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PLANNING AND URBAN DEVELOPMENT (CIPTA KARYA)

MEDAN URBAN DEVELOPMENT, HOUSING,
WATER SUPPLY AND SANITATION PROJECT

VOLUME II

INTERIM STRATEGIC PLAN AND FEASIBILITY STUDY

OCTOBER 1980

ENGINEERING-SCIENCE, INC.
SINOTECH ENGINEERING CONSULTANTS, INC.
A JOINT VENTURE
in association with
PADCO and P.T. DACREA

PREFACE

The feasibility reports emanating from the Medan Urban Development, Housing, Water Supply and Sanitation Project were submitted in draft form to the Government of Indonesia (GOI) in February 1980. These reports, together with the earlier master plan reports, were reviewed by GOI in July 1980 and discussed with the Consultant at a series of meetings at that time. The outcome of this review process was that certain changes in content and format were agreed. These changes have been incorporated into the final printed reports.

A result of adopting the new guidelines provided by GOI is that differences occur between the Repelita III investments proposed in the master plan studies and those contained in the first stage program recommendations. The latter incorporate the final adjustments and represent the recommended program for Repelita III.

v

TABLE OF CONTENTS

	LIST OF FIGURES	
	LIST OF TABLES	
	ORGANIZATION OF PROJECT REPORTS	
	LIST OF ABBREVIATIONS	
SECTION 1	INTRODUCTION	1-1
SECTION 2	URBAN PLANNING CONSIDERATIONS	2-1
	2.1 GENERAL	2-1
	2.2 GUIDING PRINCIPLES	2-2
	2.3 THE REGIONAL FUNCTIONS OF MEDAN	2-2
	2.4 POPULATION TRENDS	2-3
	2.5 HOUSEHOLD INCOME AND EXPENDITURE	2-4
	2.6 LAND AVAILABILITY AND EXISTING LAND USE	2-5
	2.7 NEW LAND REQUIREMENTS	2-5
	2.8 EVALUATION OF THE EXISTING MASTER PLAN	2-9
	2.9 THE BASIC URBAN STRATEGY	2-10
SECTION 3	HOUSING STRATEGY	3-1
	3.1 INTRODUCTION	3-1
	3.2 TYPOLOGY OF MEDAN'S LOW-INCOME KAMPUNGS	3-1
	3.3 GENERAL HOUSING DEVELOPMENT STRATEGY	3-5
	3.3.1 Objectives	3-5
	3.3.2 The Role of the Public Sector	3-5
	3.3.3 The Role of the Private Sector	3-6
	3.3.4 The Role of Bank Tabungan Negara (BTN) and Housing Finance	3-8
	3.3.5 The Role of the Construction Industry	3-8
	3.4 KAMPUNG IMPROVEMENT PROGRAM (KIP)	3-9
	3.4.1 The Role of KIP in Medan	3-9
	3.4.2 Feasibility Analyses - Levels of Short and Long Term Programming	3-11
	3.4.3 Selection of Kampungs to be Improved	3-14

3

	3.4.4 Planning Standards for KIP	3-16
	3.4.5 KIP Administration	3-16
	3.5 SITES AND SERVICES/LOW COST HOUSING (SSCH/LCH)	3-17
	3.5.1 Potential and Constraints	3-17
	3.5.2 Repelita III Perumnas Program for Medan	3-17
	3.5.3 Feasibility Analysis for Medan III	3-18
SECTION 4	WATER SUPPLY	4-1
	4.1 EXISTING SUPPLY AND PLANNED IMPROVEMENTS	4-1
	4.2 ALTERNATIVE SUPPLIES	4-1
	4.3 EXISTING WATER USE	4-2
	4.4 WATER SERVICE EXTENSION STRATEGY	4-5
	4.5 PROJECTED WATER REQUIREMENT	4-6
SECTION 5	WASTEWATER	5-1
	5.1 EXISTING WASTEWATER SYSTEM	5-1
	5.2 WASTEWATER QUANTITIES	5-2
	5.3 WASTEWATER SERVICE EXTENSION STRATEGY	5-2
SECTION 6	DRAINAGE	6-1
	6.1 EXISTING DRAINAGE SYSTEM	6-1
	6.2 DRAINAGE SYSTEM IMPROVEMENT STRATEGY	6-2
SECTION 7	SOLID WASTES	7-1
	7.1 EXISTING SOLID WASTES SYSTEMS	7-1
	7.1.1 Collection	7-1
	7.1.2 Transportation and Disposal	7-2
	7.2 SOLID WASTES - CHARACTERISTICS	7-6
	7.3 COLLECTION SERVICE IMPROVEMENT STRATEGY	7-6
	7.4 TRANSFER AND DISPOSAL ALTERNATIVES	7-8
	7.5 IMMEDIATE ACTION PROGRAM	7-9

4

LIST OF FIGURES

		Page
2.1	Land Uses Map	2-7
3.1	Distribution of Medan's Low Income by Type	3-3
3.2	Housing Development Feasibility Analysis Medan 1979	3-7
3.3	Site Selection for KIP with the Location of Kotamatsum 1, 2, 3	3-15
4.1	Existing and Potential Water Supply Sources	4-3
4.2	Water Service Strategy	4-7
4.3	Projected Water Requirements	4-8
4.4	Projected Unit Municipal Water Supply	4-10
5.1	Conceptual Plan Wastewater	5-3
5.2	Wastewater Service Strategy	5-5
6.1	Principal Rivers and Drainage Areas	6-3
6.2	Existing Drainage System	6-5
6.3	Location of Flood Prone Areas	6-7
7.1	Solid Wastes Existing System	7-3
7.2	Solid Wastes Projections	7-7

LIST OF TABLES

2.1	Distribution of Medan's Households by Monthly Consumption Expenditures October 1978	2-4
2.2	Estimated Land Needs	2-6
3.1	Distribution of Medan's Low-Income Population by Type	3-2
3.2	Real Increases in Expenditures on KIP Related Programs	3-10
3.3	Real Increase in KIP Related Expenditures during Repelita III	3-10
3.4	Feasibility Analysis--Repelita III 1979-1984 Approximate Cost & Coverage of Medan Phased KIP Program	3-12
3.5	Target Population Served by City-Wide KIP	3-14
4.1	Alternative Future Water Supply Sources	4-2
4.2	Present Domestic Water Supply	4-5
4.3	Unit Water Use Values	4-9

5

ORGANIZATION OF PROJECT REPORTS

The results of investigations carried out in connection with the Medan Urban Development, Housing, Water Supply and Sanitation Project are contained in the following series of reports:

Inception Report for Long Term Urban Development Plan and Feasibility Study on First Stage Housing Development Project

Volume I Summary

Volume II Interim Strategic Plan and Feasibility Study

Volume III Long Range Urban Development Plan

Volume IV Housing Development Program

- Part 1 - Housing Development Situation and Strategy
- Part 2 - Kampung Improvement Program
- Part 3 - Sites and Services / Low Cost Housing Program

Volume V Master Plan and First Stage Program for Water Supply and Sanitation

- Part 1 - Master Plan and First Stage Program for Water Supply
- Part 2 - Master Plan and First Stage Program for Wastewater
- Part 3 - Master Plan and First Stage Program for Drainage
- Part 4 - Master Plan and First Stage Program for Solid Wastes

6

LIST OF ABBREVIATIONS

ORGANIZATIONS

DKKP	Medan Solid Waste Management Department
KIP	Kampung Improvement Program
LCH	Low Cost Housing
MUDS	Medan Urban Development Study
RSUPP	Medan General Hospital Child Health Department
SSCH	Sites and Services and Core Housing
UNDP	United Nations Development Program
USAID	United States Agency for International Development

TECHNICAL

mm	millimetre
m	metre
km	kilometre
sq m	square metre
ha	hectare
sq km	square kilometre
l	litre
cu m	cubic metre
s	second
min	minute
d	day
y	year
m/s	metres per second
l/min	litres per minute
cu m/s	cubic metres per second
cu m/d	cubic metres per day
mg/l	milligrams per litre
l/c.d	litres per capita per day
mg	milligram
g	gram
kg	kilogram
t	tonne (metric)
BOD	5-day, biochemical oxygen demand
TDS	Total dissolved solids
ES	Electrical conductivity
TU	Turbidity units
DO	Dissolved oxygen
TDH	Total dynamic head
LS	Lump sum
ea	each
na	not available or not known
Rp	Indonesian Rupiah

SECTION 1

INTRODUCTION

This report presents a brief summary of the project progress to date in delineating alternative urban development, housing, water supply and sanitation plans. Tentative conclusions reached regarding appropriate strategies which should be pursued in these areas are also given. It is intended that this report serve as a "working paper" to focus the process of strategy development and selection and obtain guidance from agencies and individuals concerned with the implementation of programs resulting from this project. Details of the data utilized and the analyses made in developing these conclusions and strategies are presented in a series of technical memorandums.

