.5) [7.4]	- - -	10,846.8 (12.7) [6.7]	2,626.5 (3.1) [16.7]	605.4 (0.7) [5.4]	27,347.3 (32.1) [6.0]	520.2 (0.6) [4.2]	1,282.6 (1.5) [0.9]	20,371.9 (23.9) [8.4]	665.1 (0.8) [2.2]	4,502.5 (5.3) [11.2]	35,273.8 (100.0) [9.3]
4. Surabaya	33,661.0 (6.8) [12.6]	6,183.6 (1.2) [3.5]	27,477.4 (5.5) [30.3]	119,883.0 (24.0) [62.7]	1,346.5 (0.3) [61.0]	106,568.1 (21.4) [65.4]	4,039.4 (0.8) [25.7]	7,929.0 (1.6) [7.7]	345,137.1 (69.2) [75.1]	10,921.1 (2.2) [87.6]	126,365.8 (25.3) [43.0]	157,284.0 (31.5) [65.2]	28,275.2 (5.7) [94.6]	22,291.0 (4.5) [55.7]	498,681.1 (100.0) [54.3]
5. Sidoarjo	50,671.8 (45.4) [18.9]	37,153.3 (33.3) [21.0]	13,518.5 (12.1) [14.9]	32,479.9 (29.1) [17.0]	624.6 (0.6) [28.3]	26,218.4 (23.6) [16.1]	4,640.0 (4.2) [29.5]	936.9 (0.8) [9.1]	28,386.4 (25.4) [6.2]	658.1 (0.6) [5.3]	1,461.1 (1.3) [1.1]	21,917.2 (19.6) [9.1]	557.7 (0.5) [1.9]	3,792.3 (3.4) [9.5]	111,538.1 (100.0) [12.1]
6. Lamongan	69,118.2 (72.3) [25.8]	38,470.0 (40.3) [21.7]	30,648.2 (32.1) [33.7]	9,617.4 (10.1) [5.0]	114.6 (0.1) [5.2]	8,433.2 (8.8) [5.2]	1,002.8 (1.0) [6.4]	66.8 (0.1) [0.6]	16,771.0 (17.6) [3.7]	38.2 (0.04) [0.3]	257.9 (0.3) [0.2]	13,628.8 (14.3) [5.7]	76.4 (0.1) [0.3]	2,769.7 (2.9) [6.9]	95,506.6 (100.0) [10.4]
G K S	267,910.1 (24.2) [100.0]	177,095.6 (19.3) [100.0]	40,814.5 (9.9) [100.0]	191,216.4 (20.8) [100.0]	2,207.4 (0.2) [100.0]	162,977.3 (17.7) [100.0]	15,688.2 (1.7) [100.0]	10,344.0 (1.1) [100.0]	459,442.2 (50.0) [100.0]	12,461.5 (1.4) [100.0]	135,877.8 (14.8) [100.0]	241,160.7 (26.3) [100.0]	29,891.4 (3.3) [100.0]	40,050.8 (4.4) [100.0]	918,569.2 (100.0) [100.0]

Source : Penyusunan Rencana Umum Kota Surabaya dan Sekitarnya GERBANGKERTOSUSILA (GKS Study 1980)

Remarks : () Composition of Sector by Region
[] Composition of Region by Sector

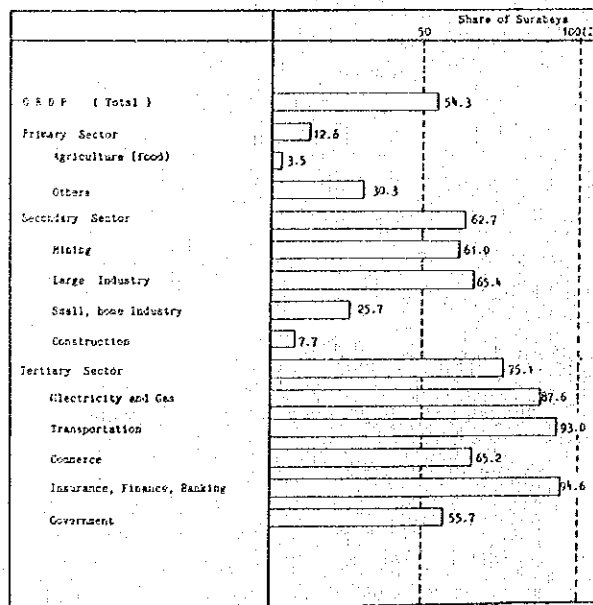


Fig. 2.2.6 SHARE OF SURABAYA IN GKS REGION, GRDP BY SECTOR

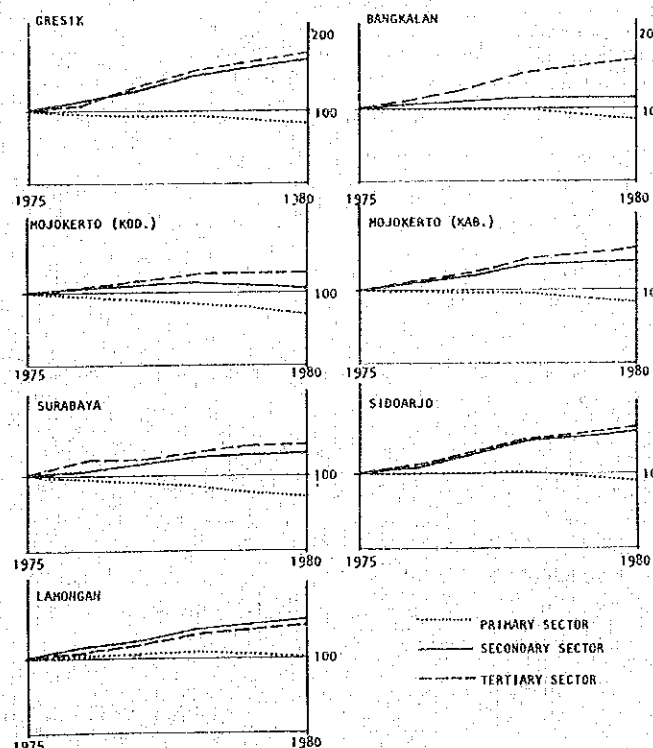


Fig. 2.2.7 TRENDS OF GRDP INDEX AT CONSTANT PRICE (1975 = 100)

Table 2.2.10 ANNUAL GROWTH RATE OF GRDP (CONSTANT PRICE)

	1971-1975	1975-1980	1971-1980
GKS	3.5	4.7	4.3
East Java	2.4	3.8	3.2
Indonesia	8.3	7.5	7.9

2.2.3 EMPLOYMENT OPPORTUNITIES

ECONOMIC ACTIVE POPULATION

(1) Labour Forces in GKS Region

Based on "Labour Force Situation in Indonesia 1978" issued by the BIRO PUSAT STATISTIK, JAKARTA INDONESIA, the percentage of Labour Force to Population in East Java was 42.1% as of 1978, and this was 2.5% higher than the national level of 39.6%. Also the percentage of labour Force to Population of 10 years old and over, is 57.9%.

In the composition of employed persons by industry, the following are worthy of note:

- the share of persons employed in Agriculture is 63.1%; higher than the national level of 60.9%,
- the share of employees in Trade/Restaurant/Hotel etc, so-called commercial business, is 17.0%, and this is a little higher than the national level of 14.9%.

Table 2.2.11 POPULATION OF 10 YEARS OF AGE AND OVER BY ACTIVITY IN 1978

	(unit : thousand)	
	EAST JAVA	INDONESIA
1 Employed		
(1) At Work	11,036.9	48,959.1
(2) Temporary	482.9	2,821.2
(3) Total Employed	11,519.8	51,780.3
2 Seeking Work	242.1	1,316.7
3 Total Labour Force	11,761.9	53,097.1
- Percentage of Employed Persons to Labour Force (%)	97.9	97.5
- Percentage of Labour force to Population of 10 Years and over (%)	57.9	56.7
- Percentage of Labour Force to Total Population (%)	42.1	39.6

Source : "The Labour Force Situation in Indonesia, 1978 "

Table 2.2.12 NUMBER OF EMPLOYED PERSONS BY INDUSTRY

	East Java		Indonesia	
	Persons	Composition	Persons	Composition
1 Agriculture	7,274.6	63.1(%)	31,545.4	60.9(%)
2 Mining/Quarrying	32.8	0.3	122.7	0.2
3 Manufacturing	702.1	6.1	3,855.6	7.4
4 Electricity, Gas/Water	0	0.0	13.3	0.0
5 Construction	149.6	1.3	805.9	1.6
6 Trade, Restaurant, Hotel	1,957.4	17.0	7,708.5	14.9
7 Transport/Storage etc	223.1	1.9	1,288.6	2.5
8 Financing, Insurance	7.4	0.1	42.7	0.1
Real Estate & Business				
9 Community Social & Personal Services	1,172.8	10.2	6,394.8	12.3
10 Others	0	0.0	2.8	0.0
Total	11,519.8	100.0	51,780.4	100.0

(2) Comparison of Urban and Rural Employment

With regard to employment which is the main factor in the migration, there are many differences between urban and rural areas.

According to the classification of the households in East Java by main source of income, the different points between urban and rural areas are as follows:

Ranking	Urban Area	Rural Area
First	Trade (21.6%)	Agriculture (74.4%)
Second	Employee (15.6%)	Trade (10.9%)
Third	Others (12.4%)	Employee (3.6%)
Fourth	Manufacturing (12.2%)	Manufacturing (3.3%)
Fifth	Transportation (10.8%)	Others (2.6%)

In rural areas the majority of households are engaged in Agriculture, but the urban area has a variety of employment opportunities. It is therefore possible to choose different jobs and this is a main factor for the social growth in the urban area. At present the share of Manufacturing to total employment in the urban area, is very low, and this shows the existing need for industrial development. According to the classification of employment by main occupation, different points in the composition of the occupation between urban and rural, are as follows:

Ranking	Urban Area	Rural Area
First	Production and Related Workers, Transport Equipment Operator (29.3%)	Farmers (69.6%)
Second	Sales Workers (28.3%)	Sales Workers (15.6%)
Third	Services Workers (15.1%)	Production and Related Workers, Transport Equipment Operator (8.9%)
Fourth	Farmers (11.2%)	Service Workers (3.5%)
Fifth	Clerical and Related Workers (11.0%)	Workers (1.3%)

In the rural area, the first occupation is Farmers (69.6%), the second occupation is Sales Workers (15.6%), and the share of other occupations is very small. In the urban area, the share of Production, Sales Workers, and Service Workers, are each large. The total share of them is more than 70%, but these occupations include low level unskilled jobs.

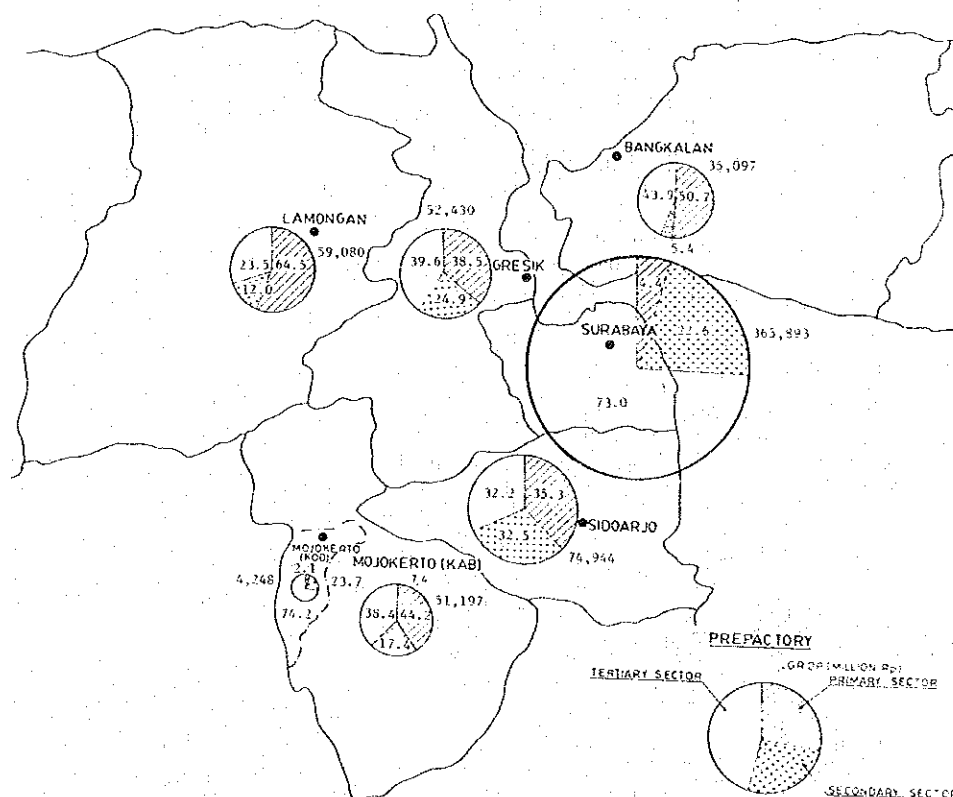


Fig. 2.2.8 ESTIMATED SIZE & COMPOSITION OF GRDP IN GKS REGION (1980) (1975 PRICE)

Table 2.2.13 NUMBER OF HOUSEHOLDS BY PROVINCE AND MAIN SOURCE OF HOUSEHOLD INCOME IN EAST JAVA, 1978

SECTOR	MAIN SOURCE OF INCOME								TOTAL
	AGRICULTURE	MANUFACTURING	TRADE	TRANSPORTATION	SERVICES	OTHER ENTERPRISE	EMPLOYEE	OTHERS	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
URBAN	85,560 (10.6)	97,960 (12.2)	173,600 (21.6)	86,800 (10.8)	97,960 (12.2)	37,200 (4.6)	125,240 (15.6)	99,200 (12.4)	803,520 (100.0)
RURAL	3,995,040 (74.4)	177,940 (3.3)	585,480 (10.9)	83,230 (1.5)	137,760 (2.6)	57,400 (1.1)	192,290 (3.6)	140,630 (2.6)	5,369,770 (100.0)
TOTAL	4,080,600 (66.1)	275,900 (4.5)	759,080 (12.3)	170,030 (2.8)	235,720 (3.8)	94,600 (1.5)	317,530 (5.1)	239,830 (3.9)	6,113,290 (100.0)

Table 2.2.14 NUMBER OF EMPLOYED PERSONS BY PROVINCE AND MAIN OCCUPATION IN EAST JAVA, 1978

SECTOR	MAIN OCCUPATION								TOTAL
	PROFESSIONAL, TECHNICAL AND RELATED WORKERS	ADMINISTRATIVE AND MANAGERIAL WORKERS	CLERICAL AND RELATED WORKERS	SALES WORKERS	SERVICES WORKERS	FARMERS	PRODUCTION AND RELATED WORKERS, TRANSPORT EQUIPMENT OPERATOR	WORKERS NOT CLASSIFIABLE BY OCCUPATION	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
URBAN	54,560 (4.3)	7,440 (0.6)	140,120 (11.0)	359,600 (28.3)	192,200 (15.1)	142,600 (11.2)	374,480 (29.5)	0 (0)	1,271,000 (100.0)
RURAL	123,410 (1.2)	0 (0)	129,150 (1.3)	1,598,590 (15.6)	358,750 (3.5)	7,129,080 (69.6)	909,790 (8.9)	0 (0)	10,248,770 (100.0)
TOTAL	177,970 (1.5)	7,440 (0.1)	269,270 (2.3)	1,958,190 (17.0)	550,950 (4.8)	7,271,680 (63.1)	1,284,270 (11.2)	0 (0)	11,519,770 (100.0)

Source : "The Labour, Force Situation in Indonesia 1978" Biro Pusat Statistik.

(3) Employment by Kod./Kab.

The employment by municipality and sector from 1971 to 1980 were estimated, since no such data is available. The result for East Java and GKS are shown in Table 2.1.15. The characteristics of each municipality are as follows:

Gresik: The number of employment opportunities in the primary sector was 161,358 in 1980 and its proportion to the total was 53.7%. This means the primary sector is the biggest one in Gresik. The secondary sector had 30,774 jobs in 1980 and the proportion was 10.2% which is far less than the tertiary sector. Although the primary sector was the biggest, the growth rate of it between 1971 and 1980 was 0.4% per annum and that of the tertiary sector was 12.61%. It is expected that the proportion of the tertiary sector will be the biggest of the three in the near future.

Bangkalan: Bangkalan specializes in the primary sector and the number of employment opportunities in each of the three sectors was 174,593, 3,772, and 86,009 respectively, in 1980. The proportion of the primary sector was 66.0% in 1980. Although the growth rate of the primary sector is as low as 0.61% and that of the tertiary sector is as high as 11.78%, Bangkalan will continue to specialize in the primary sector for a while. It is a characteristic of Bangkalan that not only the proportion of the secondary sector, but also the number of jobs in it, has been decreasing year by year.

Kod. Mojokerto: The proportions of each sector were 2.3%, 10.7% and 87.0% respectively in 1980. This municipality has specialized in the tertiary sector and presumably this situation will continue since the only sector with a positive growth rate is the tertiary sector.

Kab. Mojokerto: The features of this municipality are almost the same as those of Gresik. That is, at present, the biggest sector is the primary which is only slightly larger than the tertiary sector. The growth rate of the tertiary sector is 10.36%, while that of the primary sector is as low as 0.41%.

Surabaya: The proportion of the primary sector is extremely small (3.1%) while the tertiary sector is big at 82.8%. The number of job opportunities in the primary sector has been decreasing and that of the tertiary sector has been increasing at a rate of 6.38% per annum. If this trend continues, the proportion of the primary sector would reduce to almost zero while that of tertiary sector would continue to increase at a high rate and that of the secondary sector would increase at a low rate.

Sidoarjo: The features of this municipality are also similar to Gresik and, consequently, Kab. Mojokerto. The biggest sector is the primary but the tertiary sector is almost the same as the primary. The annual growth rates of the sectors are 0.89% (primary) and

10.91% (tertiary) and this means that the primary sector will soon be overwhelmed by the tertiary sector. The proportion of the secondary sector is 15.6%.

Lamongan: Job opportunities in this are concentrated in the primary sector, whose proportion is 83.9%. The other sectors have proportions of 2.4% and 13.6% respectively. Although the growth rate of the tertiary sector is as high as 8.18%, that of the primary sector is not so low (3.17%). Therefore, the characteristic of concentration on the primary sector will continue for a fairly long time.

(4) Proportion of employment by Kod. in GKS

Table 2.2.16 shows the number of employments by municipality in GKS, and these have been extracted from Table 2.2.15. The municipality which has the largest proportion is Surabaya with 29.7% in 1980, the second largest is Lamongan and the smallest is Kod. Mojokerto.

Table 2.2.15 ESTIMATED EMPLOYMENTS BY KOD./KAB.

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	Annual Growth Rate (%) (1980/1971)	
JAWA TIMUR	1	6,233,082	6,372,194	6,514,412	6,659,803	6,808,439	6,960,392	7,115,737	7,274,550	7,436,905	7,602,885	2.23
	2	677,012	703,372	730,758	759,211	788,772	819,483	851,390	884,540	918,980	954,761	3.89
	3	2,018,373	2,170,869	2,334,887	2,511,298	2,701,037	2,905,111	3,124,604	3,360,680	3,614,594	3,887,691	7.56
	Total	8,929,467	9,246,435	9,580,057	9,930,312	10,298,248	10,684,986	11,091,731	11,519,770	11,970,479	12,445,337	3.76
C K S	1	988,337	1,010,066	1,028,970	1,046,703	1,063,160	1,078,204	1,091,849	1,103,996	1,114,599	1,123,649	1.44
	2	172,180	179,407	186,217	193,056	199,899	206,727	213,534	220,299	226,999	233,613	3.45
	3	596,437	649,518	704,617	763,562	826,532	896,798	965,227	1,032,277	1,102,062	1,172,760	8.15
	Total	1,756,954	1,838,991	1,919,804	2,003,321	2,089,591	2,245,729	2,270,610	2,374,572	2,473,660	2,565,022	4.29
GRESIK	1	155,661	158,383	160,396	161,988	163,127	163,783	163,943	163,598	162,736	161,358	0.40
	2	15,664	17,111	18,604	20,173	21,810	23,510	25,266	27,069	28,909	30,774	7.79
	3	37,138	42,381	48,138	54,526	61,584	69,350	77,856	87,137	97,216	108,111	12.61
	Total	208,463	217,875	227,138	236,686	246,521	256,642	267,065	277,804	288,861	300,244	4.14
BANGKALAN	1	165,229	167,931	170,154	172,030	173,535	174,631	175,310	175,538	175,301	174,593	0.61
	2	4,021	4,033	4,032	4,024	4,006	3,978	3,941	3,894	3,838	3,772	0.71
	3	31,567	35,644	40,124	45,068	50,509	56,468	62,980	70,060	77,731	86,009	11.78
	Total	200,817	207,607	214,310	221,122	228,050	235,077	242,231	249,492	256,870	264,373	3.10
KOD. MOJOKERTO	1	807	781	753	726	699	672	646	619	593	568	3.83
	2	3,147	3,101	3,047	2,989	2,930	2,867	2,802	2,737	2,669	2,601	2.10
	3	13,742	14,515	15,288	16,079	16,890	17,720	18,569	19,436	20,324	21,229	4.95
	Total	17,696	18,397	19,088	19,795	20,519	21,259	22,017	22,792	23,586	24,398	3.63
KAB. MOJOKERTO	1	137,882	139,985	141,522	142,748	143,652	144,215	144,439	144,313	143,832	143,006	0.41
	2	15,023	15,764	16,472	17,173	17,862	18,534	19,186	19,813	20,409	20,974	3.78
	3	54,613	60,943	67,721	75,080	83,047	91,639	100,880	110,786	121,365	132,632	10.36
	Total	207,518	216,692	225,716	235,001	244,561	254,389	264,505	274,911	285,606	296,612	4.05
SURABAYA	1	34,922	33,536	32,205	30,928	29,700	28,522	27,390	26,303	25,259	24,257	3.97
	2	92,241	94,412	96,186	97,839	99,368	100,777	102,073	103,259	104,337	105,310	1.48
	3	361,829	387,925	413,986	441,219	469,649	500,422	530,245	571,462	606,074	631,163	6.38
	Total	488,992	515,874	542,378	569,985	598,717	628,598	659,708	692,071	725,736	760,729	5.03
SIDOARJO	1	141,408	144,317	146,550	148,488	150,112	151,401	152,363	152,981	153,253	153,176	0.89
	2	33,157	35,593	38,016	40,515	43,081	45,703	48,376	51,088	53,831	56,593	6.12
	3	60,148	67,478	75,323	83,895	93,231	103,366	114,346	126,206	138,979	152,697	10.91
	Total	234,713	247,387	259,889	272,897	286,423	300,469	315,085	330,276	346,063	362,466	4.95
LAMONGAN	1	352,428	365,133	377,390	389,795	402,335	414,980	427,758	440,644	453,625	466,691	3.17
	2	8,927	9,393	9,860	10,343	10,842	11,358	11,890	12,439	13,006	13,589	4.78
	3	37,400	40,632	44,037	47,695	51,622	55,833	60,351	65,190	70,373	75,919	8.18
	Total	398,755	415,158	431,287	447,833	464,799	482,171	499,999	518,273	537,004	556,199	3.77

Remarks : 1 : Primary Sector, 2 : Secondary Sector, 3 : Tertiary Sector.

Other municipalities, Gresik, Bangkalan, Kab. Mojokerto, Sidoarjo are of approximately the same size. Comparing 1980 with 1971, it can be seen that the changes of the proportions are fairly small, although Surabaya and Sidoarjo have been increasing and others decreasing. The total of Surabaya and Sidoarjo was 43.8% in 1980. If this trend continues, these two municipalities would increase to over 50% of GKS total. This means that labour opportunities would be concentrated in Surabaya and Sidoarjo, causing a big problem.

Table 2.2.16 PROPORTION OF EMPLOYMENTS IN GKS

	1971		1980		annual growth %
	number	Percentage of Total	number	Percentage of Total	
Gresik	208,463	11.9	300,244	11.7	4.14
Bangkalan	200,817	11.4	264,373	10.3	3.10
Kod.Mojokerto	17,696	1.0	24,398	1.0	3.63
Kab.Mojokerto	207,518	11.8	296,612	11.6	4.05
Surabaya	488,992	27.8	760,729	29.7	5.03
Sidoarjo	234,713	13.4	362,466	14.1	4.95
Lamongan	398,755	22.7	556,199	21.7	3.77
GKS	1,756,954	100.0	2,565,022	100.0	4.29

2.3 INDUSTRY

2.3.1 PRESENT SITUATION AND POTENTIAL OF AGRICULTURE IN GKS REGION

GENERAL

(1) Agricultural Land

Agricultural land in GKS (Wet field, dry field, estate, and others) occupied 77.7% of the total area. The percentage of fish pond is 5.9% and that of forest is 8.7%. Unused land such as waste land, swamp and others is only 5.2% of the total area. The land in GKS Region is intensively used and therefore there is little possibility to increase agricultural land in future. In 1977, in wet field, irrigation land was 59.7% while land which relies only on rainfall was 40.3%. Irrigation area decreased 4.7% between 1970 and 1981 in GKS Region. In the same period, irrigation area in Surabaya decreased over 40%, mainly due to urbanization.

(2) Number of Farmers

The change in the number of farmers in GKS region is shown in Table 2.3.2. Since 1975, the number has become almost constant.

(3) Crops

The main crops in GKS Region are rice, cassava, corn, peanut, sugarcane, tobacco vegetable, fruits.

Rice is the most dominant crop in GKS Region. Production of rice in GKS Region has become almost constant, and production per unit area also has the same tendency. Compared with the Indonesian average of 2.98 ton/ha, Java averages 3.43 ton/ha, and East Java averages 3.85 ton/ha. Production per unit area in GKS Region is now at a high level and there exists little possibility to increase the productivity in GKS Region.

The production of vegetables is decreasing in GKS Region, but the production in East Java is increasing. Accordingly, it seems that the area being planted is moving to upland areas where the climate is more suitable for vegetable cultivation. The production of fruit is increasing in GKS Region and the production of banana is increasing remarkably. Production of sugarcane, one of the main industrial crops, is steadily increasing, and livestock production is also steadily increasing. Fishery production is rapidly increasing. It seems that agriculture in GKS Region is gradually proceeding to multi productive. Forestry production in GKS is decreasing.