SECTION 2

URBAN PLANNING CONSIDERATIONS

2.1 GENERAL

The fundamental challenge to the Government of Indonesia is to design a nation-wide strategy for long term development which encourages dynamic economic growth, productively harnesses the countries natural resources and achieves acceptable levels of self-sufficiency in food production. At the same time, Development Planning must respond to the essential basic human needs of the people, the majority of whom are poor and presently living below the standards the Government would like for its citizens.

The goal then, at the national level, is to achieve economic growth with social equity for the people. While easily stated as an objective, this delicate balance in the national development thrust is extremely hard to implement. The trade-offs to be made are many and complex. Decisions are required in allocating investment between the most economically well situated regions and cities, capable of rapid economic growth, and less favoured regions and cities deserving on the grounds of social equity. Within a region or city investment decisions must be made between high economic rates of return and social equity objectives.

In undertaking this development challenge the Government of Indonesia is working under four significant constraints which must be recognized in the development planning effort:

1. Capital investment resources, while large in aggregate numbers compared to many less fortunate countries, are nonetheless severely limited when measured against the enormous national needs for capital.

2. Administrative and management capacity is severely limited, particularly at the provincial and subprovincial levels of government. Trained senior manpower will, for many years, be in short supply in spite of extensive initiatives on the part of Government in education and training.

3. The legislative base effecting development is obsolete and in need of substantial overhaul.

4. The powers allocated to city governments are limited.

The Government has a considerable history of urban planning and management methods development which takes these constraints into consideration. The urban plan excercise in Medan, therefore, starts within a well defined framework of national guidelines established and tested by Cipta Karya. It is the purpose of the MUDS program to adapt these guidelines to the specific needs and developmental concerns of Medan.

2.2 GUIDING PRINCIPLES

The guilding principles for Medan in Urban Development Planning are as follows:

1. Recognition of Medan as the major urban centre in the Northern Sumatra region.

2. Achievement of sustained economic growth within a framework of social equity objectives.

3. The need for capital resource conserving strategies of development.

4. Recognition of constraints on administration and management capacity at the local level of government.

5. The need for responding quickly and directly to the most severe deficits in public services and facilities, particularly those serving the urban poor.

6. Recognition that the primary determinant of future urban form will be through the spatial allocation of public investment.

2.3 THE REGIONAL FUNCTIONS OF MEDAN

Medan is generally recognized as the major urban center of the Northern Sumatra region. It is also the dominant centre of the newer regional classification (SWP) of the area as defined by Cipta Karya.

Medan, with an existing population in excess of about one million persons is more than four times the size of Padang, West Sumatra and almost seven times larger than Pekan Baru, Riau, the third largest city.

The economy of Northern Sumatra is primarily export oriented and Belawan Port in Medan is the major facility (excluding oil exports from Dumai, Riau). Medan also has the largest concentration of industry in the region. Medan's industries are mainly import substitution in nature and there is little processing of primary export products beyond the stage necessary to make it more marketable abroad. Medan is also the seat of the North Sumatra Provincial government, the location of some central government offices serving North Sumatra province and, in some cases, Aceh as well. It is a major regional center for university level education and major hospital and health facilities.

10

The economic and social sphere of influence of Medan can be seen to be very strong over all of North Sumatra Province and Central and South-eastern Aceh, and some influence is exerted throughout the four-province region.

As the dominant urban center in the region, Medan has a critical role to play in regional economic development. First and foremost, it is the major port serving the region. Almost one million tons of goods were exported through Belawan port in 1977 with a value in excess of US$ 600,000,000. Excluding oil exports from Dumai, Riau, the Belawan export levels are many times higher than Teluk Bayur, West Sumatra or the other regional ports. The same pattern holds true for imports where Belawan handles four times the level of imports through Dumai and more than ten times the level of imports through Teluk Bayur.

Medan, because of its export-import function also has a significant wholesaling and transportation industry function to play in facilitating the collection and distribution of goods.

Medan is also the entry point for tourism in the region. In 1976 some 53,000 persons entered the region through Medan for tourism purposes. This represents 73 percent of the total foreign tourists visiting the region.

The basic urban planning strategy for Medan must recognize and accomodate the region serving functions of the city. The economic future of the entire region is dependent to a significant extent on how well Medan functions as an efficient mover of goods and a provider of services and manufactured products. This function, therefore, requires a special recognition in planning and eventually, investment, beyond that of the needs of the local population.

The special economic function of Medan has already been recognized by government and a series of major transportation related investments have already been planned or are underway:

1. Belawan port expansion

2. The toll road

3. The Trans-Sumatra highway

4. Railroad upgrading project

These projects when fully implemented will have a profound effect on the future urban form of the metropolitan area.

2.4 POPULATION TRENDS

The population of Medan, the fourth largest city in Indonesia, was estimated to be slighcly over one million persons in 1978. The historic growth rate, estimated at less than three percent over the last 15 years, appears to be falling further to approximately 2.6 percent. In the longer

11

term, given a successful continuation of the government's family planning initiatives and the absence of any pronounced migration pressure, the growth rate should hold steady or drop to about 2.5 percent per year. A further decrease is not likely as mortality rates will also drop with improved health care and better water supply and sanitation.

The trend, then, is for stable slow growth which should result in a Medan urban population of two million by the year 2000.

2.5 HOUSEHOLD INCOME AND EXPENDITURE

Household expenditure distribution is a key element in determining affordable standards in urban planning. Table 2.1 presents estimated household expenditure levels as of October, 1978. It is based on the Biro Pusat Statistik's monthly cost of living indices and the expenditure data contained in the feasibility study for the Perumnas Medan I housing project. The median monthly household expenditure is approximately Rp.37,300, which approximates the results of similar studies done for other Indonesian cities.

TABLE 2.1

DISTRIBUTION OF MEDAN'S HOUSEHOLDS BY MONTHLY CONSUMPTION EXPENDITURES OCTOBER 1978

Households Expenditure Category (Rp./Month)	Percent of Total	Cumulative Percent of Total
10,000	2.4	2.4
10,001 - 20,000	12.6	15.0
20,001 - 30,000	18.5	33.5
30,001 - 40,000	18.9	52.4
40,001 - 50,000	14.5	66.9
50,001 - 75,000	18.3	85.2
75,000	14.8	100.0
	100.0	

Source: Feasibility Report, Project Helvetia, Medan, Perumnas/Padco, May 1977, and Biro Pusat Statistik, Economic Indicators, Cost-of-Living Index in Selected Cities, October 1978.

For the purpose of this study it will be assumed that the low income group consists of those households with monthly expenditures of Rs 50,000 and below (67 percent of the urban households).

2.6 LAND AVAILABILITY AND EXISTING LAND USE

A detailed land use survey was conducted in 1976 by the Provincial Agragria Department. The Medan Municipality contains 26,500 hectares of which 16,350 (62 percent) are in open space in one form or another. However, much of this open space is unsuitable for urban development because it is either low-lying swamp subject to regular flooding, or in productive agricultural use. The locations of flood-prone areas are shown in Figure 6.3. A generalized land availability map, Figure 2.1, is shown indicating presently built-up and agricultural areas. The distribution of existing urban land use follows normal patterns with residential uses accounting for 55 percent of the built-up area.

The land use data indicate four distinct areas:

1. Kotamadya Medan: The city center and the primary location of commerce, banking, institutions, government offices, industry and the highest density older kampungs, and higher income residential areas such as Polonia. The center has a concentric urban pattern with a road system which tends to funnel traffic into the central area. Surrounding the urban core are less dense peripheral kampungs and agricultural uses. Leading out of the urban core is a corridor of development consisting mostly of industry and kampungs which extend to Belawan port. The port area itself is an island surrounded by low-lying land.

2. The Binjei corridor: Urban growth is already pressing out of the municipal boundaries along the road to Binjei. Industry and residential kampungs are infilling along the road. The Sunggal district is, in fact, one of the most rapidly growing areas in the Medan area.

3. Tebing Tinggi corridor: The Tebing Tinggi corridor is along the Trans-Sumatra highway and several small towns near Medan are already experiencing growth. The road itself is proving to be an attractive site for industry.

4. Pancur Batu and Deli Tua: Urban development is already advanced along the roads to these two small centers.

Overall it can be seen that urban growth has already exceeded the municipal boundaries and has started to form strong urban corridors in the direction of nearby small towns, even while growth continues in the Kotamadya Medan center.

2.7 NEW LAND REQUIREMENTS

A generalized estimate of new land requirements was made in order to get a sense of the scale of the urban development task ahead. Table 2.2 shows the estimated land needs to the year 2000 assuming the population projections previously presented. Each five year period will require steadily increasing amounts of land starting with 641 hectares and expanding to 881 hectares by 1990. By the year 2000 some 3,000 hectares of new land will be required for urbanization.

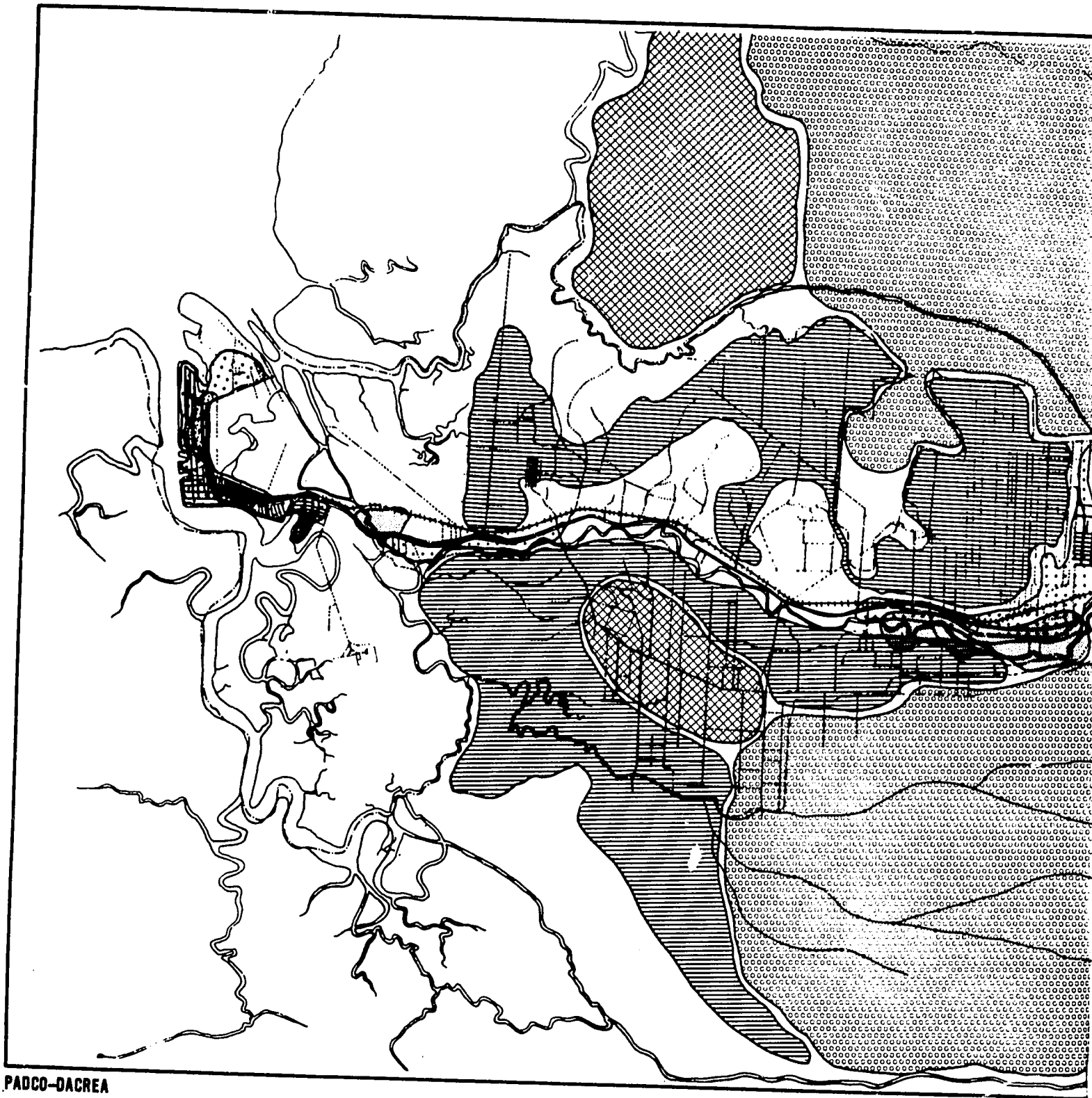
TABLE 2.2

ESTIMATED LAND NEEDS

	Estimated Land Needs, in hectares					
	1980	1985	1990	1995	2000	Total
Residential						
• Existing	9,385 (ha)	9,842 (ha)	10,303 (ha)	10,849	11,515	
• Additional	457	501	545	665		2,169
• Total	9,842	10,303	10,849	11,515		
Commercial						
• Existing	391	479	564	656	761	
• Additional	77	85	92	104		360
• Total	479	564	656	761		
Industrial						
• Existing	358	399	440	480	516	
• Additional	41	41	39	36		158
• Total	399	440	480	516		
Institutional						
• Existing	323	378	437	502	576	
• Additional	54	59	65	73		251
• Total	378	437	502	576		
Open Space						
Existing	16,051	15,410	14,763	14,020	13,139	
Total Additional	630	686	743	880		2,940

The distribution of these new land uses will be a major policy issue to be examined during the detailed planning stages of the project.