(4) Multi Cropping Pattern

It is possible to get a double harvest of rice in irrigation areas as shown in Fig. 2.3.1. In wet fields which rely only on rainfall, rice is planted in the wet season and corn, soybean, tobacco etc. are planted in the dry season.

In wet field, sugarcane and corn etc. are rotated in a two year cycle.

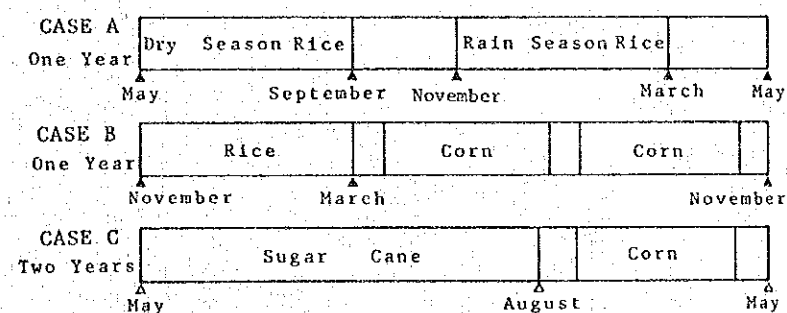


Fig. 2.3.1 ROTATION OF CROPS IN G.K.S.

(5) Farmers Income

Income of farmers is lower than that of other sectors. The study concerning Desa "Pagrawan" in Kabupaten Malang reports that the ratio of sidework farmers in the Desa is approximately 55%. Average land area which normal farmers own is less than

0.5 ha, and the study also reports that large land owners are gradually increasing.

(6) Agricultural Assistance Programmes

Two agricultural assistance programmes (Bimas & Inmas) are adopted in Indonesia.

Bimas programme comprises a credit system whereby farmers are provided with credit for the purchase of high yielding seeds, fertilizer, insecticide, etc, together with the provision of technical guidance through an extension service.

Inmas is a follow up programme, providing further technical assistance and advice, but requiring the farmers to pay for their improved seeds and fertilizers without credit.

SITUATION BY KABUPATEN IN GKS REGION

(1) Land Use

Agricultural land use by Kabupaten is shown in Table 2.3.10. Wet field exists in Lamongan (42% of total), while dry field exists mostly in Bangkalan (62% of total). Fish ponds are mostly in Sidoarjo followed by Gresik. Forest is only in Lamongan and Mojokerto. Wasted land, swamp and others exist mostly in Bangkalan.

(2) Production

Rice production is highest in Lamongan, followed by Sidoarjo and Mojokerto. Production of the three kabupaten occupies 72% of total production in GKS Region.

Production per unit area is highest in Sidoarjo where the irrigation system is best arranged. Production per unit area is correlative with the irrigation rate. Production per unit area is least in Bangkalan as fields in Bangkalan are not suitable for rice production. Next lowest production per unit area is Lamongan and if the productivity in Lamongan is increased then production in GKS will be significantly increased.

Production of cassava is highest in Bangkalan, production of corn and peanut is highest in Bangkalan followed by Lamongan. Production per unit area of these crops in Bangkalan is less than that of GKS average due to its soil and rainfall condition. If production per unit area in Bangkalan is increased by planting suitable kind of crops for the upland, production of GKS Region will be significantly increased.

For industrial crops, production of sugarcane is only available in Sidoarjo and Mojokerto and tobacco production is concentrated in Lamongan.

In livestock production, chicken production is highest in Gresik followed by Mojokerto, and sheep production is highest in Lamongan. Beef production is mostly in Bangkalan. Production of fish in fishpond is highest in Lamongan and production of sea fish is highest in Gresik. Production of forestry is mostly in Lamongan and Mojokerto.

Table 2.3.1 LAND USE IN G.K.S. AREA (IN 1977)

	Area (Km ²)	Ratio (%)
* Urban Area/Farmer's gardens	860.17	14.7
Wet rice field	2,425.42	39.9
Dry field (incl. dry rice crop)	1,551.17	25.5
Estate	38.19	0.6
Fish Pond	358.21	5.9
Forest	528.77	8.7
Swamp	74.82	1.2
Waste Land	236.57	3.9
Others	6.66	0.1
Total	6,079.95	100

Estimate Urban Area 148.00 Km² 2.4%
Farmer's gardens 712.00 Km² 11.7%

Source: Kumpulan Data Dasar

DI Wilayah Gerbangkertosusila

Jilid I Psik

Table 2.3.2 NUMBER OF FARMERS AND FISHERMAN IN G.K.S. (KODYA SURABAYA IS NOT INCLUDED)

	Farmer (1000 persons)	Fisherman (1000 persons)
1972	846.4	40.7
1973	883.1	39.3
1974	976.0	39.8
1975	1,014.6	41.6
1976	984.9	46.0
1977	1,020.7	44.9

Source : Kumpulan Data Dasar

DI Wilayah Gerbangkertosusila

Jilid II Sosial

Table 2.3.3 HARVEST OF RICE IN G.K.S.

	Planted Area (ha)	Production (t)	Production per unit area (t/ha)
1973	249,441	824,543	3,306
1974	260,268	1,050,437	4,036
1975	264,931	986,254	3,723
1976	267,077	1,039,567	3,892
1977	239,778	1,001,408	4,176
1978	251,045	1,044,166	4,159
1979	255,352	874,236	3,424
1980	272,817	1,093,138	4,007

Source : Diperta Propinsi Daerah Tingkat I

Jawa Timur

Dinas Pertanian Propinsi Dati I

Jawa Timur

Table 2.3.4 PRODUCTION OF SUGAR IN G.K.S.

	1973	1975	1977
Planted Area (ha)	7,555	8,022	9,287
Sugar Cane (1000 ton)	728	785	866
Sugar (1000 ton)	72.6	82.5	79.1
S H S (1000 ton)	62.5	67.7	62.2
TETES (1000 ton)	17.1	18.8	23.3

Source : Kumpulan Data Dasar

DI Wilayah Gerbangkertosusila Th. 1971 - 1978

Jilid III Ekonomi

Table 2.3.5 LIVERSTOCK PRODUCTION IN G.K.S.

	Egg of duck (1000 pcs)	Cows Milk (1000 L)	Chicken Meat (ton)	Mutton (ton)	Beef (ton)
1971	865	3,295	4,731	1,001	4,656
1972	913	3,564	4,783	1,385	4,546
1973	934	3,773	5,863	4,182	6,161
1974	2,529	4,047	5,094	2,163	6,988
1975	687	3,441	5,752	2,299	7,360
1976	2,669	4,644	6,679	2,660	6,782
1977	3,649	4,878	6,778	2,445	8,383

Source : Kumpulan Data Dasar
DI Wilayah Gerbangkertosusila
Jilid III Ekonomi

Table 2.3.6 FISHERY PRODUCTION IN G.K.S.

	Fish in Fish Pond (ton)	Sea Fish (ton)
1973	17,533	19,448
1974	21,264	20,990
1975	23,404	26,451
1976	22,264	45,353
1977	24,638	60,625

Source : Kumpulan Data Dasar
DI Wilayah Gerbangkertosusila
Jilid III Ekonomi

Table 2.3.7 PER CAPITA GRDP IN GKS (1978)

	Per Capita G R D P (Thousand Rp.)
Primary Sector	243
Secondary Sector	868
Tertiary Sector	437

Source : GKS Study 1980

Table 2.3.8 SIDEWORK CONDITION IN DESA PAGRAWAN, KABUPATEN MALANG

	Number of Family	Ratio (%)
Exclusive Farmer	29	45.3
* Sidework Farmer - I	27	42.2
Sidework Farmer - II	8	12.5
Total	64	100

* Sidework Farmer - I : whose income from agriculture is more than that from sidework.
Sidework Farmer - II: Whose income from agriculture is less than that from sidework.

Source : "Pagrawan" Noriyoshi Kano Asia Economic Institute.

Table 2.3.9 HARVESTED AREA BY BIMAS & INMAS IN G.K.S.

	Bimas (ha)	Inmas (ha)
1973	46,628	31,248
1974	62,233	32,207
1975	99,700	30,896
1976	121,364	36,386
1977	78,966	75,237

Source : Kumpulan Data Dasar
DI Wilayah Gerbangkertosusila
Jilid III Ekonomi

Table 2.3.10 LAND-USE BY KABUPATEN (1977)

	Urban Area/ Farmer's Gardens	Wet Rice Field	Dry field (incl. dry Rice Crop)	Estate	Fish pond	Forest	Swamp Wild Land Others	Total
Gresik	68.04	451.42	184.50		177.88	6.38	92.34	980.56
Bangkalan	201.74	124.55	958.88		6.00	11.12	122.06	1,424.35
Mojokerto	160.73	389.98	90.42	38.19		246.07	6.32	931.71
Surabaya	57.04	94.09	12.66		42.95		4.88	211.62
Sidoarjo	159.02	334.91	9.19		199.44		16.90	639.46
Lamongan	213.60	1,030.47	295.52		11.94	265.20	75.52	1,892.25
G K S	860.17	2,425.42	1,551.17	38.19	358.21	528.77	318.02	6,079.95

Source : Kumpulan Data Dasar
DI Wilayah Gerbangkertosusila
Jilid III Ekonomi

Table 2.3.11 NUMBER OF FARMERS AND FISHERMEN BY KABUPATEN (1977) (Surabaya is not included)

	Farmers (1000 person)	Fisherman (1000 person)
Gresik	177.8	9.8
Bangkalan	267.3	14.9
Mojokerto	118.9	0.1
Sidoarjo	57.5	1.5
Lamongan	399.2	18.6
Surabaya	-	-
G. K. S.	1,020.7	44.9

Source : Kumpulan Data Dasar
DI Wilayah Gerbangkertosusila
Jilid III Ekonomi

Table 2.3.14 FISHERY PRODUCTION BY KABUPATEN (1977)

	Fish in Fish Pond (ton)	Sea Fish (ton)
Surabaya	2,666	11,475
Gresik	13,924	19,923
Sidoarjo	12,981	891
Mojokerto	176	-
Lamongan	23,125	15,216
Bangkalan	1,289	13,119
G. K. S.	54,161	60,625

Source : Studi Pengembangan Wilayah
Metropolitan Gerbangkertosusila
1. Kompilasi Data

Table 2.3.12 AGRICULTURAL PRODUCTION BY KABUPATEN (1980)

		Gresik	Bang- kalan	Mojo- kerto	Sura- baya	Sido- arjo	Lamo- ngan	Total
Rice	Harvest Area (ha)	49,297	32,199	63,615	9,353	41,232	97,121	272,817
	Production (ton)	199,865	72,414	229,540	35,113	230,635	325,571	1,093,138
	Production per unit Area (ton/ha)	4,054	2,249	3,594	3,754	5,594	3,352	4,097
Cassava	(ha)	9,916	20,283	5,367	135	519	9,667	45,887
	(ton)	74,950	110,887	68,849	645	4,823	65,380	325,533
	(ton/ha)	7.56	5.45	2.83	4.78	9.29	6.76	7.09
Corn	(ha)	25,404	96,123	18,976	603	2,672	70,747	214,525
	(ton)	16,857	75,887	19,037	342	2,390	58,455	172,967
	(ton/ha)	0,666	0,789	1,003	0,566	0,891	0,826	0,806
Peanut	(ha)	7,491	13,363	3,930	132	204	9,201	34,321
	(ton)	5,874	9,198	2,846	62	180	6,764	24,874
	(ton/ha)	0,777	0,688	0,724	0,468	0,884	0,735	0,725

Source : Dinas Pertanian Produkul
Dati I Jawa Timur

Table 2.3.13 PRODUCTION OF SUGAR CANE & TOBACCO BY KABUPATEN (1977)

	Sugar Cane			Tobacco		
	Area (ha)	Production (Ton)	Unit Production (Ton/ha)	Area (ha)	Production (Ton)	Unit Production (Ton/ha)
Gresik						
Bangkalan						
Mojokerto	3,248	264,986	81.6	5	2	0,400
Sidoarjo	6,039	601,373	99.6	990	396	0,400
Lamongan				3,995	1,658	0,415
Surabaya						
G K S	9,287	866,360	93.3	4,990	2,056	0,412

Source : Kumpulan Data Dasar
DI Wilayah Gerbangkertosusila
Jilid III Ekonomi

2.3.2 MANUFACTURING INDUSTRY

NATIONAL VIEW OF INDUSTRIALIZATION

Industrial development in Indonesia is being actively promoted under the government guidance but at present the share of manufacturing sector to the total GDP is estimated at only about 13%, and therefore it is evaluated that the Indonesian industrialization is still in progress. The growth rate of the production, however, is increasing at a remarkably high level compared with the other sectors. The growth rate of the total GDP between 1974 and 1979 was around 6.5%, while that of the manufacturing sector was 11.2%.

The national industrial development policy within the term of Pelita III (1979/80 - 1983/84) insists on the following 4 points:

- Enlargement of employment opportunities and encouragement of small scale factories.
- Promotion of consumers' goods production and their sufficient supply to meet the domestic demand.
- Encouragement of industries processing basic materials to produce finished goods, and their exportation, and
- Development of the industries relevant to agricultural production.

Observing the condition of investment, the aggregate number of projects from 1968 up to 1979 was 3327 projects for domestic investment, and 980 projects for foreign investment. The capital share of manufacturing sector was more than 65% for both types of investments, as shown in Table 2.3.16.

SITUATION OF GKS INDUSTRY IN EAST JAVA

The characteristics of the manufacturing industries of GKS Region in East Java are as follows:

- The number of establishments in GKS region was around 5,000 units and this was about 36% of the total of 14,000 units in East Java, as of 1980/1981.
- Observing the characteristics by type of manufacture, the share of basic metal and machinery manufacture is 67%, and that of chemical and chemical products manufacture is 78%, of the total of East Java. The so-called capital intensive manufacture has accumulated mostly in the GKS region.

Table 2.3.15 CONDITIONS OF MANUFACTURING ACTIVITY IN INDONESIA

	(A) No. of Establishment (Share)	(B) No. of Workers (Share)	(C) Value of Gross (billion Rp) (Share)	(D) Value Added (billion Rp) (Share)	(E) Rate of Value added to Gross Output (%)
31 Food, Beverage and Tobacco	2,448 (31.4)	291,981 (35.6)	1,241.7 (39.6)	514.6 (42.1)	41.4
32 Textile, Wearing apparel	2,218 (27.9)	223,768 (27.3)	478.4 (15.2)	145.2 (11.9)	30.4
33 Wood and Wood Products	637 (8.0)	47,823 (5.8)	106.6 (3.4)	44.0 (3.6)	41.3
34 Paper and Paper Products	345 (4.3)	26,055 (3.2)	79.9 (2.5)	35.8 (2.9)	44.8
35 Chemicals and Chemical Products	799 (10.0)	92,349 (11.2)	578.8 (18.4)	214.4 (17.5)	37.0
36 Non metallic mineral Products	624 (7.8)	38,195 (4.7)	154.2 (4.9)	99.0 (8.1)	64.2
37 Basic Metal	17 (0.2)	3,978 (0.5)	24.1 (0.8)	5.4 (0.4)	22.4
38 Machinery and Equipments	735 (9.2)	92,126 (11.2)	462.7 (14.7)	160.6 (13.1)	34.7
39 Others	82 (1.0)	4,817 (0.6)	13.6 (0.4)	3.4 (0.3)	25.0
Total	7,955 (100.0)	821,122 (100.0)	3,139.0 (100.0)	1,222.3 (100.0)	38.9

Notes: 1) Value is shown at market prices

2) Number of workers includes the unpaid family workers

Source : " Statistik Indonesia, 1979"

Table 2.3.16 APPROVED DOMESTIC AND FOREIGN INVESTMENT PROJECTS BY SECTOR IN INDONESIA (Accumulation up to 1981)

Category	Domestic Investment			Foreign Investment		
	No. of Projects	Capital (billion Rp)	Share (%)	No. of Projects	Capital (million US\$)	Share (%)
1. Agriculture	559	706.8	17.5	157	865.2	10.6
2. Mining	19	101.3	2.5	1.3	1,326.6	16.2
3. Manufacture	2,425	2,734.8	67.6	469	5,356.2	65.4
4. Electricity, gas and water	1	1.2	0.0	-	-	-
5. Construction	7	17.7	0.4	61	85.1	1.0
6. Wholesaler/commercial	111	97.1	2.4	12	176.2	2.2
7. Transport	141	177.2	4.4	21	123.0	1.5
8. Financing and others	42	187.7	4.6	30	238.1	2.9
9. Service, Social	22	19.3	0.5	7	22.6	0.3
Total	3,327	4,043.0	100.0	780	8,193.0	100.0

NOTES : 1) Excluding oil, insurance and banking sectors

2) Domestic Investment; plus foreign investment transferred to domestic investment, and minus liquidated domestic investment

3) Foreign Investment ; minus liquidated foreign investment and transfer to the domestic investment, and plus additional capital

Source : BKPM (Investment Coordinating Board)

Table 2.3.17 GROSS DOMESTIC PRODUCT IN INDONESIA BY INDUSTRIAL ORIGIN

INDUSTRIAL ORIGIN	1974	1979	Annual Growth Rate	
			Share (%)	1979/1974 (%)
1. Agriculture	2,811.0	3,203.7	32.2	2.64
2. Mining & Quarring	859.0	1,043.6	10.5	3.97
3. Manufacturing	755.0	1,284.6	12.9	11.22
4. Electricity, Gas and water	37.0	59.7	0.6	10.04
5. Construction	320.0	562.8	5.7	11.95
6. Wholesale & Retails	1,224.0	1,632.9	16.4	5.93
7. Transport & Communication	288.0	557.7	5.6	14.41
8. Financial Intermediaries	88.0	183.4	1.8	15.82
9. Ownership of dwelling	174.0	306.1	3.1	11.96
10. Public administration	443.0	797.7	8.0	12.48
11. Service	270.0	304.0	3.1	2.40
Total	7,269.0	9,936.2	100.0	6.45

Source : "STATISTIK INDONESIA 1979", Biro Pusat Statistik Jakarta

- The composition of the type of manufacture in GKS region is 151 units of the metal and machinery type, 32 units of chemical manufacture and 4,802 units of miscellaneous manufacture. The shares are therefore 3.0%, 0.6%, and 96.4% respectively, in 1980.
- The distribution of small scale factories is conceived to be similar to the distribution pattern of population. GKS region shared 18.8% of the total of East Java, in number of units.

As mentioned above, the industrial concentration by number of units in GKS region is evaluated to be remarkable especially in the basic industry sector such as metal, machinery, and chemical and chemical manufacture. At the same time, this characteristic can be recognized in the condition of the investment activities.

Observing generally, the activity of investment in East Java seems to be comparatively weak, judging from the fact that the aggregate value of East Java to the whole of Indonesia is only 12.5% for domestic investment, and 4.5% for foreign investment. For reference, the share of population in East Java is approximately 19.8% of the nation. Within East Java, the investment activity in GKS region is generally evaluated to be brisk. Table 2.3.18 shows the conditions of aggregate value of investment between 1968 and 1981. As is evident from this table, the concentration ratio into GKS region is 65.7% of the domestic investment and 81.6% of the foreign sector. Within figure, the concentration into Surabaya is remarkable, with about 26.8% and 45.7% of the total of East Java shared by the domestic investment and foreign investment respectively.

Table 2.3.18 APPROVED DOMESTIC AND FOREIGN INVESTMENT IN GKS REGION

Kod. / Kab.	Domestic Investment		Foreign Investment	
	Million Rp.	Share (%)	Million \$	Share (%)
Surabaya	270,267	26.8 (40.7)	211.9	45.7(56.0)
Sidoarjo	73,643	7.3 (11.1)	85.6	18.5(22.7)
Gresik	308,205	30.5 (46.5)	42.9	9.3(11.4)
Mojokerto (Kod./Kab.)	9,692	1.0 (1.5)	37.5	8.1(9.9)
Lamongan	1,338	0.1 (0.2)	-	- (-)
Bangkalan	89	0.0 (0.0)	-	- (-)
GKS Region	663,234	65.7 (100%)	377.9	81.6(100%)
East Java	1,009,446	100.0	463.3	100.0

Source: BKPMD Annual Report 1982/83.

Note : Figures in parenthesis show the share to the GKS total

CHARACTERISTICS OF GKS INDUSTRY

(1) Factory Locations

The concentration of manufacturing factories into GKS region is one of the noteworthy characteristics. However, observing the constitutional characteristics, most of these are accumulated in the limited area of Surabaya and its peripheral area.

As shown in Table 2.3.19, about 81.6% of the total units and 91% of the total employees are shared by the area including Surabaya, Sidoarjo and Gresik. Besides this when regarding the accumulation of so called modern industries such as metal/machinery, and chemical/chemical products manufacture, it can be seen that most of these are concentrated in the same area as above. It should also be noted that some are located in Mojokerto.

(2) Movement of Factory Developments Since 1967

Based on the New Order Government's financial and economic policy, two laws, the Foreign Investment Law of 1967 and the Domestic Investment Laws of 1968 were established to take an important role in the acceleration of economic development. Since then, a considerable volume of investment has been located in the GKS Region: 66 foreign investment projects (1967/80), and 255 domestic projects (1968/80). According to the data, 199 factories and among those investments and the actual movement of factory investment is shown in Fig. 2.3.3. Observation of these figures reveals that there exists different characteristics for location by industrial sector:

- The investment in the Food and Beverages Sector has tended to be located along the Surabaya-Sidoarjo Corridor, and none are existing in Gresik.
- The investments in the Chemical Sector have been located mainly in three areas: Gresik, Surabaya-Sidoarjo Corridor and Surabaya - Krian Corridor along Kali Surabaya.
- The investment in the Non-Metallic and Mineral Products Sector has an equivalent tendency to the Chemical Sector.
- The Metal Processing Sector tends to be located mainly within Surabaya and in the peripheral area of Surabaya and Sidoarjo.
- The factories in the Miscellaneous Sector are mainly located inside of Surabaya, especially in the Rungkut area.

(3) Small-Scale Factories and Handicrafts

Observing the locations of small-scale factories and handicrafts (defined as factories with less than 5 employees), it is acknowledged that comparatively many units are located in the rural areas supported by agricultural industry. These are the so-called traditional industries and according to the 1982 annual report of the Department of Industry, the main products of these factories are:

Batik	: Bangkalan, Sidoarjo
Sarong	: Gresik, Sidoarjo
Confection	: Surabaya, Gresik
Sugar palm fiber	: Sidoarjo
Bamboo Products	: Lamongan, Surabaya
Bag, Suitcase	: Sidoarjo
Shoes	: Mojokerto
Shrimp crackers	: Sidoarjo, Gresik
Shrimp products	
Brass, Brass Processing	: Mojokerto

2.3.3 COMMERCE AND TRADE

SITUATION OF SURABAYA AS COMMERCIAL CENTER IN EAST JAVA

(1) Distribution of Commercial Facilities

According to the data on number of SIUP (Commercial Business Licence) as of 1980, the character of Surabaya as a commercial centre in East Java is evident. The number of licences is about 22 thousand in the city of Surabaya and this is about 30% of the total of East Java, 74,567. The share of GKS region is approximately 42% of the total of East Java, as shown in Table 2.3.20.