14



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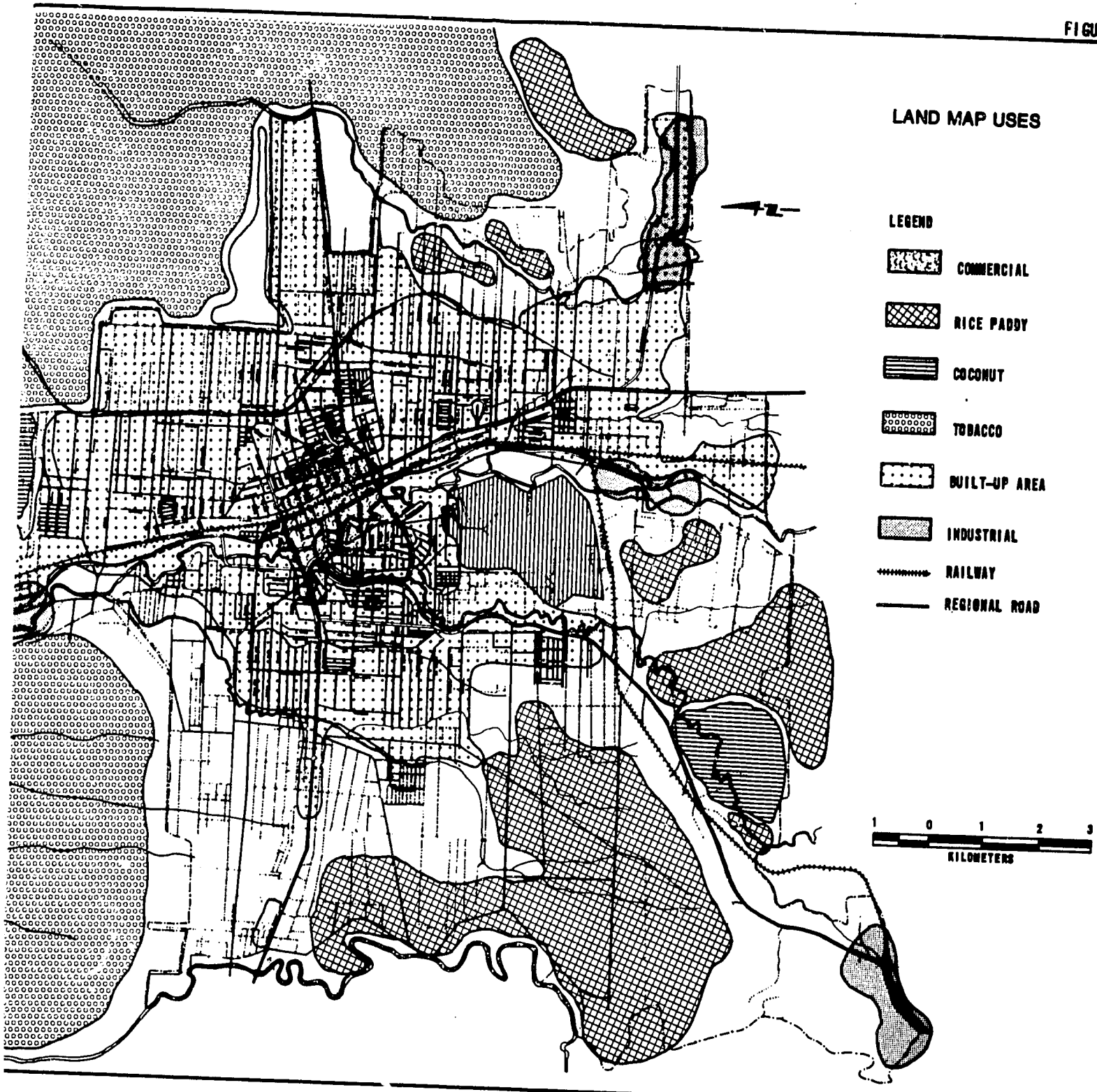
15

FIGURE 2.



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2.8 EVALUATION OF THE EXISTING MASTER PLAN

The Medan Municipality has a Master Plan officially adopted by the Minister of Home Affairs, Decree Number 253, on October 16, 1976. The Master Plan was prepared by Indonesian consultants engaged by the Municipality in 1972, and adopted in May 1974 by the City Council.

This Master Plan represents a significant achievement for the city and provided many useful recommendations and guidelines which are still relevant and which will be incorporated into the long range development strategy now under preparation.

The goals of the 1976 Master Plan are still very much the goals sought in the current planning effort: emhancement of Medan's function as a regional center and improvement of the standard of living of the local population.

The 1976 Master Plan was concerned with the need to restrict uncontrolled growth of the city and particularly to limit congestion in the central city. In response to this concern the Master Plan proposed a hierarchy of centers and subcenters within the Municipal boundaries and recommended a ring road (a critical element in the current planning effort) to relieve congestion and form the spine for the special allocation of new subcenters and major facilities. Industrial development was to be concentrated in three industrial estate complexes (one of which is currently being developed).

The 1976 Master Plan proposed a radial pattern of city streets with the ring road tying the system together. This proposal is acceptable today and awaits implementation. The Master Plan was completed before the important Toll Road scheme to Belawan port was developed and therefore the ring road proposal, where it is in proximity to the proposed Toll road, should be combined with it to achieve significant economies in construction cost and conservation of land for rights-of-way.

The Master Plan also anticipated a level of population growth that probably will not be realized given current demographic trends. The Master Plan estimate was for a year 2000 population of between 2.28 and 2.5 million persons, based on a 3.2 percent to 3.4 percent compounded growth rate.

The central difference in approach between the work of the 1976 Master Plan and the current effort at developing a long range urban strategy for Medan deals with the perception of the regional influences on the physical form of the city.

The 1976 Master Plan, while clearly recognizing Medan's functions within the greater Northern Sumatra region, nonetheless contemplated the control of development within the boundaries of the Municipality itself and allocated this development evenly throughout the land area of the municipality. The current thinking about the future of Medan departs from this premise in three significant ways:

17

1. The recently developed schemes for the Toll Road, the Trans-Sumatra highway, and the railroad upgrading project will result in vastly improved access to Medan along these transportation spines. This in turn will serve as a magnet for new private investment in economic activities outside of the central city.

2. The availability of land and its urbanization cost within the Medan municipality varies enormously from area to area. The flooding and drainage problems which are evident along the Medan/Belawan corridor are very likely to preclude this area from developing as fully as the 1976 Master Plan contemplated. It is much more advantageous to the city economically to encourage the distribution of population and activities elsewhere.

3. The last area of difference between the 1976 Master Plan and the current effort at preparing a long term urban strategy deals with the nature of the planning process itself. The 1976 Master Plan represented the "state of the art" at that time. Plans made during that period anticipated that a high degree of government control was possible over the locational decisions of the private sector and individual households. It was felt that government could successfully impose minimum standards which were high compared to the income levels of households to support them. Plans assumed that implementation would follow systematically according to the plan recommendations.

Today, the majority of planning thinking has adopted a more modest stance. It is now recognized that controls are hard to administer, and that economic factors play a much more important role in the decision making process than previously believed. Simply stated, the future is much less predictable than supposed. As a result, new planning initiatives take a much more flexible approach. Long range strategies are less concerned with precise and detailed recommendations for specific elements of urban structure (i.e. densities and facility locations in the year 2000) and much more concerned with the process by which urban development is to be guided. The need is for providing a frame of reference within which individual urban structure decisions can be made as and when required.

2.9 THE BASIC URBAN STRATEGY

In responding to these guiding principles the recommended planning strategy proposes a two pronged attack on the critical needs. First, it endorses and encourages early implementation of those projects designed to facilitate Medan's role as a major regional urban center such as the expansion of the Belawan port, the Toll road to the port, the Trans-Sumatra highway, and upgrading of the railroad service. These essential projects are required in order to stimulate economic growth of the entire region. This in turn will benefit the economy of Medan city itself. Second, the plan seeks to respond to the urgent and immediate needs of the existing Medan population, particularly the low income groups, for improved water supply, sanitation, drainage, solid waste disposal and

housing. These programs are concerned with alleviating deficits in response to the basic human needs of the existing population. The strategy is to build on the existing initiatives of the government and to take advantage of all the opportunities for improvements at relatively low per capita costs. The purpose is to demonstrate immediate improvements in the standard of living for Medan's low income population.

In the longer term, the strategy is to follow-up on the opportunities created by the region-serving transportation investment to stimulate the private sector to invest in an orderly manner consistent with national objectives and to utilize the newly developed transportation network spines to stimulate the reorganization of Medan land use to move region serving facilities (industry, warehousing, major health and education facilities, and transportation centers) to the periphery of the urban area. This will decongest the center of the city while providing improved access to the greater Northern Sumatra region. The shift in land use is recognized as taking place gradually over time so that efficiency and economy is achieved by individual entrepeneurs and government agencies.

The local population is to be accomodated and serviced at a rate equal to expected population increases through a sustained program of orderly infill in the central city and the urbanization of new land areas located close to the job opportunities expected to be created along the transportation spines.

The ultimate objective in the year 2000 will be a strong economy serving a metropolitan city of about 2,000,000 people functioning efficiently through a series of subcenters connected along major transportation corridors.

Whereas early analysis suggests that such an ideal is a feasible target, the challenge remains as to how to guide development from this point in time when extreme deficits in many sectors are recognized, capital and technical resources are scarce and land use patterns are inefficient. The orderly attack on these issues is the central purpose of this planning strategy.

SECTION 3

HOUSING STRATEGY

3.1 INTRODUCTION

Shelter is one of the basic necessities of man, along with food and clothing. A complete definition of housing should include basic services such as water, sanitation, drainage and refuse collection. An effective city-wide housing development strategy for Medan's low-income population should be concerned with progressively improving the consumption of these services for the appropriate target group.

The point of departure in the determination of the specific components for a KIP or SSCH/LCH program is to identify the broad target groups of concern. While all Medan's low-income kampungs tend to be experiencing certain common deficiencies, there are substantial specific differences between their physical, social and economic characteristics. These differences serve to focus the allocation of scarce financial and technical resources. Each target group will need to have a different emphasis placed on the kind of housing solutions which will be most appropriate.

3.2 TYPOLOGY OF MEDAN'S LOW-INCOME KAMPUNGS

The following criteria are used to identify the basic types of low-income kampungs (potential target groups for KIP and SSCH/LCH): gross residential density; vehicular/pedestrian access, configuration of circulation system, and other land use parameters (lot size, percent coverage of lot by dwelling unit, etc.); and location with respect to the central commercial and peripheral areas of the Kotamadya.

In general, most of Medan's kampungs are homogeneous with respect to type. However, certain kampungs (for example, Kampung Mesjid and Pandau Hilir), especially those contiguous to the central commercial district, are composed of more than one type. A summary of the estimated population and chief characteristics of each of the five types of kampungs identified for Medan is presented in Table 3.1. Location of kampungs by type is illustrated in Figure 3.1.

20

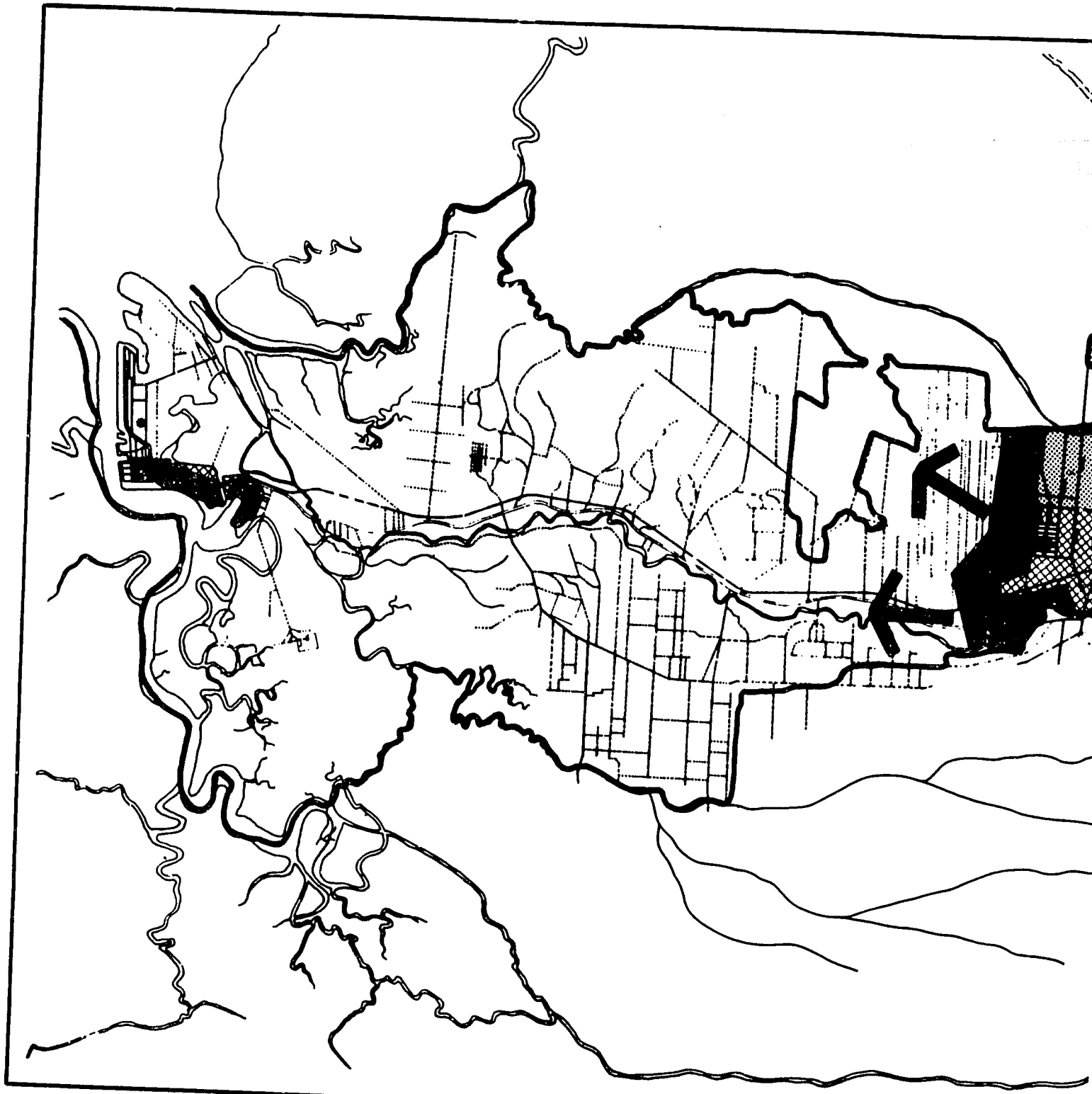
TABLE 3.1

DISTRIBUTION OF MEDAN'S LOW-INCOME POPULATION BY TYPE

Type	Major Characteristics	1978 Population (persons)	Residential Density (persons/ha)
Old	Limited raw land available for growth. Adequate public services coverage along secondary roads. Much infill of low quality housing and poor existing services off secondary roads	344,600	250-650
Peripheral	Much raw land available for growth. Rapid densification occurring where employment opportunities are nearby	279,500	100-200
Temporary	Located along rivers and railroads. Exhibit worst physical and socio-economic characteristics, minimal public services	58,300	250-799
Institutional	Housing provided by military, railroad and other large organisations for their employees. Suffers problems similar to other kampung types but also often not served by existing city maintenance and health programs	34,800	250-450
Semi-rural	Low-income residential areas outside of the built-up areas of Medan and Belawan. While public services do not normally exist, larger lot sizes provide households with a clean, attractive environment	160,400*	50
	Total	877,600	

* Assumes 75 percent of Medan's non-built-up area population is low-income.