The high degree of commercial accumulation in Surabaya can also be recognized from the number of licences per capita. As shown in Table 2.3.21, that of Surabaya is about

Table 2.3.19 CONDITION OF MANUFACTURING FACTORIES
IN GKS REGION AND EAST JAVA (1980/1981)

Kod./Kab.	Metal / Machinery		Chemical/ Chemical Products		Miscellaneous		Total		No. of small-scale factories Handicrafts (units)
	Units	No. of Workers	Units	No. of Workers	Units	No. of Workers	Units	No. of Workers	
Surabaya	91 (60.3)	11,349 (56.7)	14 (43.7)	2,281 (27.1)	2,897 (60.30)	88,068 (67.8)	3,002 (60.2)	101,698 (64.2)	2,245 (3.9)
Sidoarjo	32 (21.2)	5,727 (28.6)	6 (18.8)	1,433 (17.0)	469 (9.8)	15,077 (11.6)	507 (10.2)	22,237 (14.0)	9,004 (15.6)
Gresik	14 (9.3)	2,702 (13.5)	10 (31.2)	4,260 (50.7)	534 (11.1)	13,246 (10.2)	558 (11.2)	20,208 (12.8)	7,261 (12.6)
Mojokerto (Kod. Kab)	2 (1.3)	48 (0.2)	2 (6.3)	434 (5.2)	327 (6.8)	6,469 (5.0)	332 (6.7)	6,951 (4.4)	10,537 (18.3)
Lamongan	-	-	-	-	420 (8.7)	3,982 (3.1)	420 (8.4)	3,982 (2.5)	15,952 (27.7)
Bangkalan	12 (7.9)	191 (1.0)	-	-	158 (3.3)	3,066 (2.4)	170 (3.4)	3,257 (2.1)	12,561 (21.8)
GKS	151 (100.0)	20,017 (100.0)	32 (100.0)	8,408 (100.0)	4,805 (100.0)	129,908 (100.0)	4,988 (100.0)	158,333 (100.0)	57,560 (100.0)
(Major Cities)									
Malang	18	854	1	250	927	51,110	946	52,214	17,200
Probolinggo	-	-	2	2,076	318	9,714	320	11,290	7,293
Madiun	2	108	-	-	439	20,308	442	20,451	14,920
Pasuruan	16	990	-	-	531	13,844	547	14,884	12,605
Kediri	6	162	1	200	662	40,495	669	40,857	4,766
East Java	224 (100.0)	22,839 (100.0)	41	12,980 (100.0)	13,768 (100.0)	344,935 (100.0)	14,033 (100.0)	380,754 (100.0)	359,520 (100.0)

NOTES : 1) Parentheses mean the share (%)
2) Small scale Factories and Handicraft means the factories with less than 5 employees
Source : ANNUAL REPORT, 1981. " DINAS PERINDUSTRIAN PROPINSI DAERAH TINGKAT I JAWA TIMUR

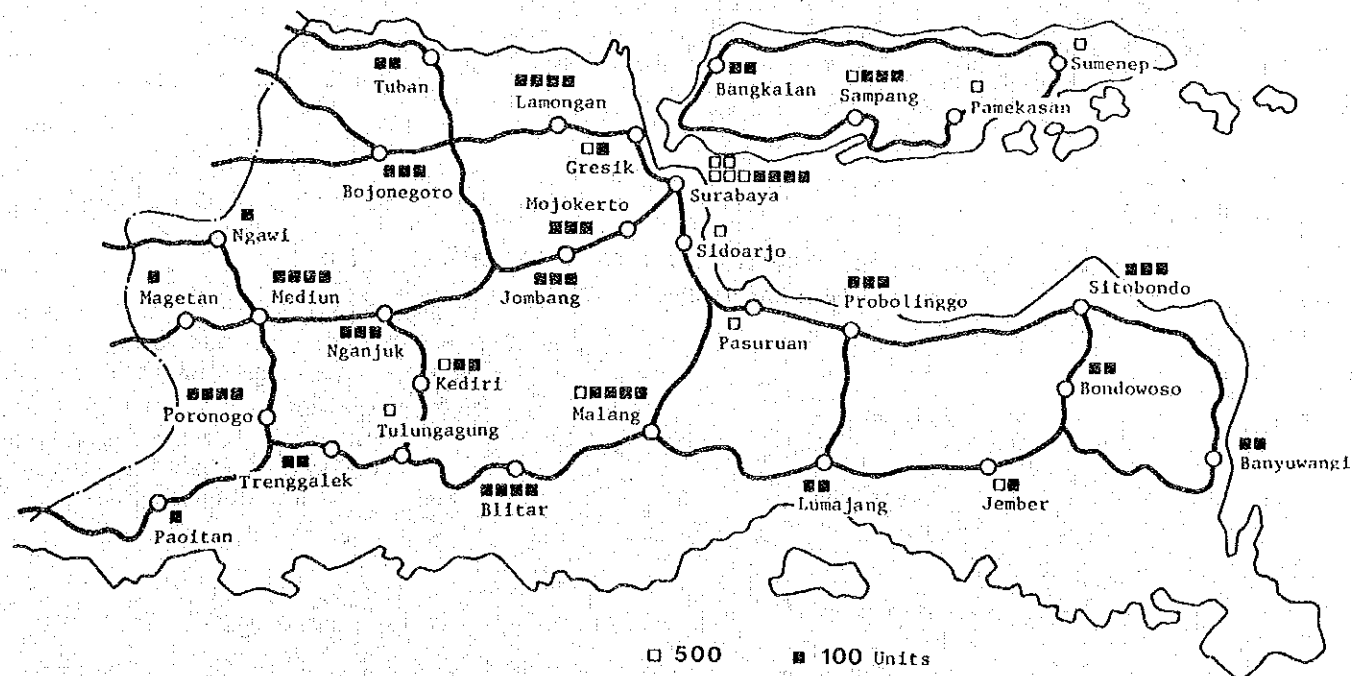


Fig. 2.3.2 DISTRIBUTION OF MANUFACTURING FACTORIES
IN EAST JAVA

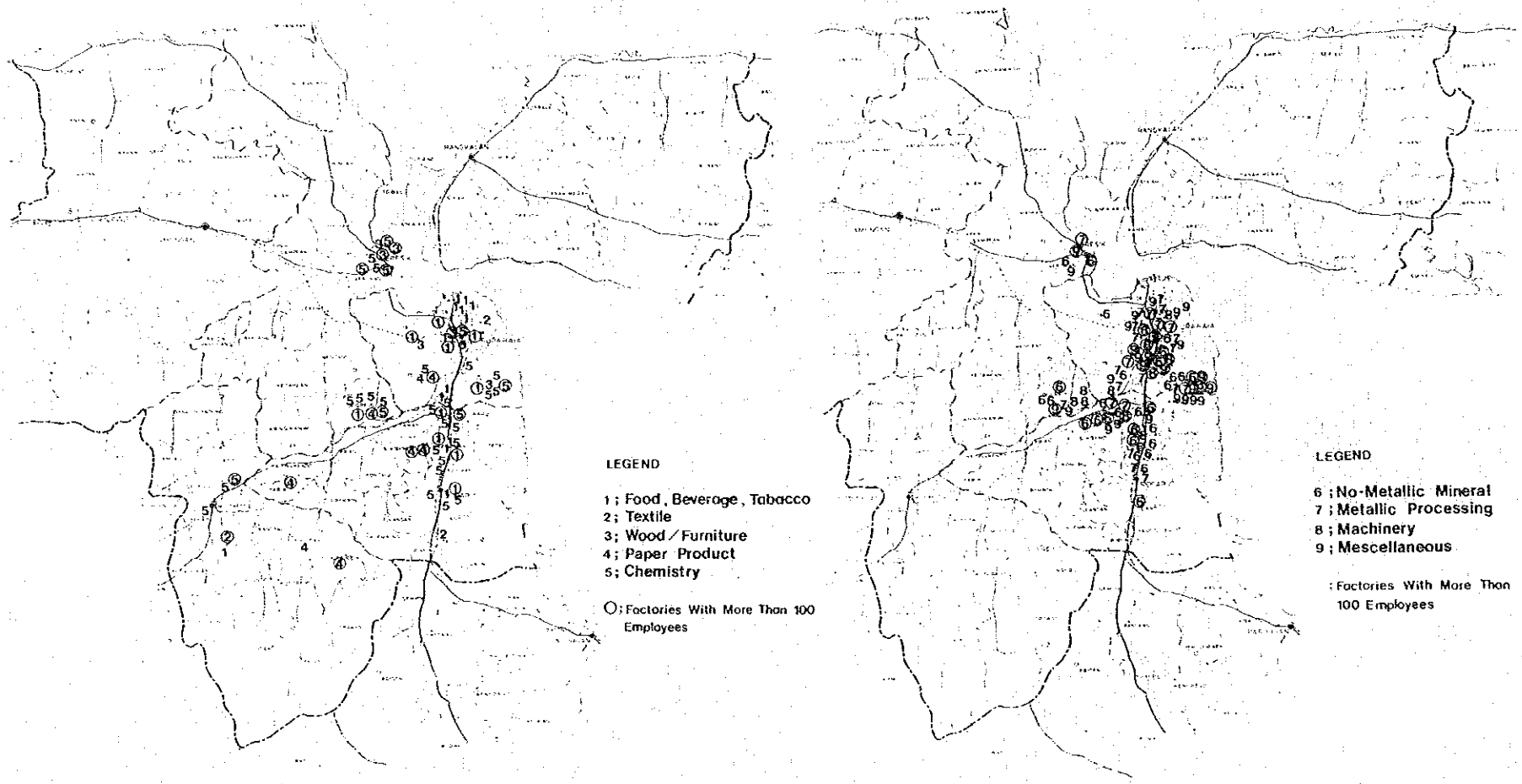


Fig. 2.3.3 DISTRIBUTION OF MANUFACTURING FACTORIES ESTABLISHED SINCE 1967

11.0 units per 1000 persons, while that of East Java is 2.6. The figures for the other areas in GKS region are similar to the average of East Java, approximately 2.6.

Table 2.3.20 NUMBER OF BUSINESS LICENCES OF MERCHANT IN GKS REGION

	Large		Medium		Small		Total		
	Number	%	Number	%	Number	%	Number	% (1)	% (2)
Total	3,333	100	15,859	100	12,378	100	31,570	100	42.3
1. Gresik	20	0.60	937	5.91	1,007	8.14	1,964	6.22	2.6
2. Bangkalan	1	0.03	442	2.79	792	6.40	1,235	3.91	1.7
3. Kab. Mojokerto	6	0.18	424	2.67	292	2.36	722	2.29	1.0
4. Kodya Mojokerto	7	0.21	558	3.52	439	3.55	1,004	3.18	1.3
5. Kodya Surabaya	3,244	97.33	12,242	77.19	6,639	53.63	22,125	70.08	29.7
6. Sidoarjo	54	1.62	802	5.06	1,174	9.48	2,030	6.43	2.7
7. Lamongan	1	0.03	454	2.86	2,035	16.44	2,490	7.89	3.3
East Java Total							74,567	100.0	

NOTES : 1) Percentage to the total of GKS
2) Percentage to the total of East Java

Source : Kantor Wilayah Departemen Perdagangan Propinsi Dati I Jawa Timur.

Table 2.3.21 THE NUMBER OF COMMERCIAL BUSINESS LICENCES PER CAPITA IN 1980

(Unit: per 1000 persons)

Kab./Kod.	Number of Commercial Business Licences per capita as of 1980
Surabaya	11.0
Sidoarjo	2.4
Gresik	2.7
Mojokerto (Kab. Kod)	2.2
Lamongan	2.4
Bangkalan	1.8
G K S	5.17
East Java	2.55

Source : Kantor Wilayah Departemen Perdagangan Propinsi Data I Jawa Timur

(2) Wholesale Function in Surabaya

Observing the characteristics of commercial function by category of licence, the number of big business licences in Surabaya in 1980 was about 3,240 and the share of the total of East Java is assumed to be more than 82%. This big business licence is defined as the business of wholesale, trading and warehousing with approved region-wide activity and whose capital is more than 75 million Rp. (as of 1980). Judging from the fact that most of the enterprises with such wide regional activities accumulate in the city of Surabaya, there is no denying the central commercial function of Surabaya serving East Java and beyond.

Share of Big Business Licences		
	GKS Region	East Java
Surabaya	97.5%	82.4%
GKS remainder	2.5%	2.1%
GKS Total		84.5%
Others in East Java		15.5%
	100.0%	100.0%

(3) Change in Number of Shops

Observing the change of number of shops between 1975 and 1980, the following facts are found:

- The number of shops in the GKS Region increased by about 12,300 and about 8,100 of these (66%), were in Surabaya city.
- Lamongan and Bangkalan, among other areas of GKS Region, received the largest change in number of shops. In Lamongan 1,352 new shops were located during the 5 years and the annual growth rate was 16.9%. In Bangkalan 848 new shops were located and the growth rate was 17.3% per annum.
- In the areas with high industrial growth such as Sidoarjo and Gresik, the increase in shops is comparatively low. It is assumed that most of the consumer activities in these and most of the increase in purchasing power may tend to be absorbed by Surabaya.

ACCUMULATION OF DISTRIBUTION FUNCTION

Observing the distribution of warehouses from Table 2.3.22, Surabaya possesses a floor area of about 1.45 million m² which corresponds to a share of 72.5% and 25.0% of the total of GKS and the total of East Java respectively. This concentration ratio to the East Java total is not so much higher than that of the commercial facilities (40%) but the ratio to the GKS total is higher. The distribution function containing the port, Tg. Perak is remarkably strong in the city of Surabaya. Observing the major cities with a comparatively high distribution function, the cities with a warehouse area of more than 200 thousand m² are;

Kab. Bojonegoro	348.2 thousand m ²
Kab./Kod. Kediri	779.4 "
Kab. Jember	444.8 "
Kab. Bondowoso	279.2 "
Kab. Banyuwangi	414.4 "

Table 2.3.22 AGGREGATE OF WAREHOUSES IN GKS REGION IN 1980

Kab./Kod.	No. of Units		Floor Area (x 1000m ²)	
		Share %		Share %
Surabaya	10,611	(70.9) [25.5]	1,452.3	(72.5) [25.0]
Sidoarjo	1,741	(11.6) [4.1%]	216.7	(10.8) [3.7]
Gresik	710	(4.7) [1.7]	78.0	(3.9) [1.3]
Mojokerto (Kab/Kod)	1,023	(6.8) [2.5]	158.2	(7.9) [2.7]
Lamongan	573	(3.8) [1.4]	75.3	(3.8) [1.3]
Bangkalan	316	(2.1) [0.8]	24.0	(1.2) [0.4]
G K S	14,974	(100.0) [36.0]	2,004.5	(100.0) [34.6]
East Java	41,568	[100.0]	5,800.7	[100.0]

NOTES : 1) Parentheses () means the share to the GKS total.

2) Parentheses [] means the share to the East Java total.

Source : Kantor Wilayah Departemen Perdagangan Propinsi Dati I Jawa Timur.

TRADING ACTIVITY

(1) Export and Import in East Java

The amount of export from East Java as of 1979 was approximately 312.95 million US\$ and the increase rate compared to 1978, was around 57.7% at market price. The type of commodities for export from East Java are mainly agricultural crops such as;

- o Food crops (Peanut cakes, Maize, Rice Bran, Beans, etc.)
- o Plantation crops (Coffee, Copra, Rubber, Tea, Tobacco, etc.).

In 1979, the destinations of exports through the port, Tg. Perak, were mainly W. Germany (23.0%), Japan (18.7%), and USA (13.0%). These areas occupy a share of 54.7% of the whole export value.

Concerning the import activity, the fluctuation in the value can be recognized by year. The amount of import as of 1979 was about 261.20 million US\$. Accordingly, the balance of the year 1979 was a surplus export of about 51.75 million US\$. The type of commodities imported to East Java are mainly industrial goods and consumers' goods, however also included were the agricultural foods such as rice, wheat and sugar. The major origins are Japan (69.3%), USA (3.9%) Switzerland (3.7%) etc., based on the import value.

This trading business has been mainly performed through the Surabaya Port, Tg. Perak.

Table 2.3.23 CONDITIONS OF EXPORT AND IMPORT ACTIVITY

EXPORT FROM EAST JAVA, IN US \$:

YEAR	IN US \$	INCREASE/DECREASE	%
1974	97,342,983.42	-	-
1975	98,067,995.67	+ 725,012.45	0.74
1976	134,163,321.37	+ 37,545,350.00	38.85
1977	161,161,937.70	+ 26,998,616.07	20.12
1978	198,498,565.55	+ 37,337,427.85	23.17
1979	312,953,961.28	+114,455,395.73	57.66

IMPORT TO EAST JAVA, IN US \$:

YEAR	IN US \$	INCREASE/DECREASE	%
1974	86,127,757.71	-	-
1975	58,191,910.80	- 28,035,846.91	32
1976	135,837,495.47	+ 77,645,548.67	133.43
1977	108,272,331.58	- 27,565,163.89	20.29
1978	257,550,370.54	+149,278,038.96	137.87
1979	261,196,570.20	+ 2,702,143.74	1.04

Source : BKPMD "Investment, Prospects in East Java (1982/83)".

(2) Economic Function of Tg. Perak

The function of Tg. Perak cannot be ignored in the discussion on the commerce and trading in this area. Based on the data for 1979, as shown in Table 2.3.25, and as arranged by the central statistic bureau, a comparison of the major ports in Indonesia is possible as below;

- Observing the tonnage of cargo handling for export and import including petroleum, Tg. Perak shares 2.1% of the whole handling amount in Indonesia and is ranked second next to Tg. Priok (Jakarta). If based on value, the share of Tg. Perak goes up to 5.0%, however the total value is slightly less than Belawan (Medan).
- The above facts are based on the data including petroleum and products. Basically the discussion on the economic function of the port should be based on the value excluding the petroleum trade. The total values in Indonesia of "with petroleum and products", and "without", were as follows.

Table 2.3.24 COMPOSITION OF DESTINATION AND ORIGIN FOR EXPORT AND IMPORT

EXPORT FROM EAST JAVA, BY END OF 1979 (in 1,000 US\$)

DESTINATION	VALUE	%
W. GERMANY	71,947	22.99
JAPAN	58,564	18.71
U.S.A.	40,807	13.04
HOLLAND	26,934	8.61
SINGAPORE	26,528	8.48
AUSTRALIS	2,517	0.80
OTHER COUNTRIES	85,656	27.37
TOTAL	312,954	100.00

IMPORT TO EAST JAVA, BY END OF 1979 (in 1,000 US \$)

FROM	VALUE	%
JAPAN	180,009	69.32
U.S.A.	10,243	3.92
SWITZERLAND	9,694	3.71
ITALY	7,996	3.06
TAIWAN	7,376	2.82
HONGKONG	7,075	2.71
W. GERMANY	5,938	2.27
CANADA	5,202	2.00
AUSTRALIA	3,244	1.25
SINGAPORE	2,213	1.02
OTHERS	22,207	7.92
TOTAL	261,197	100.00

Source : BKPMD "Investment, Prospects in East Java (1982/83)".

	Export	Import
Including Petroleum (million US\$)	15,590.1	7,202.3
Excluding Petroleum (million US\$)	6,719.2	6,409.0
Rate of Petroleum Trade (%)	56.9	11.0

The rate of petroleum trade for import was only 11.0%, while that for export occupied 56.9%. Accordingly, the evaluation of economic function of the port would rather better be based on the data of import. The share of import at Tg. Perak based on value was about 12% of the total. Compared with Tg. Perak, value of imports at the other major ports such as Tg. Priok, Belawan, and Ujung Pandang, were 3.9 times, 0.58 times and 0.11 times respectively.

- It is worthy of note that Tg. Perak has the largest function as a inter-insular trading port in Java. Although up to date information is still being collected, according to the report "Port of Surabaya Phase 2 Project Feasibility Study, 1981", the inter-insular traffic in 1978 is reported to be about 2.0 million ton at Tg. Perak and 1.4 million ton at Tg. Priok.
- The existing port capacity of Tg. Perak is estimated to be approximately 5,895 thousand ton, while the present handling amount is assumed to be 5,870 thousand ton. Therefore the existing capacity will not be sufficient to cope with the future demand.

Table 2.3.25 CONDITION OF PORT FUNCTION FOR
FOREIGN TRADE BY MAJOR PORT
(Including Petroleum)

Major Port	Cargo Value (x 100 ton : Gross)						Value of US \$ (x million US \$)					
	Export	%	Import	%	Total	%	Export (FOB)	%	Import (CIF)	%	Total	%
Medan (Belawan)	914.6	0.9	863.5	6.0	1,778.1	1.6	719.7	4.6	495.5	6.9	1,215.2	5.3
Jakarta (Tg. Priok)	6,557.6	6.7	4,977.8	34.3	11,535.4	10.2	1,025.7	6.6	3,259.5	45.7	4,315.2	18.9
Cirebon	2,605.1	2.7	494.7	3.4	3,099.8	2.7	288.6	1.9	270.0	3.7	558.6	2.5
Semarang	89.7	0.1	968.1	6.7	1,057.8	0.9	80.7	0.5	356.0	4.7	416.7	1.8
Surabaya (Tg. Perak)	961.9	1.0	1,444.1	10.0	2,406.0	2.1	280.9	1.8	851.3	11.8	1,132.2	5.0
Ujung Pandang	234.5	0.2	320.0	2.2	554.5	0.5	89.9	0.6	95.1	1.3	185.0	0.8
Others	86,904.6	88.4	5,440.4	37.5	91,383.1	81.0	13,104.6	84.1	1,864.9	25.9	14,969.5	65.8
Indonesian Total	98,268.0	100.0	14,508.6	100.0	112,776.6	100.0	15,590.1	100.0	7,202.3	100.0	22,792.4	100.0

NOTES : 1) FOB (Free On Board) : Export Price

2) CIF (Cost, Insurance & Freight)

Source : "STATISTIK INDONESIA, 1979", Biro Pusat Statistik Jakarta.

2.4 LANDUSE

2.4.1 PRESENT LANDUSE

PRESENT LANDUSE IN GKS REGION – 1981

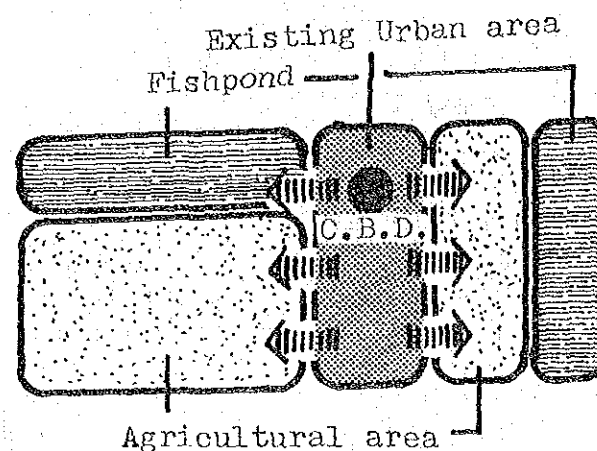
In order to understand the current landuse in GKS region, the existing landuse map was prepared. This was to a 1/100,000 scale and was based on interpretation of the 1/50,000 scale photographs taken in 1981. From study of this map, the current situation of landuse can be described as follows;

- Generally speaking, GKS region as a whole is characterized by rural landuse, except for Surabaya.
- Extensive agricultural area in GKS region is composed of paddy field in flat areas and other agriculture products on slope areas.
- The following are surmised from interpretation of the photographs.
 - * Paddy field in flat areas is not always cultivated every year.
 - * Un-used land and waste land seems to be cultivated according to season, such as only in rainy season, etc.
- Fish ponds to a width of 5 – 10 Km extend along the coast of Kab. Gresik, Kab. Sidoarjo and Kotamadya Surabaya.
- Majority of the urban area is concentrated in the city of Surabaya, and other urban areas are formed surrounding markets and shopping streets in Gresik, Lamongan, Mojokerto, Sidoarjo, Bangkalan, Krian and Babat.
- Large scale manufacturing is concentrated mainly in the city of Surabaya, but others can be seen in Sidoarjo and Gresik. In Mojokerto, a few sugar factories are distributed.
- It is characterized that large scale manufacturing is located along the major roads connected with Surabaya and other cities such as Gresik, Sidoarjo and Krian.
- Hamlets are dispersed in the extensive agricultural area. the distribution pattern of hamlets can be classified into three types as follows:
 - * Linear Type: Hamlets are formed along the road, canal and river in the high quality agricultural land. This type can be seen in the area lying between Kali Surabaya and Kali Porong.
 - * Scattered Type: Hamlets are scattered in the northern part of Kali Surabaya, mainly in Kab. Lamongan.
 - * Unformed Type: This type means that the border of hamlet can not be clearly defined and this type can be seen in Kab. Bangkalan.

PRESENT LANDUSE IN THE CITY OF SURABAYA – 1981

Existing landuse map, shown in Fig. 2.4.2, was prepared based on interpretation of the 1/5,000 scale photographs. Observing this map, the following are found as the characteristics of present landuse;

- Conceptually speaking, the city of Surabaya consists of rural areas in the western and eastern parts, with the central part as an urban area.
- In detail, the western part of Surabaya consists of fishponds in the north and agricultural landuse in the south. Also the eastern part of the city is divided into the east-side along the coast as fishponds and the west-side adjoining the urbanized area as agricultural landuse.
- It can be seen that urbanization in the central part of Surabaya is eroding agricultural areas in the east and west.



- Distribution pattern of residential landuse is that medium and/or high density residential areas including kampungs spread around and to the north of the CBD, and low and/or medium density residential areas lie outside the densely populated areas mentioned above.
- This low and/or medium density residential area expands resulting in loss of agricultural land especially in the direction of Sidoarjo.
- On the east-side of Surabaya, paddy field which also functions as a receiving reservoir is changing to urbanized area, and areas can also be seen where buildings are not yet constructed in spite of the infrastructure being ready for development.
- Up to this time, the west-side of Surabaya such as Gunung Sari hill has not been developed because of problems related to the water system. Today, large scale residential developments are being developed continuously by the private and public sectors.
- Large and small scale commercial activities have distinctive locational characteristics. Large scale trade such as export/import or wholesaling are located so as to be easily accessible to the central area, usually in the proximity of the major roads and transportation system.
- The CBD consists of two areas, one is the older and densely developed CBD to the north of the city incorporating major roads such as Kembang Tupun, Kapasa, Pabean, Slompretan. The other one is the newer and expanding CBD further south including Basuki Rahmad, Embong Malang, Kedungdoro, Bubutan and Tunjungan.
- In Wonokromo, various commercial activities are concentrated outside the CBD mentioned above. It seems likely that Wonokromo is being formed as a sub CBD, thus making a pair of CBD in the north.
- There are some places where industrial land-use areas are concentrated. These are in Krembangan (around the Port), Wonokromo, Wonosobo and Karangpilang (along the river Surabaya), Rungkut (industrial estate and its surrounding), and Tandes.
- Rungkut Industrial Estate with an area of 240 ha, is the first, real industrial estate in Indonesia.
- Warehouses are concentrated between the CBD and the port of Tanjung Perak, along the river Kalimas.
- The Institute of Technology of Surabaya has been moved from a densely urbanized area to the east-side of the City.

Land areas by landuse category, were measured by using the above mentioned 1/20,000 scale landuse map. Table 2.4.1 shows the results. According to this table, characteristics of current landuse are as follows;

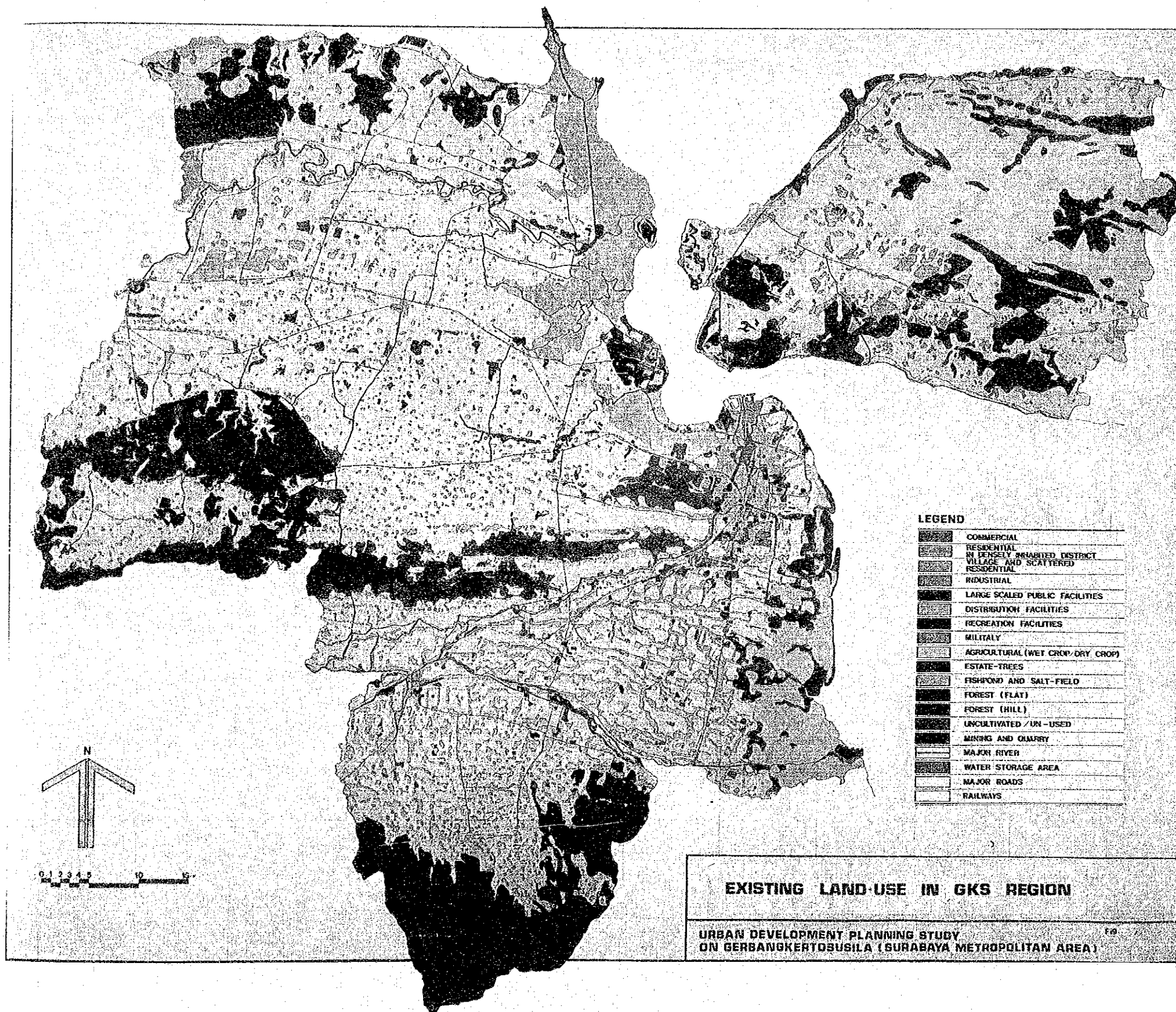


Fig. 2.4.1 EXISTING LANDUSE IN GKS REGION (1981)

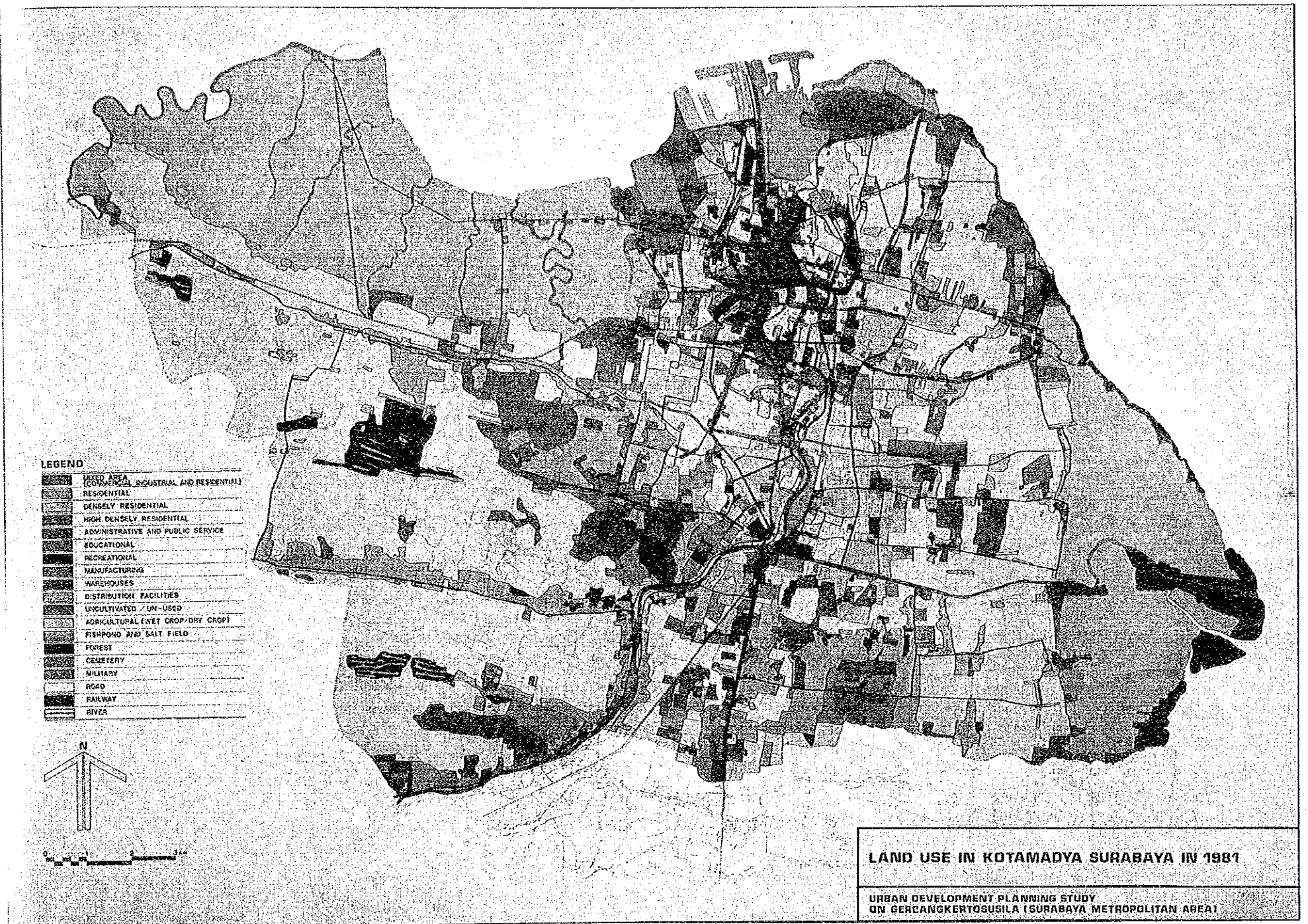


Fig. 2.4.2 EXISTING LANDUSE IN SURABAYA CITY (1981)

Table 2.4.1 LANDUSE COMPOSITION IN SURABAYA

	(ha)	% of Total
Residential	4,674.7	16.0
Medium density residential	1,722.7	5.9
High density residential	346.9	1.2
Mixed area *	570.6	1.9
Administrative and public service	205.8	0.7
Educational	203.6	0.7
Recreational	120.3	0.4
Cemetery	133.2	0.5
Manufacturing factories	707.9	2.4
Warehouses	135.1	0.5
Distribution facilities	175.7	0.6
Uncultivated/un-used	2,720.3	9.3
Agricultural (wet crop/day crop)	9,240.9	31.7
Fishpond and salt field	5,702.4	19.5
Forest	798.2	2.7
Road	416.3	1.4
Railway	97.8	0.3
River	507.2	1.7
Military	698.4	2.4
Total	29,178.0	100.0

* residential, commercial, industrial

NOTE : All areas were estimated by the Study Team from Interpretation of the 1/20,000 Scale Plan.

- Approximately 35% of the total land area of 29,178 hectares is urban area consisting of residential, commercial, industrial, public facilities, road and railway, and military.
- On the other hand, an area of 18,971 hectares, 65% of total land area, is rural land-use such as agricultural, fishpond/salt field, forest, river, uncultivated/un-used.
- Approximately 32% and 20% of total land area are agricultural and fishpond/salt field respectively. Therefore more than half of the total land area is used for primary industrial activities in the city of Surabaya.
- In the urban area, with 35% of total land area, residential land has an area of about 7,400 hectares, which is 23% of total land area. One-third of residential land use consists of medium or high density residential area.
- Industrial area such as factories, warehouses, distribution facilities, and commercial area including densely residential, occupy approximately 10% and 6% respectively of the urban area of 10,207 hectares. Also, public space such as public facilities, roads, railways, occupies 12%.
- Land area excluding fishpond/salt field and river which can be developed for urban landuse, occupies approximately of total land area 79%.
- Uncultivated/un-used land extends to 2,720 hectares and this will be developed in the near future for urban landuse such as residential, industrial, public facilities and so on.

2.4.2 URBAN DEVELOPMENT PROGRESS

URBAN DEVELOPMENT PROGRESS IN GKS REGION

Except for expansion of the urban area in Surabaya, no remarkable change can be seen in the urbanization of GKS Region during the period 1969–1981.

However, it can be seen that several urban developments are concentrated within the area lying 20 Km from the CBD of Surabaya, and also within Kod. Mojokerto. It should be noted that Surabaya–Malang highway will give significant development influence in the future, to the movement of urbanization in GKS Region.

Major on-going urban development projects are reported in the section 4–3.

HISTORICAL CHANGE OF URBANIZATION IN THE CITY OF SURABAYA

Reviewing the historical change in urbanization in the City of Surabaya, it can be seen that it was only 10–20 years ago that the urban area spread to west and east, adding to the south as in the past. The historical change in urbanization is summarized as follows;

- In the early 18th century, Surabaya was in a significant position as the major port of the Dutch East Indies.
- In the beginning of the 19th century, the Dutch built "Fort Kalimas" at the estuary of the river Kalimas, and subsequently the City of Surabaya spread from north to south.
- In the middle of 19th century, a European Community was formed in the area lying between the river Pegirian and Jalan Indrapura, as the result of Dutch business interests.
- This was the original city center and ethnic groups lived around there, ie., the Dutch occupied the northern part of Jalan Niaga, the Chinese lived and carried on their business around and to the south of the present Jalan Kembang Jupun, the Arabian community concentrated in and around Jalan Ngemplungun, while Indonesians lived near Jalan Padean Cantikan to the north.
- By the turn of the century, it seems likely that the city of Surabaya had a population of over 100,000. At this time, the port of Surabaya was being constructed at Tanjung Perak, and trading and commercial activities were expanded rapidly. Therefore, the population reached approximately 200,000 in 1920.
- The urban area then began to expand to the south towards Wonokromo. The general trend of urban growth above mentioned was supported by a steam tram service which was initially designed to carry workers from south of the city of the port in the north. Indeed, this factor had a decisive effect on the physical pattern such north-south corridor in Surabaya.
- Thus urban growth as expansion from north to south in Surabaya continued until the 1950's.
- In the early 1960's, a new aspect of urbanization appeared. It was the expansion towards the east and west along the major roads, thus adding to the north-south corridor. A census indicated a population of approximately 1,000,000 in 1961.
- After that, the urban growth continued towards Gunung Sari hill in the west which was unsuitable for urban development due to problems related to water supply and drainage. Today, the pattern of urban growth in these areas is beginning to change from linear to sprawl.
- The 1981 census indicated a population increase of approximately 1,000,000 between 1969 – 1981, and Surabaya had a population of 2,032,133 in 1981.

CHARACTERISTICS OF URBAN GROWTH 1969 – 1981

In order to understand the movement of urbanization in the City of Surabaya, urban 1969 – 1981 was analyzed in detail, in addition to the review of historical change mentioned above. Analysis made use of the distribution map of changed areas in land-use between 1969 – 1981 (Fig. 2.4.5).

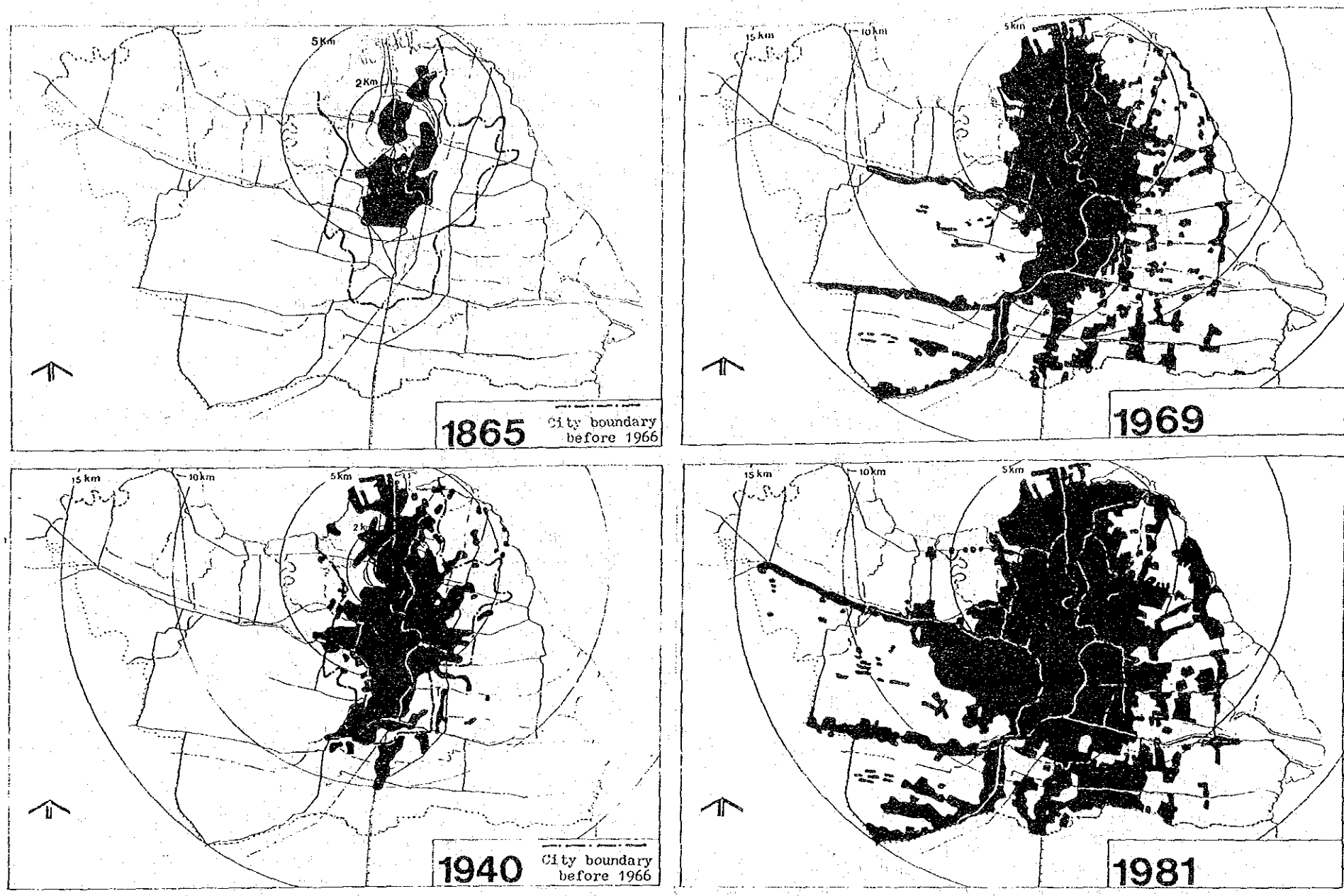


Fig. 2.4.3 HISTORICAL CHANGE OF URBANIZATION

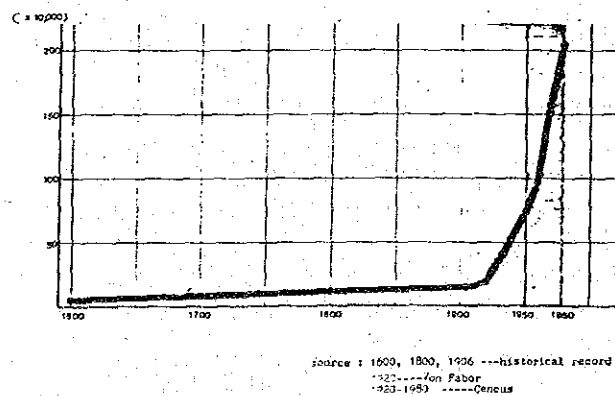


Fig. 2.4.4 POPULATION GROWTH IN SURABAYA BETWEEN 1600 - 1980

Several areas which were inhabited more densely between 1969 - 1981, can be seen within the belt lying 2-5 Km from the CBD. Within the area lying 5-10 Km from CBD, new residential developments and land development for buildings by the private and public sectors, appeared between 1969 - 1981. Due to progress of industrialization, manufacturing located between 1969 - 1981 is concentrated in the following areas:

- * Rungkut Industrial Estate (operated since 1974) and its surroundings,
- * Area along the river Kalimas in Karang Pilang.
- * Area along Jalan Gresik.

In detail, analysing this progress of urbanization between 1969 - 1981, increased built-up area during this period was 1645 hectares with an average annual increase of 1.5%, which occupies 16.1% of the total built-up area in 1981. Contents of increased built-up area were as follows:

Total built-up area in 1969	8,562 ha
Total built-up area in 1981	10,207 ha
Increased built-up Area 1969 - 1981	1,645 ha (100.0%)
* Residential	1,077 ha (65.5%)
* Industrial	449 ha (27.3%)
* Public Facilities	119 ha (7.2%)

NOTE: During the same period an existing area of 265 ha, in an existing urbanised area, was developed more densely.

Table 2.4.2 LIST OF PROJECTS BY PERUMNAS

Location No.	Site	Ha	Unit (Completed)
1.	Simomulyo I	27	1,696
2.	Kamal-Madura	28	1,292
3.	Tandes I	83	3,540
4.	Simomulyo II	24	1,700
5.	Tandes II	73	1,736
TOTAL		235	9,964

Source: PERUMNAS, SURABAYA OFFICE

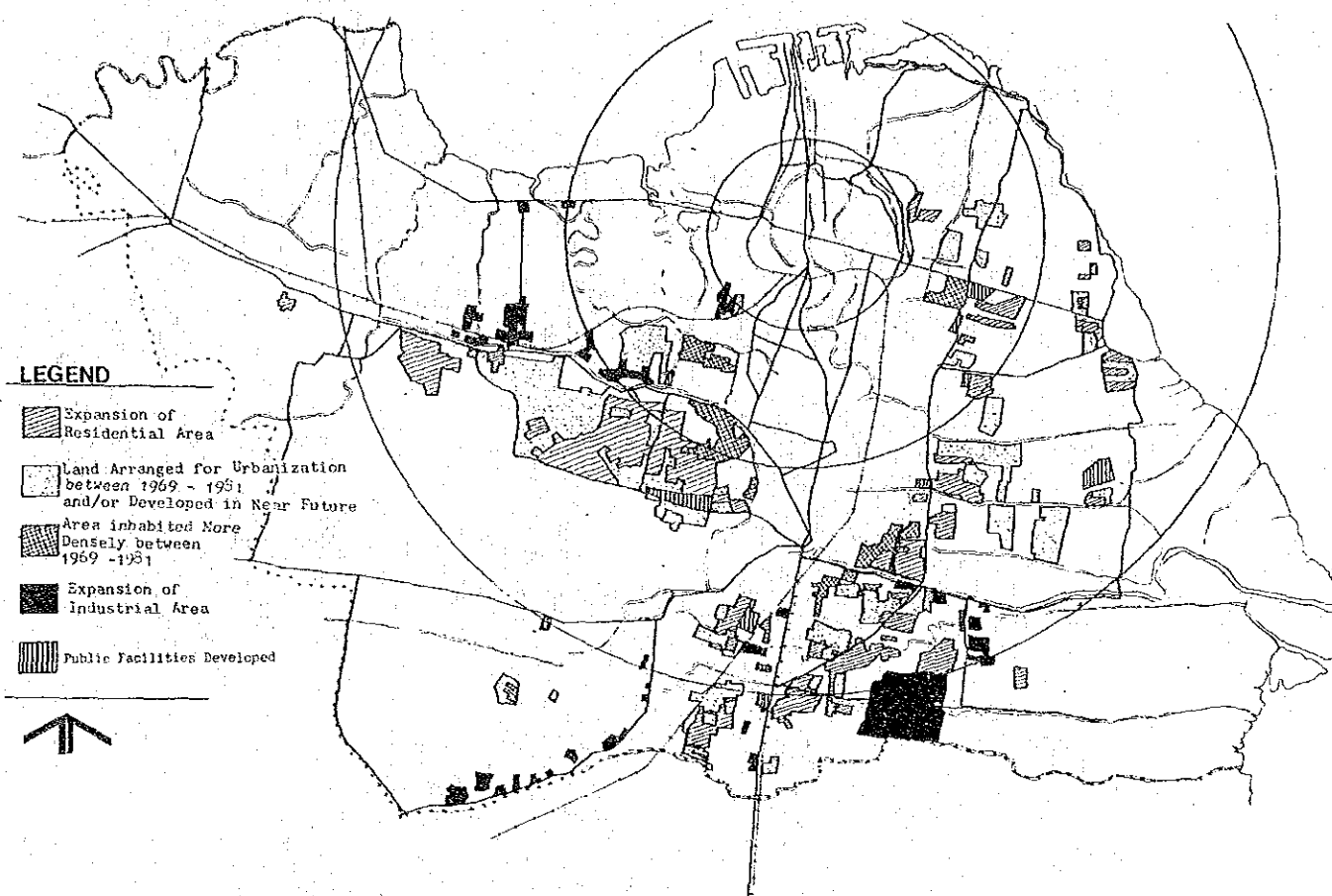


Fig. 2.4.5 URBAN GROWTH IN SURABAYA 1969 - 1981

An existing land area of 1,157 hectares, currently under-developed or used as uncultivated land, will be built up in the near future. Total increased urban area between 1969-1981 was 2802 hectares, equal to 27.5% of the total built-up area in 1981. This indicates an average annual increase rate of 2.7%.

(1) Housing Developments

Considering the above mentioned movement of urbanization, the situation of residential development by the public sector is summarized as follows: Actual housing development projects in the Study Area have been executed by PERUMNAS and YAYASAN KAS PEMBANGUNAN KOTAMADYA SURABAYA (Y.K.P.). The Housing Projects by PERUMNAS have the purpose to supply houses for people with low-income and YKP also basically has the same purpose. The actual data of implementation by both authorities is shown in Tables 2.4.2 and 2.4.3, and the project locations are illustrated on Fig. 2.4.6.

The location of YKP Projects are limited to be within Kodya Surabaya. The PERUMNAS Project in Kamal was significant in that the area developed was 28 ha and about 1300 units were produced for commuters to Surabaya.

Other residential developments include the Kampung Improvement Projects (K.I.P.) in existing high density residential areas. The major purpose of K.I.P. is the implementation of environmental improvement of high-density housing areas. Kampung Improvement Projects have been executed since 1976 mainly in the urban area of Surabaya, and they are based on finance of 65% from the World Bank and 35% from the government. To date, two projects known as "Urban II (1976 - 79)" and "Urban III (1979 - 82)" have been processed, but only Urban III is still on-going. The actual developed area during the period of Urban II (1976 - 1979) was approximately 441 ha (18 areas), and about 269 thousand persons inhabit these areas. During the Urban III period (1979-82)

Table 2.4.3 LIST OF PROJECTS BY Y.K.P.

NO.	LOCATION	PROJECT YEAR	AREA (ha)	UNIT	ROAD LENGTH (km)
1	KOMPLEK DEYAK	1958	1.0	22	0.3
2	KOMPLEK KEMAYORAN	1953/57	2.5	71	0.75
3	KOMPLEK MONORUSUMU	1962/63	1.25	29	0.4
4	KOMPLEK SIDOYOSO	1962/64	5.5	122	1.75
5	KOMPLEK BHARMA RAKYAT	1952/53	1.0	22	0.3
6	KOMPLEK PETERION KALI	1958	0.5	10	0.15
7	KOMPLEK BHARMA HUSADA	1963/64	2.0	44	0.6
8	KOMPLEK HOJOARUM	1964/73	9.85	145	3.0
9	KOMPLEK PUCANG	1956/60	8.5	200	2.6
10	KOMPLEK NGAGEL JAYA	1960/64	15.0	302	4.5
11	KOMPLEK WONGSARI KIDUL WONOBOYO	1952/56	2.0	62	0.6
12	KOMPLEK BENOL MERISI	1953	0.75	16	0.26
13	KOMPLEK GAYUNGAN	1972/75	4.2	677	1.10
14	KOMPLEK JEMUR ANDAYANI	1965/73	14.80	193	4.50
15	KOMPLEK KEMANG SARJITENGGILIS	1974/80	90.50	942	17.19
16	KOMPLEK TENGGALIKURKUT	1979/81	78.0	132	14.04

Note: The total number of units developed is about 4200 units between 1954 and 1981.



Fig. 2.4.6 DISTRIBUTION OF HOUSING DEVELOPMENT

approximately 613 ha with a population of 223 thousand has been implemented. The total areas and number of projects are estimated to be about 1,054 ha and 45 kampung respectively, and the number of inhabitants in these areas is approximately 492 thousand. The location of projects executed by K.I.P. are shown in Fig. 1.3.11.

(2) Industrial Developments

PT. Surabaya Industrial Estate Rungkut (PT SIER for short) has been playing the most significant role for promotion of industrialization in the City of Surabaya and surroundings.

PT SIER was founded on February 1974 and is a limited liability company with paid up capital of Rp.1,500 million. The capital is shared by the Government of Indonesia (50%), the Province of East Java (25%) and the City of Surabaya (25%).

The main tasks are development and operation of industrial estates in Surabaya and the region. Since 1973 the first industrial estate has been developed by the city government at Rungkut a south eastern subdistrict of Surabaya. The area is 245 ha (605 acres).

Up to 1981 PT SIER has sold and leased industrial land and buildings covering an area of 149 ha to firms including some foreign joint ventures. Since the first estate has been 75% sold, PT SIER is planning to develop a second in Berbek, Sidoarjo. (50 ha, during 1981 - 82).

(3) Increasing Trend of High Rise Buildings

In order to understand the scene of more effective and efficient landuse in the form of high rise building in Surabaya urban area, the distribution map of high rise buildings (defined as four or more floors) in 1969 and 1981 was drawn up, based on interpretation of the 1/5,000 scale photographs (Refer to Fig. 2.4.7).

Generally speaking, increased areas of high rise buildings are located along the major roads forming the north-south corridor, particularly in the center of Kec. Wonosobo. According to site reconnaissance, these high rise buildings are mainly used for shopping centres, hotels, and administrative facilities. Increased areas in detail are as follows:

- Surrounding the railway stations such as Pasar Turi and Kota.
- Along the major roads such as Jalan Tunjunga, Jalan Jend. Basuki Rahmad, Jalan Upiptuma Narjo, Jalan Darmo, which form the north-south corridor.
- West side along Raya Wonokromo, Raya Jend. Akhmad Yani.
- Along Jalan Raya Jaksu.
- Surrounding the junction of Jalan Menur Pumpungan and Jalan Mamya.
- A large building located in the eastern part of the city is the Institute of Technology of Surabaya which has been moved from a densely urbanized area.

2.7 RIVERS

2.7.1 GENERAL

Rivers and canals are the most basic and principal infrastructure in the urban areas as well as rural areas. Once the rivers and canals are developed, the basic urban structure is strongly controlled for a long time. In accordance with the urban expansion, the requirements on quality and quantity of the waterway systems will be changed. Every rainy season urban areas are inundated as many irrigated agriculture areas remain in the urban area and no conversion to a drainage system has been carried out. Systems should be established to promote improved standards and enhanced urban amenities.