21



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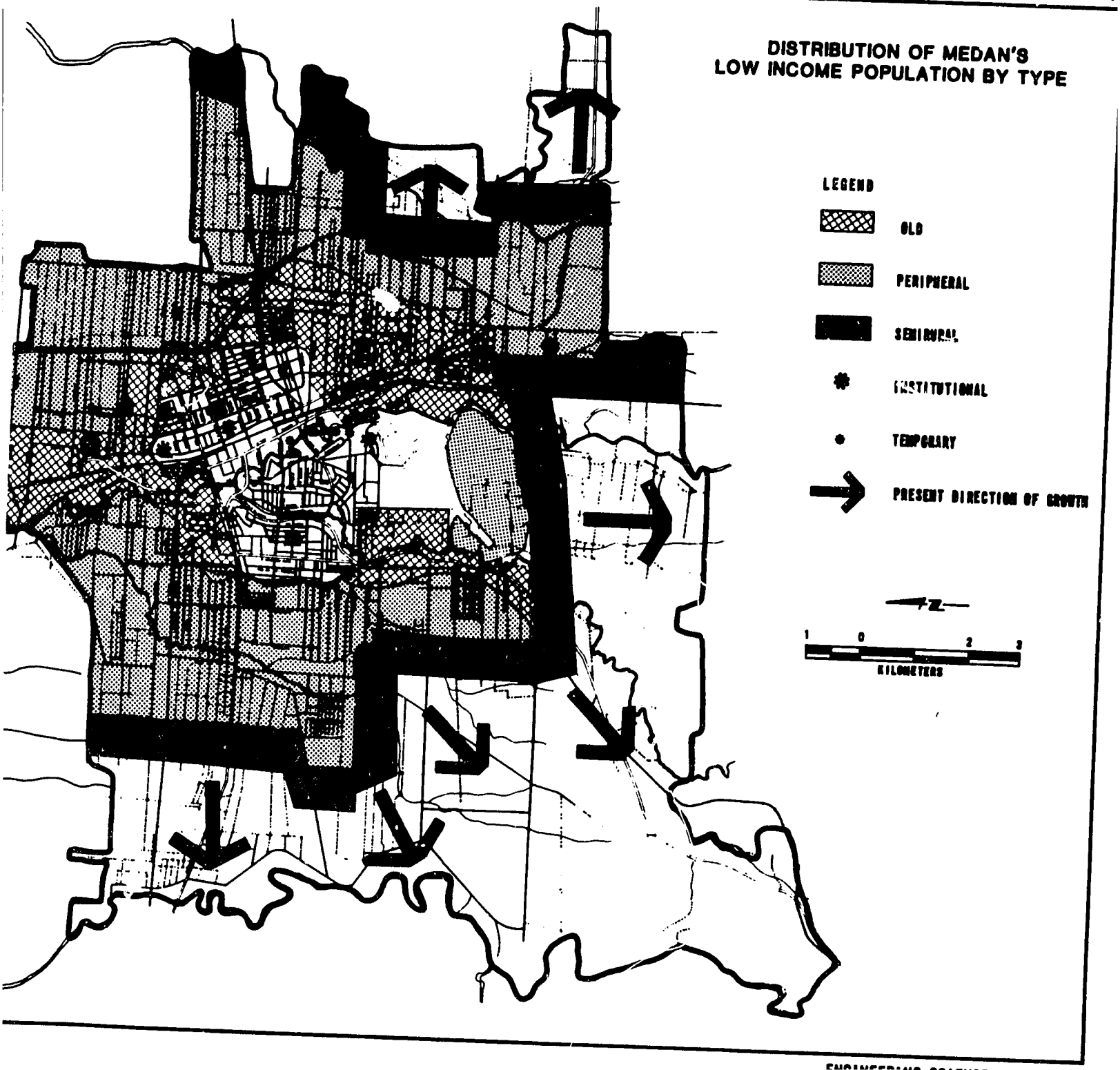
22

FIGURE 3.



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3.3 GENERAL HOUSING DEVELOPMENT STRATEGY

3.3.1 Objectives

A distinction needs to be made between planning for a given KIP or sites and services project and planning for an ongoing city-wide program. Given the low-income population in urgent need of assistance, it is important for Medan to move as rapidly as possible away from a project-by-project approach towards implementation of a program approach on a city-wide scale. Such a program approach needs to recognize three fundamental objectives in planning: (1) existing housing stock, even if substandard, needs to be preserved and improved with minimum dislocation to existing residents; (2) sufficient land must be urbanized with minimum public services to accomodate existing deficits and the increments of new urban population expected annually; and (3) the fundamental social and economic requirements in terms of jobs and income, health, and education must be given priority for the entire low-income population.

As important as the city-wide program approach is, it will take several years to be fully organized. Clearly, immediate action projects need not wait for the program planning process to be completed. In fact, early project experience can contribute to the overall city-wide planning program.

Planning for a sites and services city-wide program is directly related to the KIP program in that both are designed to serve target groups with similar physical and socio-economic characteristics. In planning a sites and services program, the standards used should be relevant to the desired standards applicable to the settlement upgrading project. The mix of supplemental social and economic program components would generally be those relevant for the given kampung target groups.

The city-wide housing strategy should be designed so that it clearly responds to the real needs of all income groups. In addition to recognising the importance of achieving better living conditions for lower-income groups, the high level of unsatisfied demand from upper and middle-income groups must be taken into consideration. Otherwise, these groups will tend to preempt and buy out the improved housing or sites and services projects developed for low-income groups. One way of relieving this pressure is to encourage private developers to build for lower and lower-middle income groups. For this to happen, the role of Bank Tabungan Negara (BTN) becomes quite important, as does the issue of land tenure as a basis for access to formal credit.

3.3.2 The Role of the Public Sector

The role of the public sector is divided into two major components -- kampung improvement and sites and services core housing/low-cost housing. The existing poor population residing within the built-up area of the Kotamadya will be served through the city-wide KIP program. The KIP target population contains approximately 682,400 persons (117,650 households) in old, peripheral and temporary kampungs. The other low-income households of the institutional and semi-rural kampungs are to be served by other public and private actions outside of the scope of Medan

KIP. Based on an estimated annual growth rate of 2.6 percent over the period 1979-1989 and 2.5 percent during 1990-2000, the increase in the existing target population until the year 2000 will be dealt with through SSCH/LCH projects, through the densification/expansion of the already existing target kampungs, or through private sector non-profit housing groups.

The selection of the combined Domestic and Expanded Domestic/External programs for kampung improvement yields the following results:

Year	Coverage of Population by Repelita	Percent of Target Group
1979 - 1984	140,000	20
1984 - 1989	210,000	30
1989 - 1994	245,000	35
1994 - 2000	245,000	35*

* Percentages based on a total target population of 700,000 persons.

Kampung improvement will serve approximately 840,000 persons by the year 2000. The original target population will be served by the year 1996, and an additional 158,000 persons may be served in new kampungs or in previously served kampungs (with increased levels of service). The remainder of the increase in the target population will be absorbed in Perumnas' SSCH/LCH projects and/or private sector non-profit housing groups. Figure 3.2 summarizes graphically the housing strategy presented for the public sector in this section.

3.3.3 The Role of the Private Sector

The private sector (profit and non-profit) presently produces very few housing solutions for those households with monthly expenditures below the 50th percentile (Rp.37,000/month). The several small contractors who do construct "low cost" housing work almost exclusively for Perumnas. Their capacity to produce minimal housing solutions outside of Perumnas is severely restricted by their inability to obtain construction and mortgage financing from Bank Tabungan Negara (BTN).