2.7.2 RIVER SYSTEM

Three river systems directly influence the GKS Region; Brantas river from the south, Sala River from the north and Lamong river from the west.

BRANTAS RIVER

The Brantas is the second largest river in Java island. Fig. 2.8.1 shows the whole Brantas basin. The total length of its main stream is about 320 km and the catchment area 12,000 km². This corresponds to one quarter of East Java. The annual rainfall in the basin is about 2,000 mm of which about 80% occurs in the rainy season from November to April. The major industry in the basin is agriculture and this employs about 70% of the population. The total farmland occupies 730,000 ha accounting for about 60% of the basin area. The remaining areas are mostly occupied by mountain slopes where the land is not suitable for farming due to topography, thinner soils, and shortage of water. The total area of uplands, estates and orchards amounts to 409,000 ha and this is mostly located at the outskirts of mountain slopes of Mt. Wilis in the west, Mt. Arjuno in the east and Mt. Kelut in the centre of the basin.

At Mojokerto the main stream divides into two rivers, Surabaya river and Porong river. The Porong river was constructed as the relief of the Brantas river many years ago. The Surabaya river receives water from the Brantas river through the Gedeg and Mlirip sluices as well as the Marmojo river, the origin of the Surabaya river.

Mt. Kelut, located at the centre of the Brantas river basin, is an active volcano and erupts at intervals of 15 to 30 years. The volcanic materials produced by an eruption are estimated to be in the order of 100 to 200 million m³, and for this reason many projects on dredging the river bed have been carried out.

Proyek Kali Brantas office has set up the project schedule up to 2000. The following 9 projects will be executed up to 1989.

– Karangates Hydro Plant	(1986 – 1989)
– Sengguroh Hydro Plant	(1982 – 1987)
– Kesamben Hydro Plant	(1984 – 1989)
– Development Project of Karangates upper reach sub-basin and of Selorejo upper reach (Lesti dam and Kepanjen Hydro Plant)	(1983 – 1989)
– Brantas middle reach river improvement	(1982 – 1989)
– Ngrowo sub-basin development project	(1982 – 1989)
– Surabaya river improvement (stage II)	(1983 – 1989)
– Widas sub-basin development	(1984 – 1989)
– Land conservation, spring water source development and erosion control	(1983 – 1989)

A total of 31 dams, including existing, will be constructed by 2000.

SALA RIVER

Sala River is the largest river in Java island and Fig. 2.7.1 shows the whole basin. The river runs about 600 km and drains area of about 16,100 km², which is approximately 12% of the total area of Java.

The Sala River has two tributaries, Upper Sala and Madium river. These two rivers originate from the southern mountain range (G. Sewu), and drain areas of 6,072 km² and 3,775 km² respectively before both join together at Ngawi. From this point, the Sala River flows northward through Kendeng ridges to Cepu and then takes its course eastward in the long extending alluvial flat land to the north of Gresik before finally emptying northward to Java Sea through the straight cut channel. The present river course meanders and has a gentle slope. Actual elevation of the riverbed is only about 100 m above MSL 500 km upstream of the estuary.

Waterhead of the Dengkeng and Woro rivers, flows down the southern slope of G. Merapi, an active volcano, and flushes a large quantity of volcanic debris to the Dengkeng river and then to the Upper Sala River.

Vast marshy and swampy areas occur in Bengawan Jero and Jabung Lawlands in the lower Sala basin. In the basin the farmland occupies 73% (1,148 thousands ha) of the total land. Forest area accounts for only 22% (342 thousands ha) and the others for 5% (72 thousands ha). Direct rainfall in the basin amounts to about 2,100 mm annually or 33.8 billion m³/year on an average. About 40% (16.7 billion m³) is estimated to run off as surface water in the stream. The run-off varies from about 65% in the driest year to about 160% in the wettest year. Every year several floods carry most of the yearly run-off into the sea. Such floods are not only losing available water, but also cause severe damage to the surrounding area, especially in the lower basin. The Sala river has too small a flow capacity (500 m³/sec) to carry floods from the basin. Every rainy season an average of 93,600 ha involving 55,000 houses are damaged by the floods. The river dikes in the Sala lower reach were constructed in the Dutch period, the right bank Babat to Sumbayat 75.6 km and the left bank Rengel to Laren 46.8 km. These dikes have to be repaired every year.

– Jipang Dam:

Jipang dam is planned to be about 6 km upstream of Cepu and operated for flood control, irrigation and hydropower generation. 1,159 million m³ and a storage capacity of 740 million m³ can be distributed to irrigate the farm land of 54,000 ha. The maximum output of 18,000 Kw and total annual generation of 70,800 MWH can be produced.

– Jabung Retarding Pond:

The Jabung retarding pond is planned as a temporary water reservoir for flood protection and irrigation purposes. At the end of the rainy season, flood water of 216 million m³ will be reserved in an area of 6,000 ha and will be utilized in the dry season for irrigation.

– Bengawan Jero Swamp:

Bengawan Jero Swamp is located in Sala River Hilir between Sala River and a provincial road (Gresik – Babat). The Jero Swamp lies in low land with a total area of 10,448 ha ranging from – 1.20 to + 0.60 SHVP and connects the Sala river through Kuro Sluice located at the down stream end of the Blawi river. The swamp consists of three areas depending on the water level as follows:

Jero Tinggi (Highest Portion)	: 1,497 ha
	water level –0.60 – ±0 SHVP
Jero Tengah (Middle Portion)	: 2,806 ha
	water level ±0 – 0.60
Jero Dalam (Lower Portion)	: 6,145 ha
	water level –0.60 – –1.20

Fish-ponds operate throughout year. The swamp is also managed as rice paddy depending on the water level.

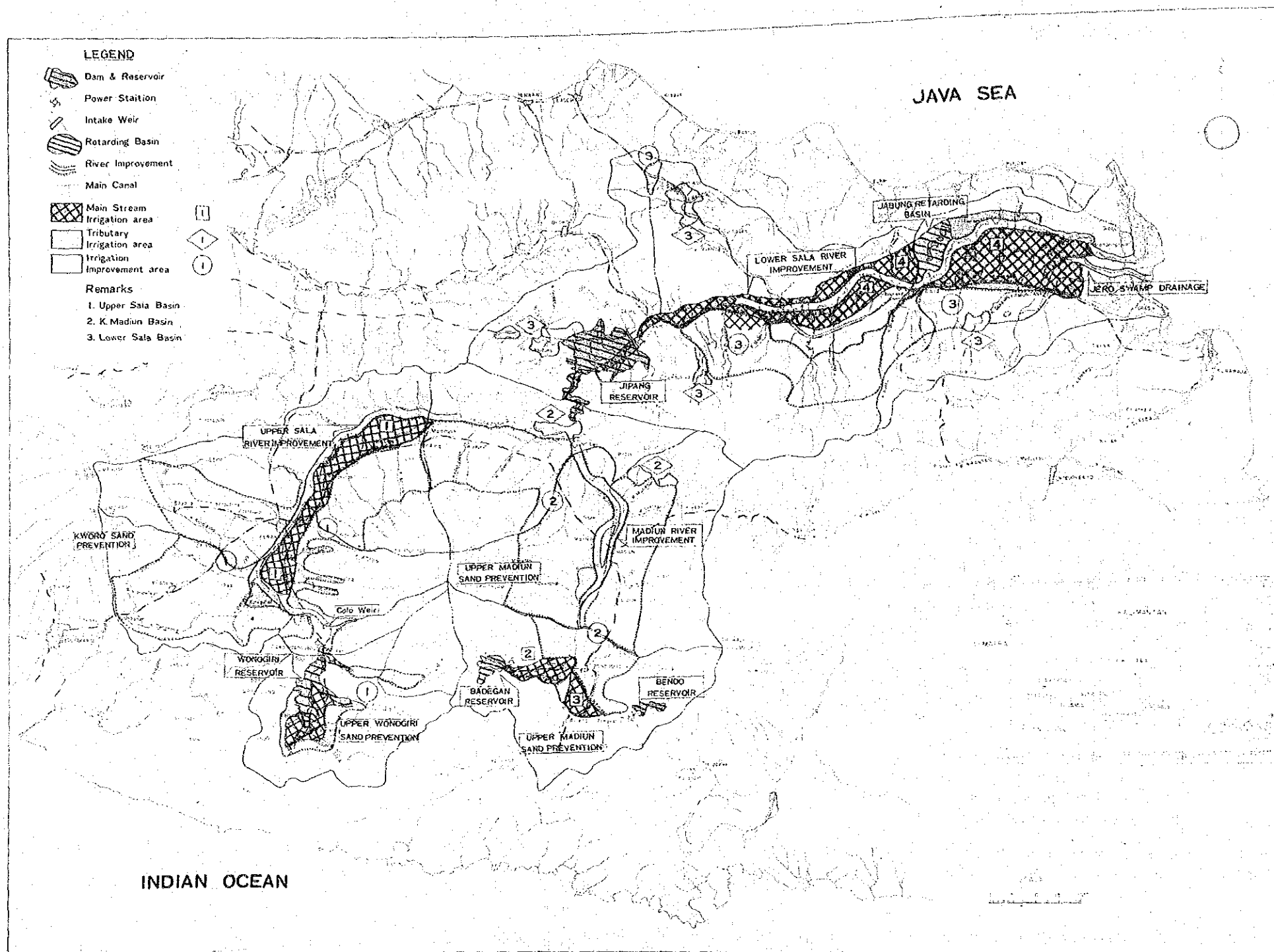


Fig. 2.7.1 BENGAWAN SALA BASIN

The Kuro sluice is the most important water gate to ensure the swamp activities on the paddy/second crop production, fish production, drinking water/bathing water and the local traffic by sailing vessels. The swamp experiences inundation and floods in the wet season and lack of water in the dry season every year. The inundation is brought from five rivers merging from the south into Kali Blawi. The paddy field in the swamp had only low production at 672t in 1979 and 549t in 1980.

Well boring and installation of pumps for the paddy production has been carried out by the Government in the past. Dredging of the Blawi river as well as its tributaries has been executed since Pelita I.

Two major subjects are identified for the Jero Swamp:

- to provide land communication between south and north of Lamongan, through the swamp.
- to expand further facilities for water supply and inundation protection.

- Past and Future Projects in the Sala Basin

Many projects have been completed and others are scheduled as follows:

- | | |
|--------------------|------------------------------|
| - Wonogiri Dam | Completed in 1982 |
| - Hydro Plant | On-going |
| - Irrigation Canal | On-going (for 22,000 ha) |
| - Badegan Dam | Pre-feasibility stage |
| - Bendo Dam | Before pre-feasibility stage |

- Jipang Dam Problem for 13,000 houses to be inundated
- Saboo Project On-going for Woro river on Mt. Merapi and some projects along Madiwn river
- River Improvement Project Short cuts and protection work for river dikes being executed in the Sala lower reach. River bank repairing work due to disaster in the up-stream section. Full scale construction to be executed in 1982 on the completion of feasibility study.
- 35 dams construction on-going and 3 dams completed.

LAMONG RIVER

The Lamong river is located in Lamongan region for the upstream reaches and on the boundary between Gresik and Surabaya in the lower reaches. It has a total catchment area of 830 km² and an irrigation area of 4,500 ha. The Lamong river area is a low food producing area in East Java due to its dependance on rainfall. Although there are 53 water reservoirs in Lamongan, these are still insufficient to meet the water demand for irrigation purposes. The government has prepared a plan to construct the Lamong dam based on the geological and topographic survey conducted in 1978 and 1979, but no construction is scheduled yet. It will be located in Kec. Sambeng of Kabupaten Lamongan. On completion of the reservoir, it will serve a 2,500 ha irrigation area using 12.7 x 10⁶ m³ reserved water volume in a 378 ha watershed.

It is reported that Kebomas area in Gresik and the Benowo area in Surabaya are flooded every year. It is assumed that these inundated areas act as retarding ponds in the rainy season. No detailed information is available about this.

SURABAYA/WONOKROMO RIVER

The Surabaya river has a total catchment area of 604.4 km², a total length of 100 km and river bed slope ranging from 1/300 in the Marmojo basin to 1/4200 near the Mas river mouth. The Kedung Soro river receives water from the Brantas river through the Gedeg sluice and confluence of the Marmojo river upstream of the Perring gauging station. Every rainy season the Marmojo river floods due to the confluence water of the Kedung Sala river diverted from the Brantas river.

At Wonokromo the Surabaya river divides into two, the Wonokromo river and the Mas river. The upstream of the diversion point there is Gunungsari dam which was constructed in 1981 and maintains water levels for 9 irrigation intakes and industrial water intakes.

Immediately downstream of the dam, the Surabaya river is joined by the Kedurus river. The Jagir dam is located 2.5 km down-stream of Gunungsari dam. The Jagir dam maintains the water level for the Ngagel water treatment plant, and diverts water into the Mas river through Wonokromo sluice. Water passing Jagir dam flows to the sea through the Wonokromo river, which is tidal through its length. The Wonokromo river is primarily a flood relief channel.

2.7.3 LOCAL RIVER/CANAL SYSTEM

SMA consists of four areas; Surabaya, part of Sidoarjo, Gresik and Bangkalan (Kamal).

SURABAYA

(1) Rivers/Major Canal System

- Drainage Area

The drainage areas in Surabaya are divided into 5 basins; Wonocolo-Rungkut, Sukolilo, Central Tandes and Karang Pilang. Each area drains directly to the east sea or to the north sea except the Karang Pilang area which drains to the Wonokromo river through the Surabaya river. There are 13 major drainage rivers or canals and 7 major irrigation canals as shown in Table 2.7.1 and 2.7.2.

Table 2.7.1 DRAINAGE CANALS IN SURABAYA

Name of River/Canal	Length (km)	Outlet Controls
River		
Lamong	68.0	None
Surabaya	28.7	Jagir Dam
Wonokromo	12.3	None
Kedurus	10.8	Jagir Dam
Mas	13.9	Gubeng Dam
Kandangan	40.0	None
Drainage Canal		
Perbatasan	10.0	None
Wonocolo - Wonorejo	14.3	None
Kalidami	6.1	Tide Gate
Tambakwedi	5.7	Tide Gate
Pegirian	8.4	Tide Gate
Greges	4.9	Tide Gate
Anak	3.9	None
Simo	10.6	None
Baloug	4.6	None
Semimi	7.9	None
Other Canal		
Lesser Canal	86.0	
Conduits/Pipelines	1,525.0	

Table 2.7.2 IRRIGATION CANALS IN SURABAYA

	Lengths (km)
Main Irrigation Canals	
Menangel	4.8
Kebonagung	13.1
Karah	3.8
Kali Bokor-Keputih	9.0
Kali Kepiting	6.4
Jeblokan	7.7
Gunungsari	21.1
	65.9
Lesser Irrigation System	
Kabonagung	17.9
Kali Bokor-Keputih	5.9
Jeblokan	4.0
Rowo Wyung area	5.7
Others	0.4
	33.9

- Irrigation

Less than 4,000 ha were irrigated in 1981 and these are in 4 zones; Wonocolo-Rungkut, Sukolilo, northern area of Jl. Tandes, and Rowowyung area (Kedurus river basin). These irrigation canals will become drainage canals with urbanization.

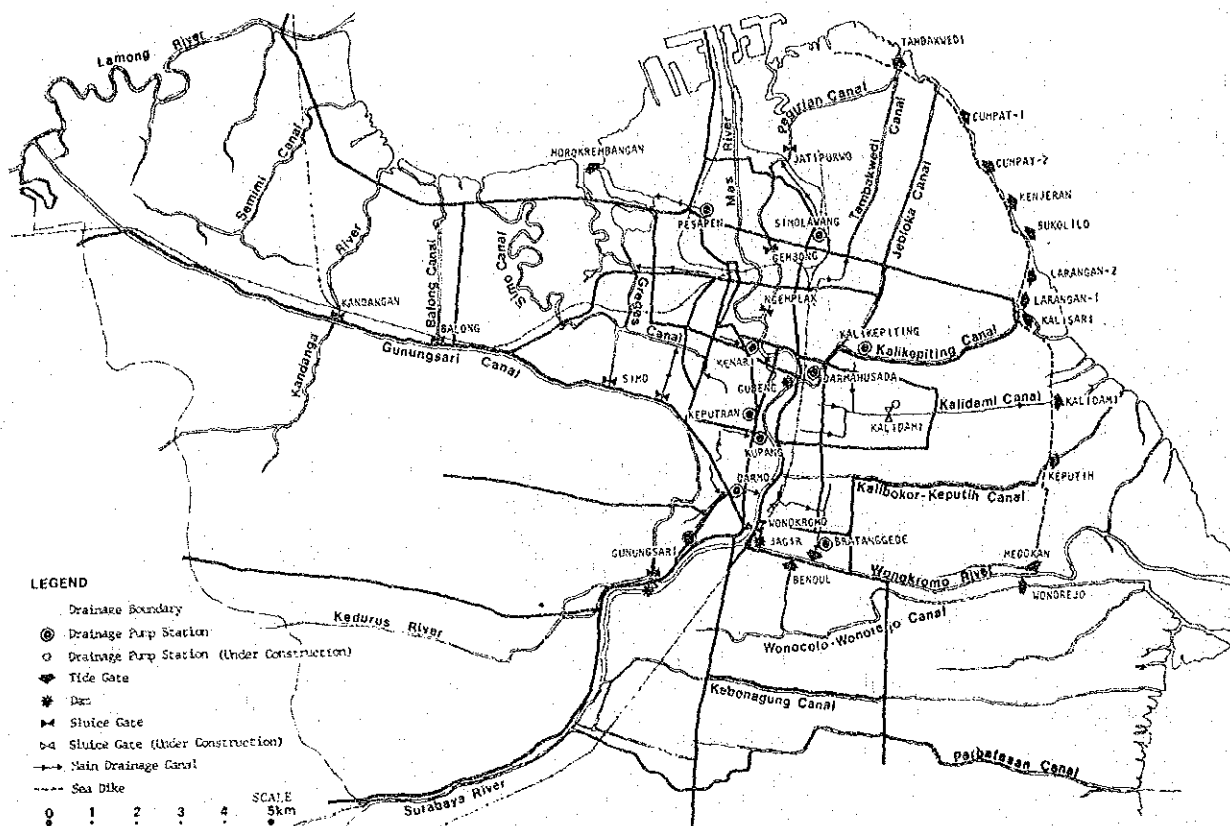


Fig. 2.7.2 EXISTING WATERWAY SYSTEM IN SURABAYA

— Water Reservoir

Two water reservoirs are currently operated; Morokrempangan Boezem and Jeblokan reservoir. The Morokrempangan Boezem has some 83 ha and drains water from the Gregess river by using three mitre gates, 5 m width and 4 m depth which are operated between the Boezen and the sea. The Jeblokan reservoir takes water from Jeblokan canal and drains to the sea through the Tambakwedi mitre gates. In the middle of the reservoir dike a 50 cm diameter pipe with stop logs is installed for the fish-pond along the access canal to the Tambakwedi gate. The reservoir is approximately 5 ha.

— Sea Dike

The sea dike was constructed to prevent saltwater intrusion from the sea. Only 17 km of sea dike is provided for the north to the east coast of Surabaya. No sea dike has been constructed for the western side of the Mas river, and for the south of the Wonokromo river. A total of 12 gates are provided in the sea dike including new 9 gates constructed in 1976/77 by the Brantas Lower Reach Project Office. Many of these flap gates are not successfully operated due to the theft of apparatus required to raise the gate. Due to holding of flood water behind the gate, a large area behind the dike is inundated every year. At almost all dike gates, no gate operators are working.

— Some Problems on Selected Rivers/Major Canals

Mas River

The Mas river is regarded as an urban river from consideration of existing functions, which are drainage for the run-off from its catchment area, the water supply for irrigation/industries, and flushing of its downstream and related canals in the dry season.

The Mas River is controlled by Gubeng dam, located 4.5 km down-stream of the Wonokromo sluice. The dam is used to maintain water levels for the Jeblokan and Kalibokor irrigation offtakes, and for several industrial offtakes. Downstream of the Gubeng dam it is tidal and enters the sea at Tanjung Perak.

Up-stream of the Gubeng dam, the river is heavily silted and has been illegal narrowed. The Gubeng dam now has the important functions and maintains the high water level. This makes it difficult to drain run-off from the surrounding area. It is hoped to lower the water level to allow some natural drainage but this may allow salt water intrusion into the surrounding ground and also water shortage at the surrounding wells, which are used by many people for bathing and washing purposes.

— Kedurus River

The Kedurus river basin, which has a catchment area of 67 km², is located between two hills; Gunungsari hill to the north and Kebraon hill to the south. There are however no stream flow records. The river basin suffers habitual inundations every rainy season and it was reported that the inundation in January 1978 was more than 1,030 ha, at about 1 m depth, and lasted about two weeks. This is basically due to the maintenance of a high water level at the Jagir dam and the small capacity of the confluence zone to the Surabaya river. However, gravity drainage is still possible.

— Gregess River

The Gregess river basin also experiences habitual inundations every rainy season. It is reported by Surabaya city that parts of Sawahan, Bubutan, Krembangan and Pabean are affected. The inundation is mainly caused by the low capacity of the minor access rivers and drainage pumps. Garbage, siltation, illegal occupants and flow blockage by bridges and water pipes also aggravate the situation.

— Gunungsari Canal

The Gunungsari canal is an irrigation canal and abstracts water from up-stream of the new Gunungsari dam. The canal receives the whole run-off from Gunungsari hill which is already developed as a residential area. In order to drain the excess water, four spillways were provided at Banyu-urip, Simo, Balong and Kandangan on the canal. However, due to the shortage of spillway capacity, frequent inundation occurs on the left bank, and the right bank of the canal has been cut by inhabitants to relieve their inundated area. This results in the inundation of the Darmo urban area.

– Inundation Problems

Fig. 2.7.3 shows inundated areas in 1981 and observed problems are due to:

- The width of the canal is small continually varying and the downstream section is sometimes narrower than the up-stream.
- Canal planning as an isolated waterway system.
- Inadequate maintenance for siltation and dumped garbage.
- Reduced canal cross-section by bridges, irrigation canals and water pipes crossing over the drainage canals. This indicates no approvals for the construction of these structures by the administrative agency.
- Illegal temporary houses and other structures have been built out from the banks and into the stream or canal.
- Many sluices gates are operated by nearby residents.

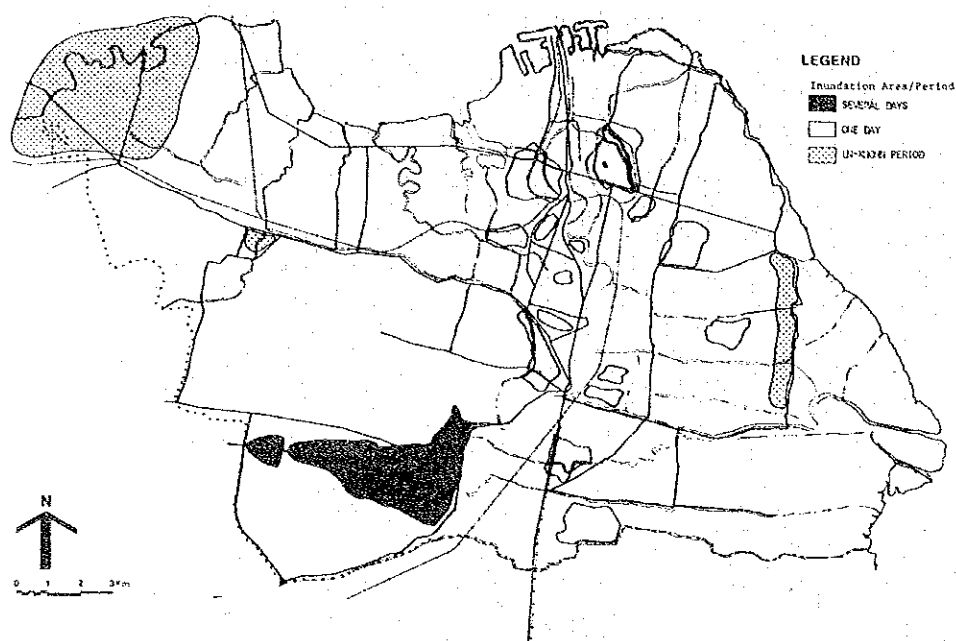


Fig. 2.7.3 INUNDATED AREA IN 1981

(2) Minor Canal

Tertiary and quaternary canals except street ditches and gutters are reported to be some 150 km by the studies for SURABAYA WATER, WASTEWATER, DRAINAGE AND SOLID WASTES (CDM Report), Sep. 1976.

Local flooding of the minor canals can be overcome, by first maintaining and cleaning up the canals, and secondly by maintaining the pump stations.

There are 9 pumping stations in operation for local drainage. Based on a site investigation in April 1982, 12 pumps out of a total 30 pumps are out of order. These pumps are shown in Table 2.7.3. Two pump stations in Bratangede and Kalidami are under construction by Surabaya city.

(3) Surabaya Area – Projects of the Related Agencies

The drainage systems in Surabaya, in terms of operation, maintenance and development, are managed by separate agencies such as Surabaya city, Pengairan TK-1 and the Brantas Lower Reach project office, with overlapping efforts and only limited effective coordination. Brantas Lower Reach project office is the responsible agency for the construction/operation/maintenance work on the primary river system including the Mas river. For the past 10 years the office has executed many projects in Surabaya area as listed below:

Table 2.7.3 EXISTING DRAINAGE PUMP STATION

Station	Existing Pumping Units			
	Pump No.	Rated Capacity m^3/sec	Type of Drive	Total Rated Capacity m^3/sec
1. Kupang	1	0.67	Electric	5.62
	2	0.67	Electric	
	3	0.67	Electric	
	4	0.67	Electric	
	5	0.47	Electric	
	6	0.47	Electric	
2. Darmo	1	0.26	Electric	4.18
	2	1.10	Electric	
	3	1.35	Electric	
	4	1.47	Electric	
3. Simolawang	1	0.20	Electric	4.14
	2	0.67	Electric	
	3	0.67	Electric	
	4	1.13	Electric	
	5	1.47	Electric	
4. Gunungsari	1	1.20	Electric	2.65
	2	2.25	Electric	
	3	0.25	Electric	
5. Pesapan	1	0.25	Electric	1.84
	2	0.12	Diesel	
	3	0.12	Diesel	
6. Bratang Gede	1	1.30	Diesel	3.90
	2	1.39	Diesel	
	3	1.39	Diesel	
7. Keputeran	1	0.20	Diesel	0.24
	2	0.20	Diesel	
8. Kalikepiting	1	0.12	Diesel	0.24
	2	0.12	Diesel	
9. Darmahusada	1	0.12	Diesel	0.24
	2	0.12	Diesel	

Surabaya/Wonokromo River

- River Course Improvement
- Section of Spanjang – Gunungsari dam Completed
- Spanjang – Mlirip Sluice Waiting for approval
- Mlirip Sluice Construction Completed in 1979
- Gunungsari Dam Construction Completed in 1981
- Jagir Dam Improvement Works 50% completed

Mas River (Dredging, Reventment): 80% completed

Morokrengangan Boezam:

- 17 km embankment and revetment 13.5 km completed will be finished within 1982
- Remaining 3.5 km (Keputih-Medokan)
- 9 Sluice Completed in 1980

Appurtenant Facilities (including test facilities, water & rain gauge station and communication station). Completed in 1980

In 1979 the office proposed the extension projects for the secondary drainage system improvement in the western area of the Mas river as the second stage project. The project has not been implemented yet. The office is currently executing the remaining works for the sea dyke, Jagir dam, and dredging and reventments for the Mas river.