The non-profit construction contractor Koperasi Serba Guna (Koserna) has faired better than the small private contracting firms in its ability to attract BTN financing. It is provided with financing during the construction stage and mortgage financing at 9 percent for 15 years. Over the past few years, Koserna has built on its own approximately 600 units ranging in size from 36 to 72 square metres on plots from 200 to 250 square metres. While Koserna's primary goal is to build inexpensive housing for retired army personnel, and in fact, with the exception of Perumnas, is producing housing at a lower cost than has been produced in the past, BTN financing restrictions have required applicants to possess

25

HOUSING DEVELOPMENT FEASIBILITY ANALYSIS
MEDAN 1979

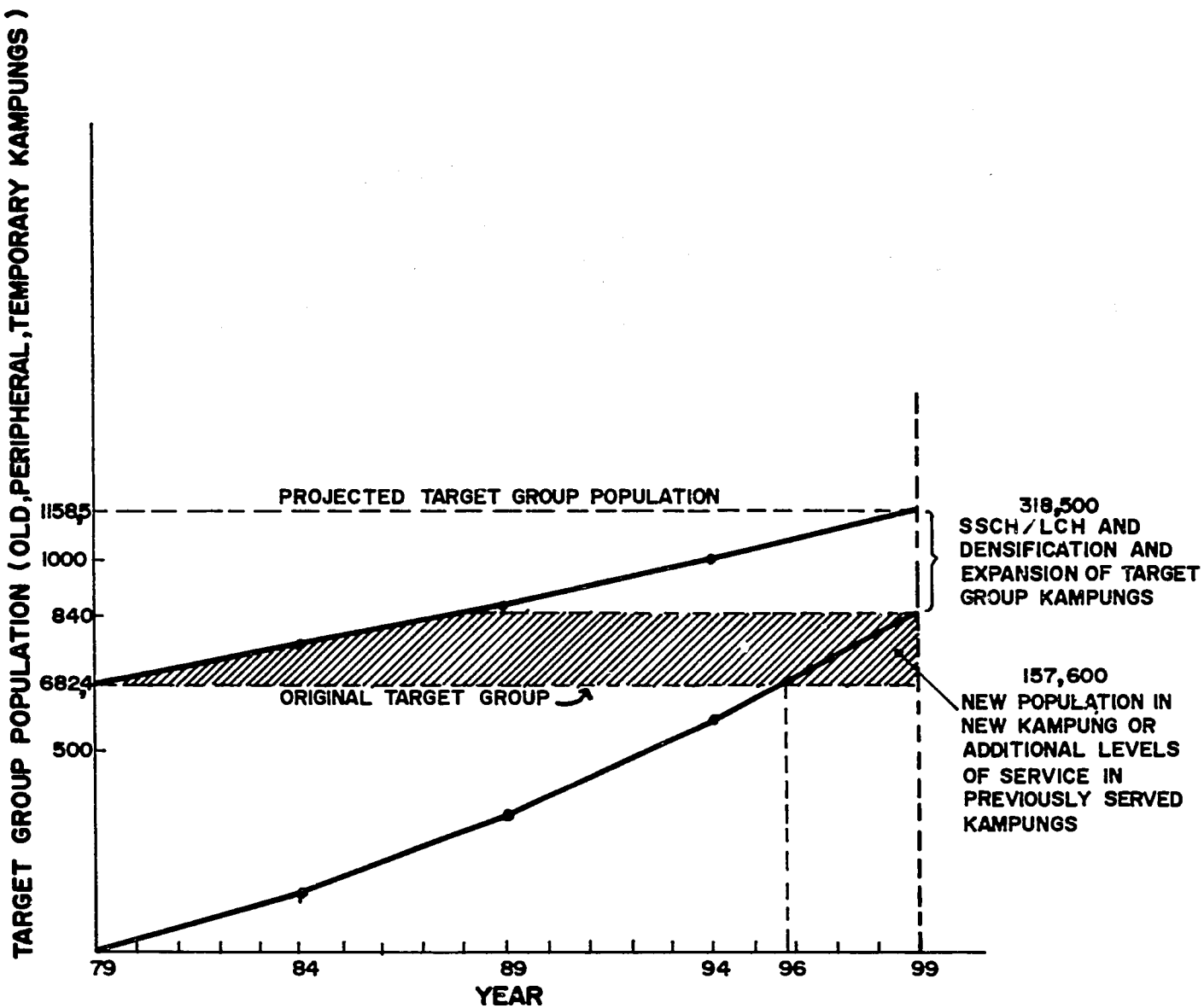


FIGURE 3.2

at least a GOL III salary of Rp.60,000 per month, well above the median expenditure level for Medan, placing these units out of reach of the great majority of Medan's poor population. Presently, in an attempt to expand its base of operations, Koserna has begun to construct houses as a sub-contractor to Perumnas. It has already constructed 1300 units in Medan I and II.

3.3.4 The Role of Bank Tabungan Negara (BTN) and Housing Finance

Bank Tabungan Negara (BTN), organized as the national housing mortgage bank in 1974, began small scale finance operations in late 1976. As of mid-1978, it had made only 1100 loans and commitments for another 7,650. Its target for FY 1978/79 was 10,000 additional loans. All of these past loans have been made to members of the civil services and the Military. Significantly the average borrower still has quite a high income of approximately Rp.65,000 per month. The average loan per unit has been about Rp.2 million with terms of 12 percent interest per year for 20 years.

BTN is just beginning to make a successful transition to becoming a housing finance agency and major administrative and coordination problems still need to be solved. BTN has not made any loans to residents of Perumnas projects though financing for Perumnas was one of the major reasonsfor establishing the institution. A number of other issues remain to be solved:

1. Development of a uniform mortgage instrument.

2. Development of an effective method for repossessing property deliquent in mortgage payment.

3. Generation of sources of monies for housing finance.

In order to become an effective participant in the solving of the Nation's housing problems during Repelita III, BTN must move towards resolution of these issues.

3.3.5 The Role of the Construction Industry

The formal production of low and lower-middle income housing in Medan on Perumnas' Medan I and II projects has been done by small contractors. The several small firms used on these projects use almost exclusively labor intensive methods and operate without the architectural/ engineering capabilities found in most larger Jakarta firms. Most of the project tasks from excavation to the mixing of concrete and mortar are done by hand. Perumnas' use of small contractors, while necessarily implying certain management, manpower and financial problems, has provided them the opportunity to build capacity and experience. An accelerated program of technical assistance and credit to these firms is required.

3.4 KAMPUNG IMPROVEMENT PROGRAM (KIP)

3.4.1 The Role of KIP in Medan

The potential: Repelita III marks the clear recognition of the KIP program as an integral element of national and local government strategy to meet the needs of the low-income urban poor. For the city of Medan, the KIP program offers the potential to: (1) serve the lower 20 percent of the population in need of minimal services who cannot afford sites and services plots and low-income housing units; (2) stimulate more development activities by kampung residents thereby mobilizing additional human resources; and (3) cover a large number of persons with minimal essential services and complementary high priority social-economic components.

Significantly, the implementation of KIP in Medan over the period of Repelita III must deal with two rather significant limitations. These are:

1. Technical Constraints: The Kotamadya of Medan does not now have sufficient trained staff to carry out a greatly expanded KIP program. Even large amounts of money over Repelita III would not remedy the basic problem of finding experienced competent technicians in the numbers required. A total of 15 professionals staff the 5 most important KIP related agencies. A KIP program that attempted to increase the level of works quickly could spread these staff resources even thinner and negatively effect the ongoing development activities. These limitations suggest the consideration of a separate KIP unit, as well as the effective integration of existing outside resources such as U.S.U. in the KIP program. The key question here is the potential effectiveness of a separate KIPunit in dealing with existing city agencies and its effect on the institutional development of Kotamadya.

2. Financial Constraints: From the present trends in municipal KIP related expenditures, projections can be made of estimated expenditures over Repelita III. Table 3.2 summarizes the City's expenditures on KIP related programs from the development budget for the four-year period 1974 to 1978 in absolute and real terms, and shows the real growth in expenditures over the period.