Surabaya city is responsible for the construction, operation and maintenance work for the drainage canals below the secondary system in the urban area. Mainly canal improvement works (excavation and revetment) and construction of pump stations have been executed in the past. In the five year program (Pelita III), Surabaya city is scheduled to improve some 34,600 m of existing canals on a local budget amounting to Rp.981 million, and to maintain about 96,700 m by a local budget amounting to Rp.5,837 million. Out of these projects, canal improvement and expansion projects and construction of pump stations are under-way in 1982/83. Total 9 pumps are replaced in Kupang and

Darmo stations. Two pump station with total 5 pumps are under construction at Bratangede and Kalidami.

Pengairan Tk-1 controls water through the operation of irrigation facilities such as dams/sluiques/gates and canals. Irrigation in Surabaya has no future and it is reported by Pengairan Tk-1 that no extension projects for irrigation will be undertaken.

SIDOARJO

(1) General

The Delta Brantas Sidoarjo, enclosing Surabaya and Porong river, is the best rice production area in East Java. The Brantas delta has a total area of approximately 32,600 ha of irrigated sawah. All water for this land is abstracted from the Kali Brantas upstream of Lengkong dam. Beside the rice fields, fish ponds of 10.9 ha lie along the east coast. The elevation of the Delta ranges from about 16.0 m to -1.0 m and the area has a gentle slope of 1/2000 toward the east. The area with the elevation of less -1.0 m is utilized for fish ponds.

Most of the irrigation water is supplied through two large primary canals, the Magetan canal (17,970 ha) which feeds the north of the delta and the Porong canal (12,505 ha) which supplies the south. The total length of the primary canals is 64 km. There are 263 km of secondary canals, about 800 km of tertiary and about 950 km of quaternary canals. There are 7 drainage basins with the total discharge area of 51,800 ha. The length of secondary drainage canals are shown in Table 2.7.4 and in Fig. 2.7.4.

(2) Inundation

Fig. 2.7.4 shows the inundation area investigated by the Pengairan Brantas Mojokerto office in 1980/81. A total of 265 ha was damaged with more than 30 cm inundation depth for more than one day.

The major causes are:

- Insufficient cross-sectional area of the drainage canal due to siltation.

Table 2.7.4 EXISTING DRAINAGE CANAL LENGTH IN DELTA SIDOARJO

Drainage Canal	Field Area (km)	Pond Area (km)	Total (km)
Tambakoso	16.5	2.0	12.5
Boentoeng	52.0	9.5	61.5
Bulubendo	17.0	1.5	18.5
Tombokogung	11.9	10.0	21.9
Kebetingan	199.7	32.1	231.8
A l o o	47.3	19.2	66.5
Dalong	12.0	11.5	23.5
Total	350.4	85.8	436.2

- Obstruction of flow due to the provision of structures such as water intake weir in the drainage canal.
- No adequate operation of voor canal intake gate during rainy season.
- No drainage due to high tides especially to the east of the highway.

(3) Past and Present Projects

The Delta Brantas office has executed canal improvement projects and construction projects for water control structures for the primary/secondary systems since Pelita - I. For the period of 1982 - 1984 (Pelita - III) the following projects will be executed:

- Improvement of drainage canal 26.55 km
- Strengthening canal embankment 1.95 km
- Improvement of 2 water control structures 2 nos.
- Pilot reclamation project 300 ha
- Lining project for tertiary canals 14,800 m.

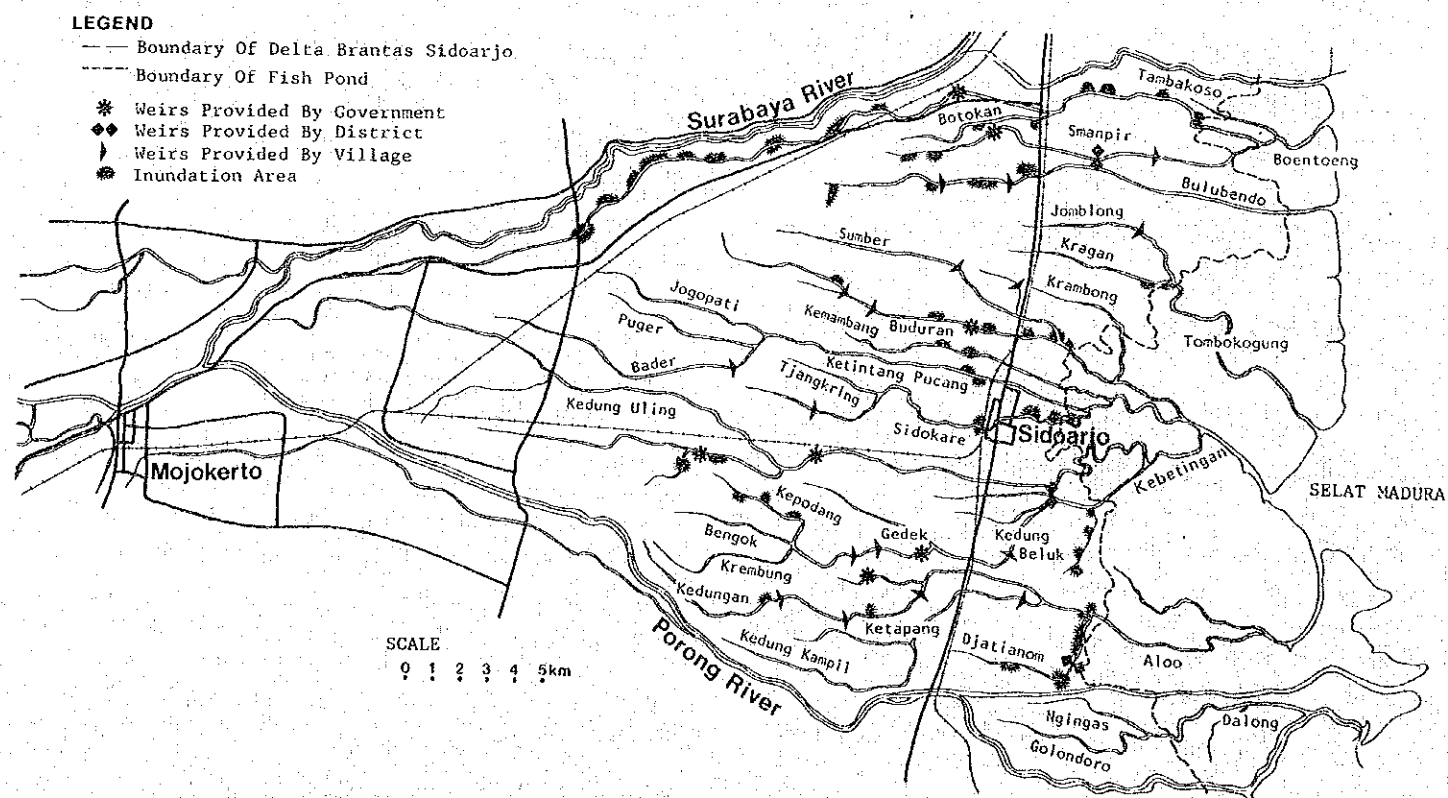


Fig. 2.7.4 DRAINAGE CANAL/INUNDATION AREA IN BRANTAS DELTA SIDOARJO

GRESIK

(1) General

Drainage system develops within the existing city area and has steep gradient due to the development on the slope of the Gresik limestone hill as shown in Fig. 2.7.5. The outline of the urban drainage facilities are summarized in Table 2.7.5.

Tributary canals are around 65 km of Lamang river and 50 km of Surabaya river in the rural area of Kabupaten Gresik.

Table 2.7.5 EXISTING GRESIK DRAINAGE CANAL

Drainage System	Length (km)	Canal Size W x D (m)	Catchment Area (ha)
1. Market-Kali Tutup	0.8	2.0 x (2-2.5)	32
2. Sukorame-JL. Petrokimia	4.1	(1.0-6.0) x (1.0-2.5)	242
3. East Kali Tutup -Jagung Suprpts	3.5	(2-3) x (1.8-2.0)	340
4. P. 1 Cemen Gresik -Tambak	21.0	2 x 1.0	12
Total	29.4	-	626

(2) Inundation Problem

Inundation areas are shown in Fig. 2.7.5. The cause of the inundation is:

- Lack and difficulty of maintenance (cleaning) in the drainage system 1 and 3 due to the existence of road and houses on the canals.
- Small canal capacity at the merging point in system 2.
- Broken water gate at Tambak in system 4

The inundation periods of these areas is reported to be about 3 hours.

KAMAL

There are 3 secondary rivers defined in the Kamal area within SMA: namely tellang, Korok and Rebon. The river lengths are approximately 8 km Tellang, 2 km Korok and 1.6 km Rebon. The river bed slopes are steeper than Surabaya and Sidoarjo ranging from 30 to 50 m in the upstream of the rivers. No river improvement has been made in the past.

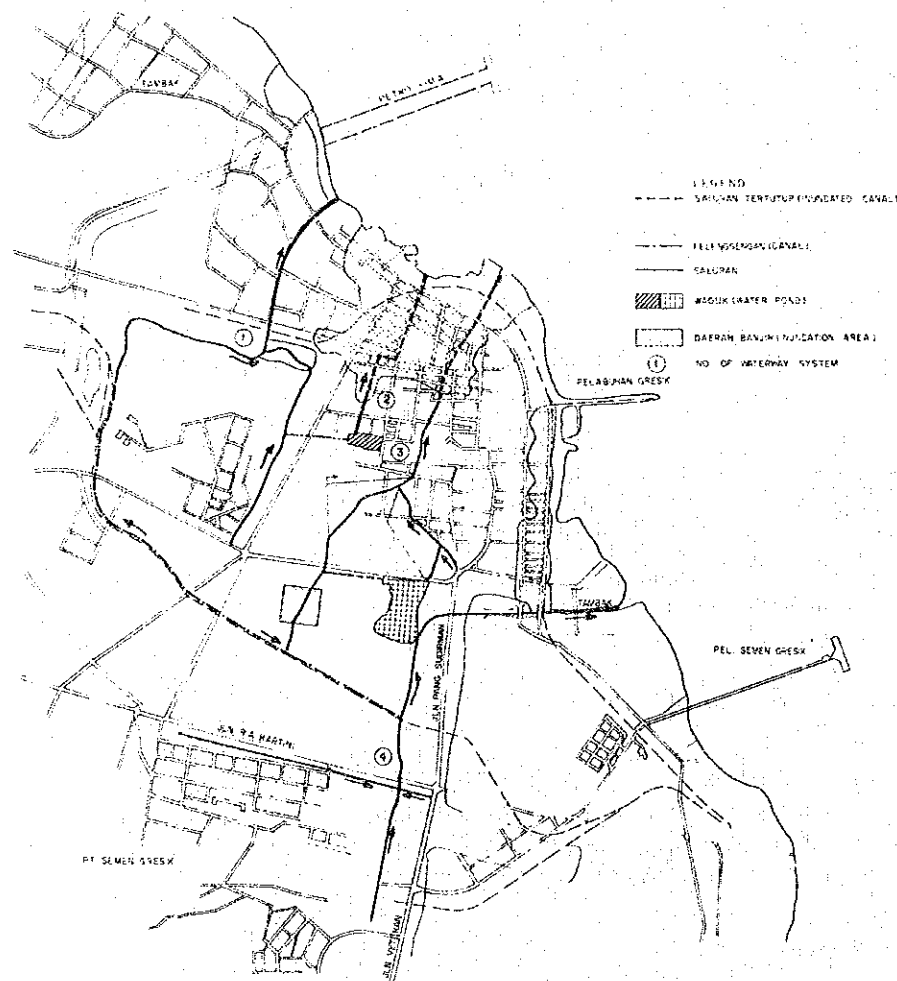


Fig. 2.7.5 EXISTING DRAINAG SYSTEM IN GRESIK

2.8 UTILITIES

2.8.1 WATER SUPPLY

GENERAL

Water supply is one of the critical resources for urban development and it is necessary to clarify the potential, availability and possibility of various water resources. Data and information were collected from relevant agencies not only from GKS Region but also within East Java. Study reports conducted in the past were reviewed in detail. East Java is in a poor situation for water supply, and little water volume and low water pressures prevail in the piped water system.

WATER SUPPLY SITUATION

This section considers the general supply situation in GKS Region and SMA. The description is given for two categories namely urban water supply (drinking, industry, commercial, etc.) and irrigation water usage.

(1) Urban Water Supply

The direct piped water supply situation in GKS Region is currently at a very low service level as shown in Table 2.8.1. Major water supply features in GKS are summarized as follows:

- In the rural area only Kabupaten Mojokerto has a piped supply system.
- Surabaya is the highest service area in GKS Region and serves 49.4% of the population, 46.5 L/day/capita. Mojokerto city is the lowest service level among the city areas, although the spring sources yield abundant water.
- The water source is mostly from springs except Surabaya and Bangkalan.
- Two new plants are operated in Bangkalan (Tangkel in 1981) and Surabaya (Ngagel-III in 1982). The Babat plant is expected to operate in 1982 for Babat and Lamongan cities.
- The future water supply in Surabaya up to 1985, as scheduled by PDAM Surabaya (Drinking Water Corporation, Surabaya) is shown in Table 2.8.1.

Table 2.8.1 PIPED WATER SUPPLY SITUATION IN GKS REGION

Kabupaten/ Kotamadya	Service Level % ; L/day/Capita		Yield (L/sec), Water Source	Remarks
	City Area	Rural Area		
Lamongan	7% ; 10 L	-	10, Mantup Spring	May, 1982
Bangkalan	14% ; 22	-	35, Bancarang River	May, 1982
Mojokerto	2.4% ; 3 ¹⁾	0.5% ; 1.8L	Kab.-115, Jubel, Mojo, Ubalan Springs Kot.-33, Balongsari, Jubel Pangreman Springs	Rural figures are for 1981. City figures are for Feb. 1982.
Sidoarjo	5% ; 3.2L ²⁾	-	18-Jubel Spring 75-Umbulan, Pandaan Spring 20-Porong river	May, 1982
	12.1% ; 17.9			
Surabaya	49.4% ; 46.5	-	311-Taman, Umbulan, Springs 2500-Surabaya river	Jan, 1982
Gresik	10.6% ; 19.5	-	12-Suci Spring	Monthly average in 1981

Note : 1) These figures include residential houses, Social use, Hospital use.
2) These figures are for the whole Kabupaten.

(2) Irrigation Water Supply

In 1981 the irrigated area in GKS Region was approximately 137,000 ha. The development trend (1970-1981) shows a decrease of 4.7%. In the same period, that of Surabaya decreased by more than 40% due to the urban expansion. Only Lamongan increased by 1.4%. Lamongan is however the least developed irrigation area in GKS, while Sidoarjo is the most developed. In Surabaya all irrigation canals are polluted and used as sewerage canals. Table 2.8.2 shows water supply situation from various water resources for GKS irrigation sections in 1980/1981.

Sidoarjo, Mojokerto and Surabaya irrigation sections are highly irrigated. This indicates that water in the Brantas system is abundant. Sala River supplies a small amount of water to the Lamongan irrigation system. No records are available for Lamong river.

(3) Water Use in SMA (1980)

In 1980 the water use situation in SMA was estimated and summarized as follows:

- Residential water was supplied to an estimated 34.3% of the SMA population; piped service was 10.9% and vendor service was 23.4%. Piped water was supplied at 2.5 million m³/month through 65,300 connections and selling water (vendor) was served at 407,400 m³/month through 4,000 vendors.
- The other water supply for industrial, commercial and social uses are shown below.

Water Use	Number of Connections	Consumption (m ³ /month)
Industrial	731	306,500
Port	2	25,000
Commercial	12,484	608,300
Social	3,087	706,900
Total	16,305	1,646,700

PDAM SURABAYA PLAN (UP TO 1985)

Source	Existing (L/sec)	Future (L/sec)
Taman Spring	211	211
Umbulan Spring	100	150
Umbulan New Spring	-	3,000
Ngagel Plant- I	1,000	1,500
- II	1,000	1,000
- III	1,000	1,000
Karangpilang Plant	-	1,000
Mini Plant	-	100
Resource Development	-	100
T o t a l	3,211	8,061

Table 2.8.2 IRRIGATION WATER SUPPLY SITUATION IN GKS REGION

Unit : l./sec

Water Resources	I		II		III		IV	
	Apr	Jun	Jly	Sep	Oct	Dec	Jan	Mar
	4 - 6		7 - 9		10 - 12		1 - 3	
Lamongan Section								
Bengawan Sala	575		930		-		-	
Other Rivers	134		46		-		101	
Water Reservoir	2,041		1,919		-		1,664	
Swamp	1,185		794		-		3,032	
Total	3,935		3,689		-		4,797	
Sidoarjo Section								
Brantas river	10,384		5,661		12,653		42,280	
Spring/Pump	754		319		931		2,263	
Total	11,138		5,980		13,584		44,543	
Wonokromo Section								
Surabaya River	2,504		1,679		1,577		3,694	
Mojokerto Section								
Brantas River	1,181		492		417		2,374	
Marmoyo River	161		63		129		316	
Porong River	753		353		806		831	
Other Rivers	11,243		6,704		10,351		23,395	
Total	13,338		7,612		11,703		26,916	
Bangkalan Section								
Bangkalan River	568		1,146		2,160		2,349	
Asemantanto River	550		16		823		-	
Other Rivers	57		17		583		-	
Spring	109		128		909		839	
Total	1,284		1,355		5,830		3,188	

Source : Pengairan Tk-I Jawa Timur.

EXISTING WATER FLOW IN SURABAYA RIVER

(1) Drainage System in Upper and Middle Reaches

The main features of the Brantas Basin are shown in Fig. 2.8.1. The Brantas Basin is an important agricultural area and many irrigation areas were established during the Dutch Colonial period. Recent extensive development of the Brantas Basin has enlarged the irrigation area, improved drainage and also provided considerable capacity for hydroelectric power production. In respect of the present study it is important to understand the influence, of these developments on dry season Brantas flows. The Brantas Project Office established the project schedule for the river development up to year 2000. There are several projects in the upper/middle Brantas which affect the discharges in the lower reaches and these were taken into account for analysing the distribution of low flows in the river.

There are many planned developments in the basin, the precise effect of which is still uncertain. However since most are on tributaries which contribute little or no water to the main river during the critical low flow periods, it can be assumed there will be no further reductions in flows in the lower Brantas and these projects have been ignored in this report.

(2) Minimum Discharge for the Lower Reach

To determine the availability of water for the Kali Surabaya, it is necessary to analyse flows in the neighbourhood of Mojokerto. For this purpose SURABAYA WATER USE STUDY was conducted by Directorate General Cipta Karya in June 1981.

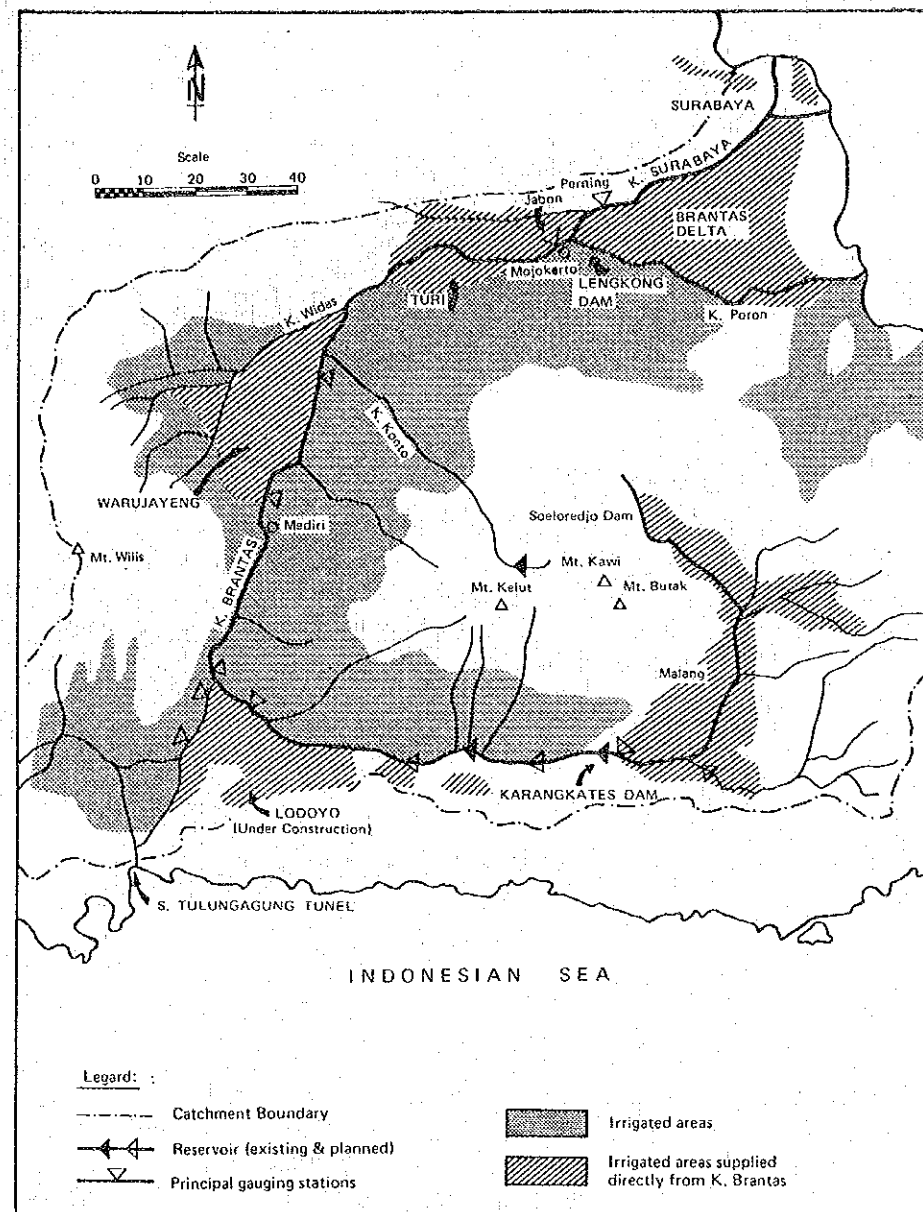


Fig. 2.8.1 BRANTAS BASIN

A schematic river flow in this area is shown in Fig. 2.8.2. The Brantas river flows into Kali Surabaya and Kali Porong through Mlirip Sluice and Lengkong Dam, but the water intake for Brantas delta irrigation area is located before the Lengkong Dam. Kali Kedung Soro diverts before Jabon gauging station and merges with Kali Marmoyo. The Perning gauging station is located downstream of the junction of Kali Surabaya and Kali Marmoyo.

An analysis of flows in the Kali Surabaya at Perning is invalid since these depend primarily on controlled releases from the Kali Brantas, and have increased significantly in recent years. However it is possible to analyse a combination of flows which is independent of the varying pattern of releases to the Kali Surabaya and also includes natural inflows from the Kali Marmoyo and Kali Kedung Sumur, i.e., the base flow component in the Kali Surabaya. A low flow frequency analysis on the mean 10-day available Perning discharges was performed for both the naturalized flow series and for flows regulated by Karangates reservoir.

As the result, a minimum mean 10-day discharge at Perning was established on the basis of the historical record. Since 1973 the mean 10 day flow at Perning has never fallen below 11 m³/sec. and this figure was proposed as the minimum allowable discharge in the future.

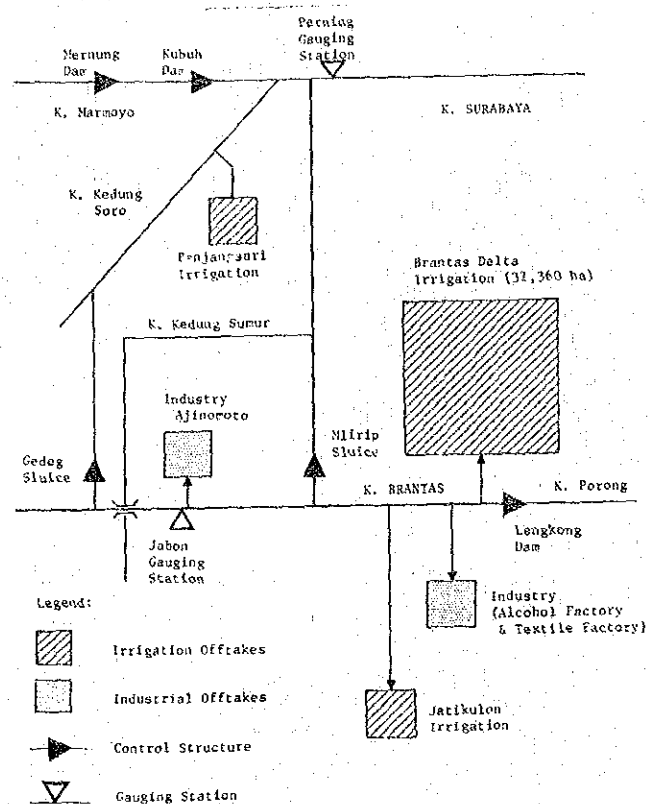


Fig. 2.8.2 RIVER SYSTEM NEAR MOJOKERTO

(3) Existing Water Balance of Surabaya River

The Kali Surabaya is one of two major distributaries of the Kali Brantas, extending from Mlirip sluice, east of Mojokerto (see Fig. 2.8.3.) to Surabaya. There are three significant left bank tributaries, the Kali Kedung Sumur, the Kali Marmoyo and the Kali Kedurus.

The first major structure on the river is Gunungsari dam which was rebuilt in 1981, and maintains water levels for 9 irrigation intakes between Sepanjang and the dam, with a total command area of 2500 ha. Immediately downstream of Gunungsari Dam, the Kali Surabaya is joined by the Kali Kedurus, which has a catchment area of 67 km². There are no streamflow records for the Kali Kedurus, but observations during 1980 indicate that dry weather flows are negligible.

The second major structure on the river is Jagir Dam, located 2.5 km downstream of Gunungsari. Jagir dam maintains a head for the Surabaya Water treatment works, and diverts water into the Kali Mas through Wonokromo sluice. During the dry season little or no water is discharged through Jagir Dam, and at such times levels in the Kali Surabaya are in effect controlled by Wonokromo sluice. The dam is used to maintain water levels in the river for the Jeblokan and Kalibokor irrigation offtakes, and for several industrial offtakes. The channel downstream of Gubeng dam is tidal, and enters the sea at Tanjung Perak.

(4) Existing Abstractions

Water is taken from the Kali Surabaya for irrigation, industrial and domestic purposes. The location of the various principal irrigation and industrial areas and the Ngagel water treatment plant is shown on Fig. 2.8.3.

— Irrigation Offtakes:

There are eleven irrigation offtakes (including four for Rowowiyung irrigation area) on the Kali Surabaya and Kali Mas. The irrigation Service estimates the total irrigated area of those systems taking water from the Kali Surabaya and Kali Mas to be 3940

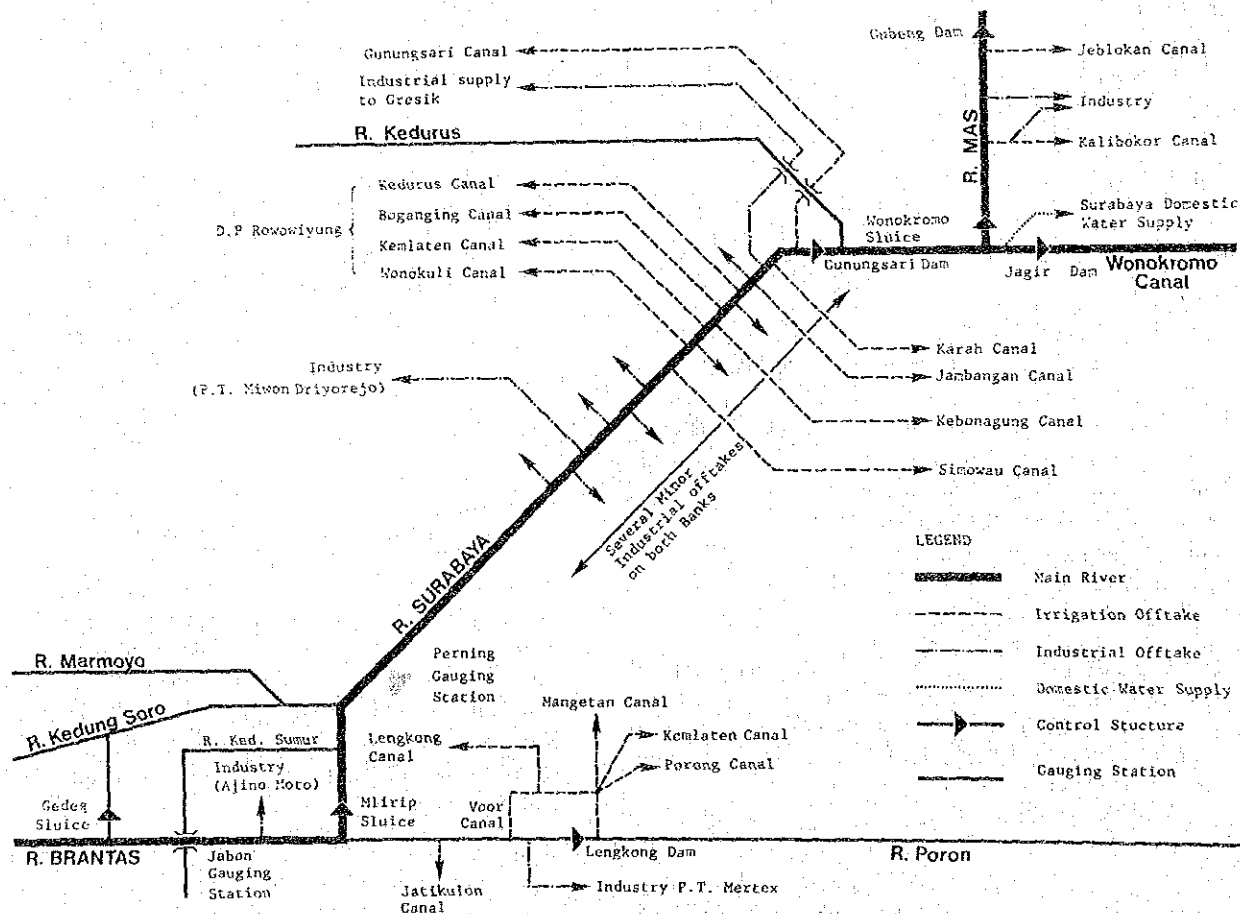


Fig. 2.8.3 WATER INTAKES FROM SURABAYA/MAS RIVER

ha. The area has declined steadily in recent years due to urban expansion in the vicinity of Surabaya. In 1975 it was reported to be 5350 ha and the systems were originally constructed for 7000 ha.

Details of the estimated water requirements and actual recorded canal discharges for the irrigation areas are given in Working Paper No. 4. The total water requirements are estimated as 4.2 m³/sec to 2.0 m³/sec from June to November.

Industrial Abstraction:

There are 23 licenses abstractions for industrial purposes from the Kali Surabaya and its associated canal systems (not including abstractions from the Brantas delta canal system). The total licensed abstractions from the Surabaya river and Mas river amount to 1.0 m³/sec.

Surabaya Domestic Water Supply

The largest single licence holder for water abstractions from the Kali Surabaya is the Surabaya Water Supply Authority (PDAM), which can take up to 2 m³/sec for its Ngagel water treatment. The licensed abstraction is shortly to be increased to 3.3 m³/sec following full operation of an extension to the treatment works. Due to losses in the treatment works and partial operation of Plant III, the actual abstraction from the river in July 1982 was 2.5 m³/sec; part of this being returned to the Wonokromo river, just downstream of Jagir Dam, as filter washwater and sludge removed from the clarifiers.

Summary of Water Balance:

A summary of water requirements and the availability of water is given in Table 2.8.3. From the results, water for dilution and flushing is available in a range of 1.9–4.1 m³/sec in the dry season, since minimum Perring discharge is 11 m³/sec.

Table 2.8.3 WATER BALANCE IN KALI SURABAYA

Item	Unit : m ³ /sec					
	Jun	Jul	Aug	Sep	Oct	Nov
Domestic	3.3	3.3	3.3	3.3	3.3	3.3
Industry	1.0	1.0	1.0	1.0	1.0	1.0
Irrigation :						
D.P. Rowowiyung						
Simowau canal						
Kebonagung canal						
Jambangan canal						
Karah canal						
Canungari canal						
Kallibokor canal	0.9	1.1	1.1	1.1	0.8	0.0
Jeblokan canal	1.1	0.7	0.7	0.7	0.5	0.2
Leakage, evaporation and other losses	0.6	0.6	0.6	0.6	0.6	0.6
Minimum discharge to meet requirements of water supply, industry and irrigation	9.1	9.1	8.8	8.4	7.6	6.9
Minimum Perring discharge	11	11	11	11	11	11
Available water for dilution and flushing	1.9	1.9	2.2	2.6	3.4	4.1

1. Discharge to D.P. Rowowiyung, the Simowau, Kebonagung, Jambangan, Karah and Canungari canals is based on historical usage.

2. Discharge requirements assessed from the 1980 cropping data.

(5) Delta Irrigation Requirements

A detailed estimate of the water requirements for the delta irrigation system was made by SANYU CONSULTANTS from cropping data for the period 1962/1963 to 1969/1970. Revised estimates of water requirements have been made by Sir M. MACDONALD & PARTNERS, on the basis of 1973–1979 cropping data, to account for the effect of new rice varieties which have been introduced in recent years. The revised optimum water requirements at the head of the system are given in Table 2.8.4.

Table 2.8.4 WATER REQUIREMENTS FOR THE DELTA IRRIGATION AREA (m³/sec)

June	July	August	September	October	November
40.5	46.7	46.0	36.5	26.7	44.2

ALTERNATIVE WATER SOURCES IN EAST JAVA

For the urban development of SMA, alternative water sources, such as ground water, spring and surface water sources, are studied in this section. The selected sources in this study limited to a radius of 100 km from Surabaya city to allow for economic water transmission.

(1) Ground Water

The Directorate General of Water Resources Development has encouraged deep water development for many years. The areas developed in the past are mainly distributed in the hilly areas or on the mountain slopes of Tuban, Mojokerto, Pasuruan, Probolinggo and Bangkalan regions as shown in Fig. 2.8.4. The following table shows the survey results in these regions. The yields show comparatively high values in Tuban region and rather low values in Pasuruan and Probolinggo. In each region the drilled depth was recorded as less than 100 m in total. The developed water in each well is utilized mainly for irrigation purposes and their yields are less than 70 L/sec as shown below:

Area	Well Depth (M)	Constant Discharge (L/sec)
Tuban	30 – 70	66 – 67
Mojokerto	40 – 95	19 – 60
Pasuruan	20 – 90	9 – 35
Probolinggo	50 – 95	3.5 – 31.5

From these wells, areas of 114 ha in Tuban, 103 ha in Mojokerto, 45 ha in Pasuruan and 87 ha in Probolinggo area are irrigated. It is understood that these water sources are not utilized economically for SMA water supplies.

(2) Spring Water

A total of 8 Kabupaten around GKS region were studied based on the 1980 data from the Proyek Air Bersih Jawa Timur. They are Jombang, Bojonegoro, Tuban, Malang, Pasuruan, Kediri, Probolinggo and Nganjuk as shown in Fig. 2.8.4. Through this study, some indication of the existing water situation around the GKS region can be understood.

Among those spring water sources, some sources with an abundant yield are listed:

Name of Spring Source	Yield (l/sec)	Name of Spring Source	Yield (l/sec)
- Tuban Region		- Nalan Region	
Bektiharjo	1,132	Mendit	500
Srunggo	430	Bureng	1,500
Bungkuk	520	Kajar	400
Krawak	444	Taman	575
Beron	458	Lenggak Songo	300
Ngerong	693	Umbulan I	981
- Bonjonegoro Region		- Probolinggo Region	
Nganut	300	Ronggojalu	3,000
Pirang/Arum	583	Kowo	470
Ngerong/Beron	400	- Pasuruan	
- Kediri Region		Umbulan	
Biru	760		5,000

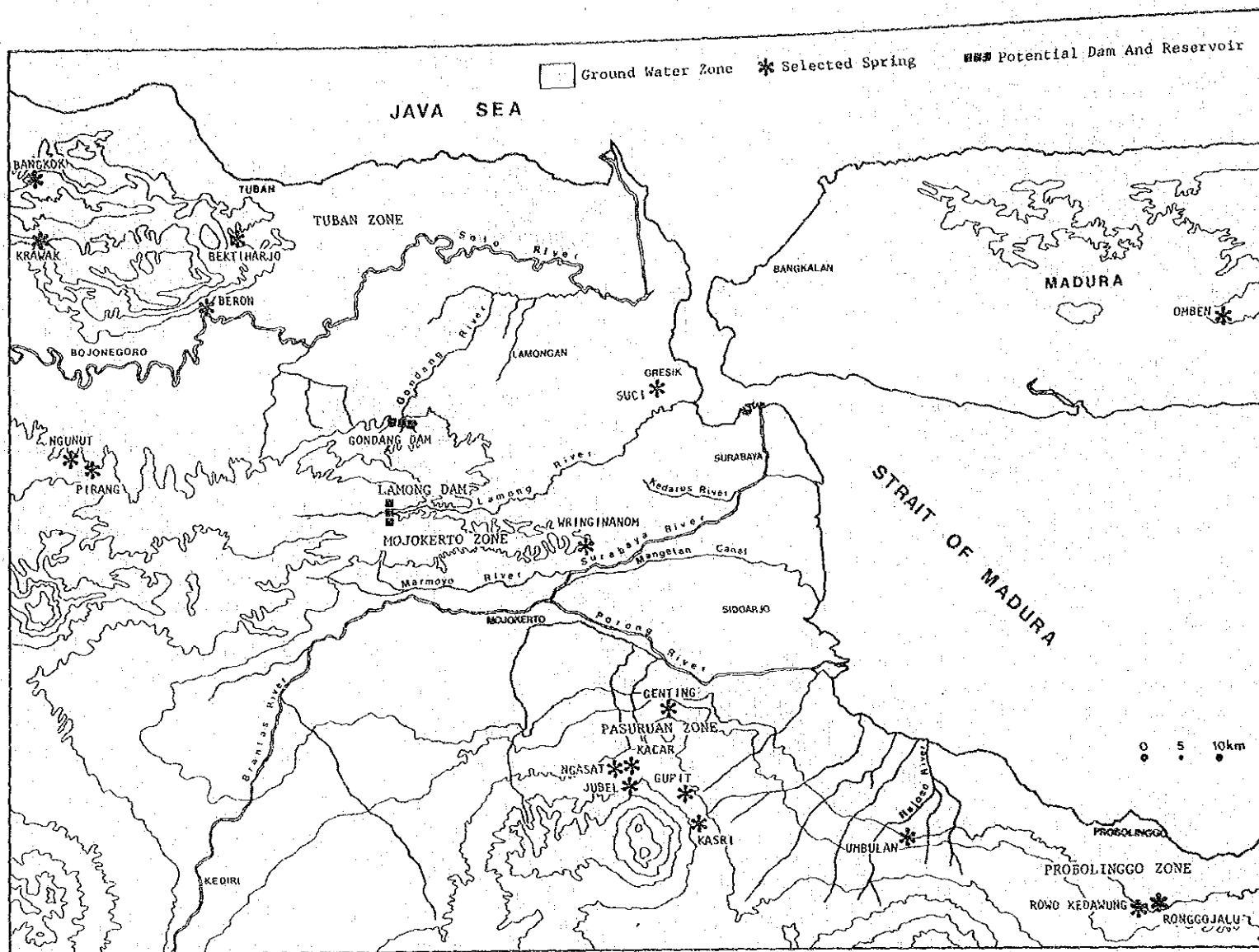


Fig. 2.8.4 ALTERNATIVE WATER SOURCES IN EAST JAVA

Data on the existing water utilization and surplus were however not obtained. Consequently these sources are not included in this study and this provides a task for future study.

(3) Surface Water

Many of the rivers influencing the GKS Region have high water use potential. A large quantity of the high rainfall flows out to sea without utilization, and these water resources should be developed further.

— Brantas River

The annual rainfall in the basin is about 2000 mm of which about 80% occurs in the wet season from November to April. The total surface water potential in the basin amounts to 24 billion m^3 . About 50% of the surface water is evaporated and 9 billion m^3 is used for irrigation purpose. The remaining 3 billion m^3 is not utilized and flows into the sea.

— Sala River

The total rainfall is about 2100 mm of which about 80% occurs in the rainy season. Only 10% of the annual rain occurs in the dry season from June to September, the rest falls in the transition periods in October and May. The total surface water potential in the basin amounts 16.7 billion m^3 as surface runoff into the stream, but only

2.6 billion m^3 is utilized for irrigation purposes. The future water demands for irrigation and urban water in the basin were estimated in 1974 to become about 14,340 million m^3 .

Despite the large water potential of the basin, the possible surface storage capacity is small, and is expected to be only 2,246 million m^3 in gross total. The prospective availability of water will be far less than the possible demand and only 22% of the incremental demand can expect to be satisfied.

— Lamong River

There are no rain gauge stations in the basin, but there is an automatic flow recording station in Simongagrok, located to the north-west of Mojokerto city. The station records over the period 1950 to 1978 indicate that the average annual discharge in the basin amounts to 800 million m^3 , as follows:

Maximum Average Monthly Flow (February):	828.6 m^3 /sec.
Minimum Average Monthly Flow (September):	28.1 m^3 /sec.

There have been no river improvement plans executed in the basin. However, recently the Lamong dam was planned for irrigation purpose with a storage capacity of 12.7 million m^3 in the upper reaches, but there is no construction schedule yet. The Lamong area is not a good prospect for irrigation. The water use from the dam to SMA is not considered.

- Bancaran River

The Bancaran river is the only river running through Bangkalan city. No general information is available, but the discharge at the Tunjung dam was recorded as $6.7 \text{ m}^3/\text{sec}$ maximum, and $4.0 \text{ m}^3/\text{sec}$ minimum. This water source will be utilized for the development in Kamal.

- Results

Unutilized water of 3 billion m^3 in the Brantas river, 14 billion in the Sala River, 300 million m^3 in the Lamong river are identified at this stage. Further efforts in promoting water utilization from existing water potential will be desirable.

2.8.2 WASTE WATER

Todate, there has been no operation of a wastewater treatment system in the GKS Region. The realization of the system is related to conditions such as environmental situation, inhabitants understanding and demands, and budget constraints, etc.

WASTEWATER SYSTEM

There are at present only two small areas in Surabaya city, at Ngaglik and Kalibutih, that have sanitary sewer systems. The sewers, which are over 50-years old, carry wastewaters from connecting residences to nearby drainage ditches and serve a total of less than 5000 people. Both of these systems are no longer effective.

With the exception of these minor separate collection systems, SMA relies on household septic tanks and cesspools for domestic wastewater disposal. Many homes are without such facilities and simple latrines are constructed directly over waterways. Other residents having no access to private household facilities rely on public toilets or use semi-private latrines located along many principal ditches, rivers and canals. Wastewater from commercial, institutional and industrial activities is also discharged to nearby ditches and canals after passing through on-site septic tanks, cesspools or simple holding basins. Most large industrial establishments are located along the principal river systems and discharge directly to the river.

HOUSEHOLD OPERATION

There is no effective collection, treatment or disposal of household wastewaters in the SMA. In 1980 it was estimated that there were approximately 180,000 private toilets and disposal systems available to 890,000 persons in SMA. It is normal practice for only toilet waste to be flushed into septic tanks while sullage water from bath, laundry and kitchen uses are discharged directly to the nearest drain. Average septic tank capacity is 2 m^3 with a maximum of 4 m^3 , and minimum of 1.5 m^3 .

Night soil collection is reported to operate in Surabaya. Four private companies operate with an average of 10 trucks, and a total capacity of 30 m^3 . The payment made by residents is 5000 Rp. per m^3 in week days and 20% additional payment on holidays. The service is made at a rate of 8 houses/day/truck (200 – 240 houses/month) in the rainy season and 15 houses/day (375 – 450 houses/month) in the dry season. The collected night soil is disposed in the Wonokromo river, just downstream of the Jagir dam.

Most toilets are flushed by water taken from an open water tank that is filled by bucket from wells or the PAM system. Gravity-flush toilets are assumed to be used in only 15 percent of the homes due to higher costs and lack of continuous water pressure to supply tanks. A typical household wastewater collection and disposal system is illustrated in Fig. 2.8.5.

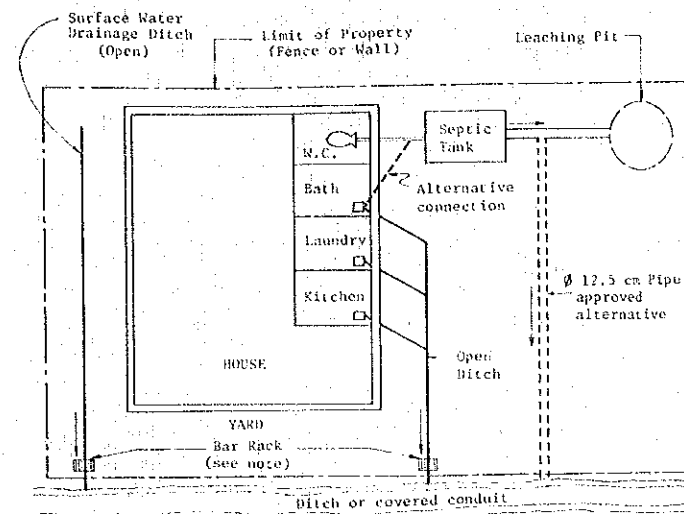


Fig. 2.8.5 HOUSEHOLD WASTEWATER FACILITIES

PUBLIC TOILET FACILITIES

There are presently 300 public toilet facilities reported in Surabaya. These have been constructed by the Public Works Department/Kampung Improvement Project (KIP Project) and many of them are operated by PAM. Of these, 131 toilets were constructed by KIP Project in Urban II (1976–1979) and 66 toilets in Urban III (1979–1982). These toilets in Urban II and III serve 894 ha, about 418,300 persons, and average 2,100 persons per public toilet.

The KIP project defined a total of 115 kampungs with total area of 3,795 ha (1,460,000 persons) within 11 old Kecamatans. At the end of the KIP project roughly 700 public toilets will have been constructed.

The facilities are served by piped water and include flush toilets with sub-surface disposal systems, bathing and laundry areas. The public facilities usually contain between two and ten individual toilets and occupy areas of from 100 to 400 sq. meters.

In addition to public toilet facilities there are also many makeshift enclosures used as latrines that are erected on wood poles over waterways. Although these are constructed by individuals and are not "public", it is evident that persons from more than one home use such enclosures. As an indication of the number of these semiprivate facilities there are 33 units along a 1.7 km stretch of Gunung Sari canal between Jl. Padmosusastro and Jl. Kembang Kuning.

It has been concluded that about 640,000 people are currently using the public toilet facilities in SMA. There is a need to expand the programme; construct new facilities, improve existing facilities, and provide a better maintenance programme.

INDUSTRIAL OPERATIONS

There is no effective control over the treatment and discharge of wastewaters from industries except in the Surabaya Industrial Estate Rungkut. Industries in SMA discharge untreated liquid wastes directly to nearby rivers or canals. The drainage ditches in areas surrounding most industrial sectors of SMA are unsightly due to waste discharge. During 1975, the municipal water treatment plant was forced to shut down on two occasions as the results of upstream discharges of toxic industrial wastes to the Surabaya River. An industrial survey was made in which questions were asked of major industrial firms as to the quantity and characteristics of their waste discharges. Little quantitative information was made available and only very rough estimates of present and future industrial wastewater flows and loads can be made.

It is anticipated that all large industrial estates which will be developed in the future will be required to provide some form of adequate collection, treatment and disposal of their wastewaters similar to that in use at the Industrial Estate at Rungkut.

Night soil collection is also served by private companies for offices, factories and hotels. The septic tank capacity ranges from 50 to 80 m³. Five or six septic tanks are served by one company in a month.

2.8.3 SOLID WASTE

GENERAL

Each Kabupaten or Katamadya operates solid waste management only in the city area and operations do not meet the full requirements generated in all their administrative area. The solid waste service is a vital service for urban residents and social activities.

EXISTING SOLID WASTE OPERATION

Serious difficulties are presently experienced in refuse collection and disposal services in Surabaya. While most difficulties are due to budget constraints, it is evident that even with adequate funding, present operations and methods will require significant modification in order to manage the larger solid waste quantities anticipated in 2000.

Within the administrative framework there are three offices immediately concerned with solid wastes management and these are the Departments of Public Works (DPW), District Governments, and Public Health. These departments are responsible for the present operation of the solid wastes system as it pertains to collection, transport, disposal and public safety.

Within the Department of Public Works the City Cleaning Section is most directly responsible for refuse management. Its responsibilities are divided into two categories: street cleaning (including sweeping, trash rack cleaning and berm repairs), and solid wastes management. The latter includes maintenance of disposal bins or other receptacles at public collection centers, systematic pickup and transport of refuse to disposal sites, operation of disposal sites, and administrative control of private contractors and industries engaged in refuse collection and transport to disposal sites. A well-managed solid wastes organization can not keep the city clean without the assistance of the community and associated branches of the city government.

Solid wastes are stored in private bins provided by the solid waste producers ie; households, hotels, meeting halls, hospitals and stores. The solid wastes are collected in hand carts by collectors from the cleaning department or from Rukun Tetangga and Rukun Warga and then stored in trailers and at collecting stations. The solid waste collected in the trailers and at stations are transported by hauling the trailers with tractors, press truck, flat bed trucks and hydraulic trucks to the final disposal sites or the compost plant operated by a private company. Transportation can be carried out at any time so long as it does not cause a nuisance to the residents and does not hinder the flow of traffic.

At the disposal sites, usually landfill areas, bulldozers are operated. The site must be planned not as to cause a negative influence upon the public, living environment, or ground water. The sites are usually located in places remote from the Central Business District but due to the difficulties of obtaining sites, there are some located in open spaces in the urban area.

SOLID WASTE PRODUCTION IN SMA, 1980

(1) Production Volume

The following table shows the solid waste production in 1980 based on information from Katamadya/Kabupaten.

Unit : m³/day

Kab./Kot.	Residence	Commerce	Industry	Social	Market	Total
Surabaya	4,000	100	300	100	500	5,000
Kota Gresik	-	-	-	-	-	100
Kec. Kebomas	5	3	0.3	0.5	5	13.8
Kota Sidoarjo	-	-	-	-	-	117.2
Krian	-	-	-	-	-	30.5
Taman	-	-	-	-	-	30.6
Waru	-	-	-	-	-	-

This data does not present the actual production and is assumed to be based on the volume actually received.

The actual generated volume must therefore be estimated. The estimate for solid waste production is made using the unit rate surveyed in the study for SURABAYA WATER, WASTEWATER, DRAINAGE AND SOLID WASTE in September 1976 (socalled "CDM Report").

The solid waste production in 1980 was estimated to be as shown Table 2.8.5.

Table 2.8.5 SOLID WASTE PRODUCTION BY CATEGORY IN SMA (1980)

Categories	Production Volume (m ³ /day)	Weight (ton/day)
Residential	9,077	1,366
Seaport	93	25
Naval Base	7	2
Market/Institution	424	113
Industry	934	251
Construction	39	27
Total:	10,504	1,784

The solid waste production in SMA is estimated to be 3.6 L/capita/day and 614 g/capita/day. Compared with the production volume, the handled volume is assumed to be 35% in SMA. The remaining 65% of solid waste is not handled, and disposal is by dumping into convenient areas such as ditches and canals, and by unregulated burning.

(2) Physical Composition

No survey on the physical composition of solid waste has been recently conducted. The composition changes according to the change of society and Table 2.8.6 shows the composition in some countries.

FACILITIES AND EQUIPMENTS

The facilities and equipment used in collection, transportation and disposal work are shown in Table 2.8.7.

The land fill sites currently available are 20 ha Keputih, 8.5 ha Asemrowo in Surabaya, 3 ha Rowa/Kebomas in Gresik, 1.5 ha Sidoarjo, 0.8 ha Krian, and 0.2 ha Taman in Sidoarjo.

P.T. Kurnia's composting plant, a private commercial venture, has been in operation for about 7 years. It has a rated capacity of 475 ton/day of solid waste.

Table 2.8.6 PHYSICAL COMPOSITION COMPARISON

Waste by Category	Composition (%)		
	Surabaya 1975	Bangkok 1980	Japan 1976
Paper Products	2	18	35.4
Garbage (Market and Yard)	94	36.1	16.0
Glass and Metal	1	10.3	19.0
Plastic	2	10.3	11.2
Chemical and Exotics	1	-	Traces
Construction and Container	Traces	10.3	8.8
Others	Traces	15.0	9.6
Total	100	100	100

Table 2.8.7 EXISTING FACILITY AND EQUIPMENT IN SMA

Facilities and Equipment	Unit	Surabaya	Gresik	Sidoarjo	Kamal	Total
Facilities						
Compost Plant	No	1	-	-	-	1
Land filling Site	No	2	2	3	-	7
Temporary Storage	No	42	6	61	-	109
Container Depot	No	11	-	-	-	11
Trailer Depot	No	33	-	-	-	33
Equipment						
Trailer	No	65	-	-	-	65
Container Truck	No	17	-	-	-	17
Tractor (for trailer)	No	29	-	-	-	29
Press Truck	No	2	-	-	-	2
Flat Bed Truck	No	1	7	5	-	13
Bulldozer	No	2	1	-	-	3
Hand cart	No	150	10	16	-	176
Waste Basket	No	400	-	-	-	400
Broom	No	4,000	-	-	-	4,000
Shovel	No	40	-	-	-	40
Hoe	No	150	-	-	-	150

Temporary storage and container/trailer depots in Surabaya are as follows:

	No.	No. of Trailer/Container	Capacity (m ³)
Temporary Storage	42	-	1,588
Trailer Depot	33	54	1,015
Container Depot	11	42	293
Total:	86	96	2,896

By 1983 four additional container depots will be available.

Capacity and Size of Equipment

Type of Equipment	Capacity
Transport/Handling	
Trailer	-
Press truck	20 m ³
Flat bed truck	3/4 ton
Tractor with trailer	10 m ³
Bulldozer	2 - 4 ton
Container truck	6 m ³
Cart/Tool	
Hand cart	1 - 1.5 m ³ (1 x 1.4 x 0.8 m)

ORGANIZATION/PERSONNEL

In Surabaya three cleaning sections, north, south and east are operated under the control of Solid Waste Urban III sub-project office. As shown in Table 2.8.8, in 1982 a total of 2,010 persons are engaged in cleaning work in SMA.

BUDGET STATISTICS

No budgetary data was available in Gresik, Sidoarjo and Kamal. A total of 1,764 million Rp. was spent for cleaning work in Surabaya in 1981/1982 as shown in Table 2.8.9.

Table 2.8.8 PERSONNEL IN SOLID WASTE, 1982

Kabupaten/Kotamadya	Administration Staff	Cleaning Section Staff	Total
Surabaya			1,798
Head Office	40	-	
Section: North	7	477	
: East	6	412	
: South	7	583	
Special Section	-	366	
Sidoarjo			142
Kota Sidoarjo		91	
Krian		25	
Taman		26	
Gresik			70
Kota Gresik		30	
Kebomas		40	
Bangkaian			
Kamal			
Total:			2,010

Table 2.8.9 BUDGET OF SURABAYA CLEANING WORK IN 1981/1982

Unit: Million Rp.

Budget	Fiscal Year	1977/'78	1978/'79	1979/'80	1980/'81	1981/'82
Routine Budget						
Total Routine Budget		599.8	694.3	865.4	1,222.3	1,487.8
Total Special Budget		45.8	72.5	107.0	179.3	200.0
Development						
Equipment for Final Dumping		20.0	45.0	50.0	25.0	-
Kip Urban-III		-	-	308.0	885.4	76.0
Total		665.6	811.8	1,330.4	2,312.0	1,763.8

Table 2.8.10 ELECTRIC GENERATION IN EAST JAVA

Unit: G.W.H.

Year	1969/70	1975/76	1980/81	1981/82
Hydro	128.9	436.7	682.7	833.0
Steam	221.9	140.9	511.9	986.7
Gas	-	-	56.6	41.5
Diesel	35.4	37.5	67.5	89.9
Total	386.3	615.1	1,318.7	1,951.1

2.8.4 ELECTRICITY

ELECTRICITY GENERATION

Fig. 2.8.6 shows the electric power system in East Java in 1985 and the generation by category between 1969/70 and 1981/82 is shown in Table 2.8.10.

From 1970 to 1982 the power generated increased by about 5 times. In 1982, 1951 GWH was generated by a total of 30 generating stations. In GKS Region 11 generating stations produced 1,035.9 GWH in 1981/82 as shown in Table 2.8.11.

Around 53 percent of the total generation in East Java was produced in the GKS Region, of which the bulk was produced in SMA.

ELECTRIC CONSUMPTION

In GKS Region some 214,700 consumers consumed 863 GWH in 1981/82 as shown Table 2.8.12. The Surabaya, Gresik and Sidoarjo share was 91 percent of the total number of consumers and 96 percent of the total consumption in the Region. In Surabaya, Gresik and Sidoarjo average daily consumption per consumer was 3.6 KWH for residential use, 19 KWH for commercial use, 1223 KWH for industrial use and 84 KWH for public use.

TARIFF SYSTEM

Table 2.8.13 shows the tariff on electricity consumption classified into 19 categories. Payment is usually made at PLN accountant offices or a bank contracted with PLN.

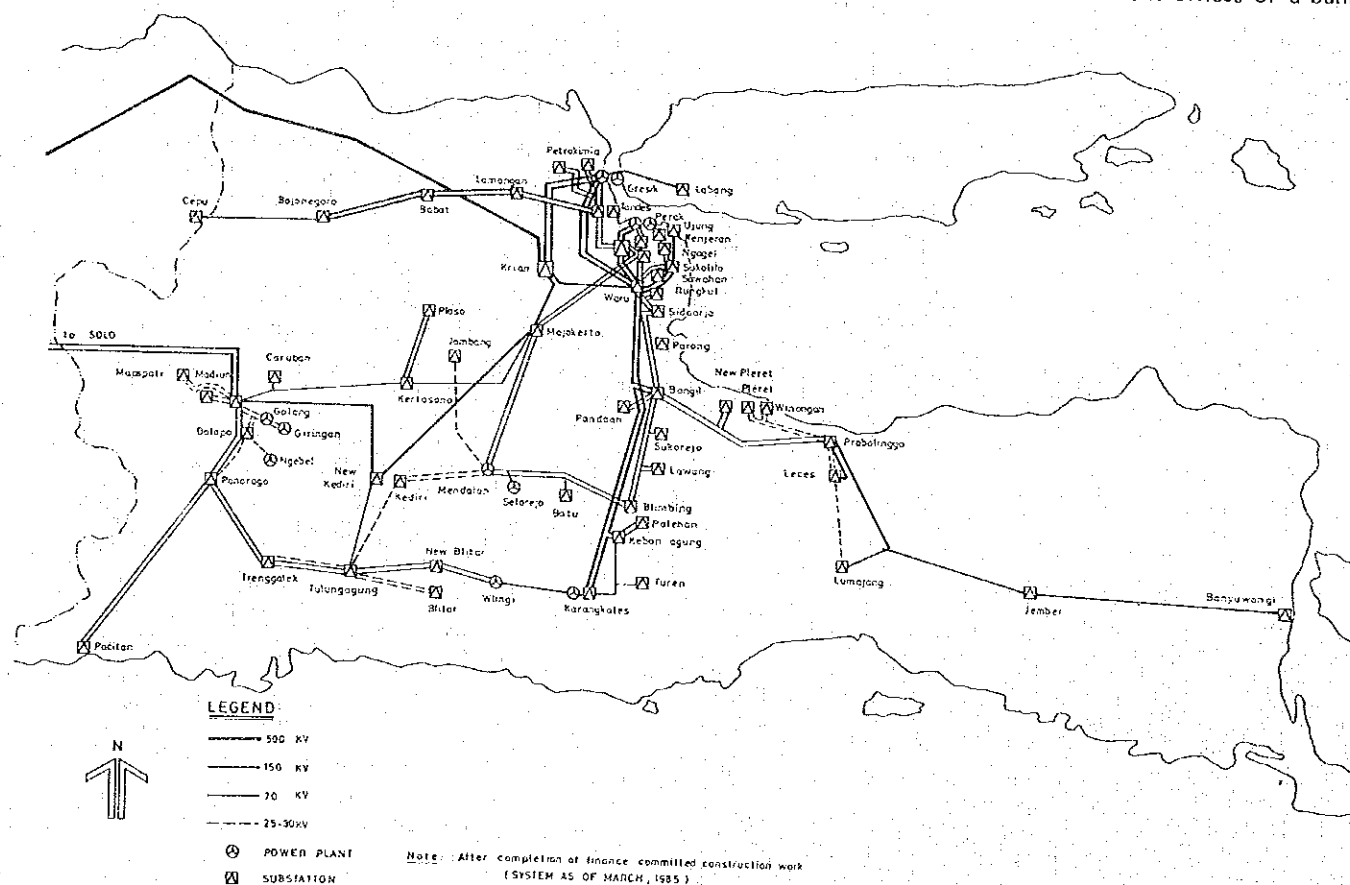


Fig. 2.8.6 EAST JAVA POWER SYSTEM

Table 2.8.11. ELECTRIC GENERATION IN G.K.S. REGION

Unit: GWH

Name of Generator		Production
STEAM	Perak I + II	246.9
	Perak III + IV	234.3
	Gresik I + II	505.5
		986.7
GAS	Perak	14.0
	Gresik I + II	27.5
		41.5
DIESEL	Lamongan	2.2
	Bangkalan	4.9
	Waru Barat	0.2
	Tanjung Bumi	0.2
	Kwanyar	0.2
		7.7
Total		1,035.9

Table 2.8.13. ELECTRICITY TARIFF (YEAR 1982)

Kabupaten/ Kotamadya	Category	No. of Consumer	Consumption (KWH)
Surabaya/ Gresik Sidoarjo	Resident	181,381	239,803,336
	Commerce	10,345	71,872,734
	Industry	976	435,738,198
	Public Service	2,512	77,318,285
Sub-total		195,214	824,732,553
Bangkalan	Resident	2,961	2,732,558
	Commerce	208	392,824
	Industry	7	71,007
	Public Service	107	649,326
Sub-total		3,283	3,845,715
Mojokerto	Resident	11,663	11,006,070
	Commerce	780	1,634,014
	Industry	42	15,338,134
	Public Service	347	3,481,878
Sub-total		12,832	31,460,096
Lamongan	Resident	3,204	2,181,255
	Commerce	94	157,059
	Industry	-	-
	Public Service	83	303,293
Sub-total		3,381	2,641,607
Total		214,710	862,679,791

Table 2.8.12. ELECTRICITY CONSUMPTION IN GKS REGION
(1981/82)

CLASS	DESCRIPTION	FIXED CHARGE RP./KVA	CONSUMPTION CHARGE RP./KVA
S1	Special Tariff for the poor (60 VA to 200 VA)		
S2	Church, School, Mosque, Hospital (250 VA to 200 KVA)	1,600	22
R1	Residential use Smallest (250 VA to 500 VA)	1,600	37.5
R2	Residential use Small (501 VA to 2200 VA)	1,600	45.5
R3	Residential use Medium (2001 VA to 6600 VA)	2,800	63.5
R4	Residential use Large (more than 6601 VA)	2,800	79.5
U1	Commercial use Small (250 VA to 2200 VA)	2,800	66
U2	Commercial use Medium (2201 VA to 200 KVA)	2,800	70
U3	Commercial use Large (more than 201 KVA)	1,750	WBP-74, LWBP-46.5
U4	Temporary Connection	-	160
M1	Hotel Small (250 VA to 200 KVA)	2,800	54.5
M2	Hotel Large (more than 201 KVA)	1,750	38.5
I1	Industry Small (3.8 KVA to 99 KVA)	1,750	WBP-49, LWBP-30.5
I2	Industry Medium (100 KVA to 200 KVA)	1,750	WBP-46.5, LWBP-29.0
I3	Industry Large (Medium Voltage) (more than 2001 KVA)	1,600	WBP-44.0, LWBP-27.5
I4	Industry Large (High Voltage) (more than 5000 KVA)	1,500	WBP-40, LWBP-25.5
C1	Government Office (250 VA to 200 KVA)	2,800	46
C2	Government Office (more than 201 KVA)	1,500	WBP-46, LWBP-30
J	Street Lighting	-	41

Note: 1) Fixed Price by Class 60 VA - 905 Rp., 75 VA - 1,135, 100 VA - 1,465, 125 VA - 1,870, 150 VA - 2,200 Rp.
2) WBP - Hour 18:00 - 22:00, LWBP = Hour 22:00 - 18:00.

2.9 ENVIRONMENT

2.9.1 EXISTING CONDITIONS

GENERAL

Some striking environmental problems are prevailing in SMA. These are inundation, water/solid waste pollution, and the traffic problem. Air pollution and noise from factories are not yet serious problems.

— Inundation

In the urban area of SMA inundation occurs frequently every rainy season and as stated in the river section of this report, lack of adequate maintenance and reduced waterway capacity are the main causes of this.

— Water Pollution

Untreated waste water from households and industry are freely discharged into the waterway system and the existing water pollution has reached a serious condition for public health. Household operation gives a large number of coliform and skin diseases and water borne disease like cholera are common. It is reported that the Ngagel plant in Surabaya was shut down in 1971, 1973 and 1975, due to the appearance of many dead and dying fish affected by industrial pollution.

— Solid waste

The treated volume of solid waste in SMA in 1980 is at a low service level of 35%. Considerable amount of irregular dumping of solid waste affects the majority of the urban area. The scattered solid waste not only makes the sanitary condition worse but also becomes one of the major causes of inundation.

— Traffic problem

According to the traffic accident data supplied by Surabaya Police office, accident locations in 1981 were distributed over all the urban area. A total of 2,292 accidents occurred in 1981 and 292 persons died, 1,393 persons were seriously injured and 1,062 slightly injured.

The potential for traffic accidents rises according to the traffic conditions (volume and quality) and the street structure. It is an apparent problem that many streets are used for multi-purpose uses and by various transport modes without any defined functional structural provision. Pedestrians are always exposed to traffic hazards and few side-walks and crossing bridges are provided.

Among the problems inundation, solid waste and traffic problems are reported in the relevant sections in this report. Water pollution is therefore the remaining topic, and is discussed in the following section.

WATER POLLUTION

The fundamental problem related to current wastewater practices in SMA, especially in Surabaya, is that of pollution — a slow but steady deterioration of the quality of the urban and rural environment brought about by inadequate collection and disposal of domestic and industrial wastes. Although this is well recognized occurrence, little evaluation of the factors involved and the extent of degradation has been performed.

RIVER WATER

Laboratory tests for chemical substances were executed by the Provincial Health Agency on the Surabaya and Mas rivers water in 1981. Results showed high values of iron, nitrite and organic substances and that the water is not suitable for drinking purpose. Coliform investigation data reported by the Technical Environment Health Agency is available along the Surabaya and Mas river for October 1980. October is the end of dry season and the number of coliform per 100 ml is shown in the following table.

The table shows that the number of coliform contained in the water starts increasing rapidly from the water intake of Ngagel Plant in Surabaya. The number reaches the maximum at Jembatan Merah bridge. It is understood that the Surabaya piped water supply has a perceptible colour and smell due to the high value of excreta.

POLLUTION OF DRAINAGE SYSTEM

The drainage system which carries wastewaters from the city to the sea, receives effluent from septic tanks. The dumping of garbage and lack of hydraulic gradient, in conjunction with the long dry season, aggravates the extensive pollution of the drainage waterways and the Pegirian canal and the Morokrempangan Boezem in Surabaya are particularly affected. The Pegirian canal flows through the central part of the city for a distance of about 5.5 km and a population of 190,000 in a drainage area of about 500 ha, are estimated to contribute wastes to the water. There are many industries also located within this area so that the canal is extremely polluted. Although a sluice gate and pump station are located at the upper end of the canal (on the Mas River), for introduction of flushing water, the facilities no longer operate. The downstream reach of the canal is stagnant and odiferous.

The Morokrempangan Boezem is a storm and wastewater retention basin located to the northwest of the central part of the city. It consists of two shallow ponds with a total area of about 0.82 km² connected by a channel under Jl. Gresik. Three drainage canals discharge into the Boezem from an area of about 16.70 km² and this is nearly one-half of the urban area of the city (a contributory population of about 400,000). The capacity of the Boezem is greatly reduced by siltation and this has resulted in extensive shallow areas where vegetation is thick and scum has been trapped along the shores which are odorous and unsightly. Surface water samples from drainage canals, the river system and street ditches within the study area were collected and analyzed for dissolved oxygen (DO) content, biochemical oxygen demand (BOD) and chemical oxygen demand (COD) on two separate occasions in August and September, 1976. Laboratory results from the sampling programme are presented in Table 2.9.1.

Table 2.9.1 MAJOR RIVER/CANAL WATER QUALITY TEST DATA

No. of Samples	General Location	DO	BOD	COD
5	Surabaya River	4.3-8.6	5-10	6-20
5	Upper Mas River	1.1-6.9	5-20	12-70
4	Pegirian and Lower Mas Rivers	nil-4.0	10-100	30-220
6	Drainage ditches*	nil-3.0	25-350	30-700
5	Morokrengan Boezem	nil-0.6	30-400	135-1095

* : Six sampling sites located throughout the central urban area.

Source: CDM Report in 1975.

The test data illustrates the significant decline in water quality with passage from the Surabaya River area (to the south of the city), through the upper Mas to the lower Mas and Pegirian areas. The high oxygen demands and low dissolved oxygen levels in typical open street drainage ditches and in the northern retention basin of the Morokrengan Boezem, are evident.

POLLUTION OF GROUNDWATER

Wastewaters of the cities discharge into groundwaters from both septic tank leaching systems and from unlined drainage ditches. The shallow ground water table is subject to direct pollution from these sources. Due to the number of urban inhabitants who still rely on shallow wells for water supply and the high incidence of water-borne disease in the area, the reduction of contamination in groundwaters is the major concern for health authorities.

Shallow ground water wells furnish water supply needs for the majority of the SMA's inhabitants. In general these wells are one meter in diameter, three to five meters deep and the walls constructed of brick masonry. Walls are usually built up to an elevation above danger of being topped by flood waters. It is usual practice to take water from the wells by use of a bucket, however, on higher land, such as Gunungsari Hill, hand pumps and rope winches, are used for wells up to 15 or 20 meters deep. Measurements of ground water surface levels in wells of the Ngaglik area indicates that a 50 to 100 centimeter elevation variation occurs between the dry and rainy season. Many wells are privately owned although a considerable number exist at public sanitation facilities and sometimes along the median strips of the main throughfares. Based on the number of wells in representative areas it is estimated that there are approximately 50,000 ground water wells in Surabaya. Water taken from the wells is primarily used to flush toilets, for bathing and laundry, and for irrigating local grounds. Water is not considered potable unless boiled. The wells have provided a dependable supply of water for many industrial and domestic needs.

In July 1976 water samples from 38 shallow wells were tested by CDM Study. The study reported that coliform organisms were found in 14 (37 percent) of the wells at an average density of 530 colonies per ml. Average chloride level was found to be 505 mg/l, 30 percent of the wells had levels exceeding Ministry of Health permissible limits (600 mg/l) while 87 percent were found to have chloride levels exceeding desirable limits (200 mg/l). Chloride test results are shown as follows:

	Chlorides mg/l
Average	505
Maximum	1,500
Median	360
Minimum	180

From the results, chloride contents around Darmo were about 200 mg/l in 1976, although saline water can be shut out by the Gubeng dam and Jagir dam in the Mas and Wonokrom rivers.

POLLUTION OF MADURA STRAIT

That portion of the Madura Strait located between Surabaya and the island of Madura is primarily used for shipping and fishing. Recreational use is very limited, consisting of some sailing off Kenjeran and very restricted boating and swimming near the port area. There are few areas along the shores which could be considered as potential beach resorts due to the shallow, muddy bottom. The north approach channel must be continually dredged to enable shipping to reach the port area.

Commercial fishing is an important industry in the offshore waters from Surabaya and Fig. 2.9.1 indicates the general location of the principal commercial fishing areas between Surabaya and Madura. The East Java Provincial Fishery Department reports that there is a good potential for increased cultivation of shellfish off Kenjeran if the area can be protected from pollution. Crabs, shrimp and other shellfish are presently caught in areas to the east of Juanda airport and off Gresik and Bangkalan. Bottom dragging is not allowed in the waters between Surabaya and Madura because the practice would disturb natural spawning grounds of shrimp. At one time there were areas off Gresik that were good sources for crustaceans but evidence exists that the resource has been adversely affected by industrial wastes.

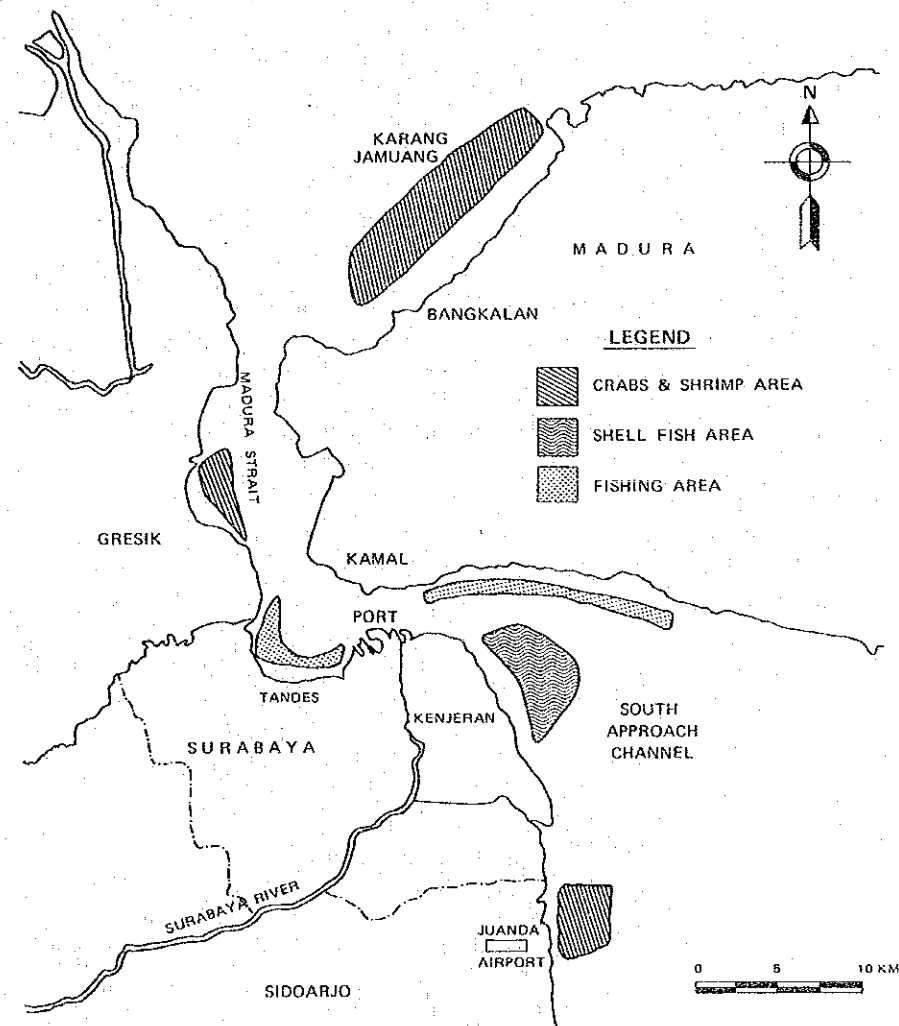


Fig. 2.9.1 FISHERY AREA

Many small fish traps are located near outlets of city drainage canals along the coast. There are also areas off Tandes and the island of Madura where fishing with nets is carried on. The strait is considered a region wherein fish spawn and feed during the juvenile stage. Young fish, caught in the strait, are released in propagation ponds along the eastern shoreline of Surabaya, where, upon rapid growth, they are marketed. Future land use planning excludes development along the coast for about 40 sq. km, so as to be available for fish cultivation. There is evidence that this important resource is being damaged by using polluted water from the Wonokromo River.

2.9.2 INFECTIOUS DISEASE IN SURABAYA

Diseases related to digestive organs are still common in Surabaya and this is related to every day use and contact with ground water/surface water. Data provided by the Health Centres and the Central Hospital in Surabaya is shown in Table 2.9.2.

Table 2.9.2 INFECTIOUS DISEASE

Unit : Person

Diseases \ Year	1970 / 1971	1975 / 1976	1981 / 1982
Cholera	1227 / 104	1610 / 14	1228 / 3
G.E.A	749 / 77	558 / 22	1578 / 9

Note: 1) G.E.A. : Sudden and severe inflammation of the stomach and intestines
 2) Figures : Number of patients / Number of deaths

Cholera decreased in number from 1976, while G E A recently increased dramatically. The mortality of both diseases, however, shows a tendency to decrease. The trend by Kecamatan was also studied. In 1970 the majority of patients were from the CBD area such as Wonokromo, Gubeng, Sawahan, and Bubutan, but in 1981 there was a tendency for the patients to be from the remote Kecamatan such as Semampir, Tambaksari and Sakolilo. This is related to the polluted water concentration in the lower reaches of canals which are drained to the peripheral area of Surabaya.