The current financial limitations of the Kotamadya, when considered in the context of the current consumption levels of Medan's urban poor in the area of water supply and sanitation clearly suggests that the KIP program should give priority consideration to complementing the efforts of the existing public service agencies. This would be done by directly focusing and integrating KIP program development activities with the first stage program for water supply and sanitation, providing distribution networks, and environmental health services to complement major investments in trunk infrastructure provided through the principal entities in Medan responsible for water and sanitation.

TABLE 3.2

REAL INCREASES IN EXPENDITURES ON KIP RELATED PROGRAMS

Year	Total Absolute Expenditure (Rp. thousand)	Total Real Expenditure* (Rp. thousand)	Yearly Real Increase (%)
1974/75	149,398	149,398	
1975/76	229,419	194,098	29.9
1976/77	403,838	271,379	39.8
1977/78	290,673	145,918	-46.2

* Real expenditures based on 1974 constant prices as published by the Biro Pusat Statistik.

The MUDS team is presently analyzing the Kotamadya's financial status. Pending completion of the work, we believe that it is not unreasonable to assume a real annual increase of 10 percent. The following Table reflects this 10 percent real increase in KIP related expenditures during Repelita III allowing for a 10 percent annual cost of living increase.

TABLE 3.3

REAL INCREASE IN KIP RELATED EXPENDITURES DURING REPELITA III

	Estimated Total Real Expenditure (Rp. Thousand)
1979/80	488,644
1980/81	591,259
1981/82	715,484
1982/83	865,663
1983/84	1,047,452

3.4.2 Feasibility Analyses - Levels of Short and Long Term Programming

Given the financial and technical limitations which the Kotamadya will encounter in the implementation of a city-wide KIP program, it is recommended that, rather than present several alternatives which require a choice between greater or lesser levels of spending per capita or per hectare and greater or lesser yearly coverage of the target population (in terms of hectares), a 2 or 3 tier phased program based initially on national and local government's capacity to sustain the program from domestic funding sources be undertaken. In later phases the program could be expanded depending on the availability of additional national and local resources and/or financing from international lending agencies. The following sections briefly discuss a Domestic Program for KIP based on Cipta Karya guidelines found in Repelita III and two possible options which include external financing. A summary of the feasibility analysis for these alternative level of KIP is presented in Table 3.4.

Domestic KIP Program

The Domestic KIP Program established by Cipta Karya for Repelita III will cover approximately 200 hectares. The national government will provide about Rp.620 million or roughly 60-70 percent of the program, with the remainder being supplied from the Kotamadya's budget.

The Domestic KIP Program would make use of previously budgeted, readily available funds to initiate programs of immediate action in kampungs of greatest physical priority. These programs should include solid waste, water supply, drainage, etc. A program similar in concept is already underway in Medan under Cipta Karya's and the Kotamadya's pilot program for Kotamatsum I, II and III. The pilot program will cost Rp.475 million of which 32 percent will be supplied by the Kotamadya and PAM Tirtanadi amd the remainder by Cipta Karya.

Assuming a similar level of financing for a 200 hectare program for Repelita III -- Cipta Karya supplying Rp.620 million (60 percent) and the Kotamadya Rp.413 million (40 percent), a total of Rp.1,033 million would be generated which would benefit 80,000 persons, or 11 percent of the total KIP target group. This amounts to Rp.5.17 million per hectare or Rp.12,900 (US$ 20.80) per capita. While it is anticipated that this program would be financed jointly by Cipta Karya and the Kotamadya, it is obvious from Table 3.3 and 3.4 that the Kotamadya alone could easily finance this Domestic KIP Program. At no time during Repelita III does the total yearly budget for the Domestic Program approach even 20 percent of the city's total funds that are projected to be available for KIP related programs.

Option #1 - Expanded Domestic/External Program

In the event that additional domestic (national and/or local) and external financing are available, the Expanded Domestic/External Program would supplement the on-going Domestic Program. While the on-going Domestic Program is focused mainly on improvements to the household's living environment, the Expanded Domestic/External Program, while still concentrating on the solution of more costly environmental problems,

TABLE 3.4

FEASIBILITY ANALYSIS--REPELITA III 1979-1984 APPROXIMATE COST & COVERAGE OF MEDAN PHASED KIP PROGRAM

Phase Level	Estimated Coverage (ha)	Total Population Served		Yearly Cost of Program (Rp. Million)					Total Cost Repelita III (1979-1984) (Rp.Million)	Financing Mechanisms		
		1979-1984	% of Target Population	1979-1980	1980-1981	1981-1982	1982-1983	1983-1984		Amount (Rp.Million)	% of Total	Funding Source
Domestic Program	200	80,000 (Note 1)	11 (Note 2)	50	75	75	100	113	1,033	413	40	Local & Provincial
				75	100	125	150	170		620	60	National
Option # 1 Expanded Domestic/External Program	350	140,000	20	-	100	150	200	300	3,207 (Note 2)	750	23	Local & Provincial
				-	50	75	100	112		337	11	National
				-	400	500	600	620		2,120	66	International
Option # 2 Maximum Coverage Domestic/ External Program	750	300,000	44	-	250	350	425	550	8,054 (Note 2)	1,575	20	Local & Provincial
				-	400	450	525	560		1,935	24	National
				-	800	1,000	1,200	1,544		4,544	56	International

Note: 1. Based on an estimated population living in low income kampungs of 877,600 persons of which about approximately 700,000 persons live in kampung types targeted for KIP (old, peripheral and temporary kampungs).

2. Based on per capita costs of Rp.24,600 (US$ 40.00) over the period 1979-1982 and a per capita cost of Rp.35,077 (US$ 58.50) during 1982-1984. The per capita cost is assumed to increase by an inflation rate of 10 percent per annum over the 5 year period to 1984.

will also focus on the other two main components of kampung improvement — improvements in the family's access to educational, health and nutritional facilities and services and improvements in the family's productivity. It is recommended that the KIP programs focused on the family and its improved productivity be developed in the second phase Expanded Domestic/External Program.

The availability of additional funds from both domestic and external sources would allow an increase in both the hectare coverage and per capita investment of the program over Repelita III. The original 200 hectares of the Domestic Program could be expanded to cover 350 hectares. This coverage would serve approximately 140,000 persons (20 percent of the total KIP target group) during Repelita III. Based on previous programs partially financed from external sources, per capita investment could be increased to Rp.24,600 (US$ 40.00) for the first three years of the program (1979/82). The cost per hectare for the combined program would be Rp.12.11 million. External sources would supply 66 percent of the supplementary Expanded Domestic/External Program or 50 percent of the total budget (including Domestic Program). The Kotamadya would be asked to supply the greatest share of the remaining required funds. However, referring to Table 3.3, it can be seen that the Kotamadya, over the five-year period, would never be required to spend more than 30 percent of any year's projected KIP related budget on the program.

Option #2 - Maximum Coverage Domestic/External Program

Table 3.5 shows that only by the year 1996 will the original target group of 682,000 persons be served by a combined Domestic and Expanded Domestic/External Program. Option #2, a Maximum Coverage Domestic/External Program, is designed to accelerate the KIP by serving the entire original target population by the end of Repelita IV (1989). The Maximum Coverage Program is similar in concept to Option #1 in that it would contain components to improve the physical environment as well as programs to improve the family's access to various health and educational facilities and services as well as its productivity. This program would cover 750 hectares and a target population of 300,000 during Repelita III (43 percent of the total designated KIP target group). Per capita spending would be maintained at the same level as for Option #1. External financing would have to provide at least 50 percent of the program's total budget, with the remainder being supplied between the Kotamadya and the national government.

Given current conditions, the Maximum Coverage Program could overload the financial and technical capabilities of the Kotamadya. In addition, the financial contribution required at the national level would greatly exceed the amount allocated for KIP in Medan during Repelita III. For these reasons, a decision to select a KIP program based on the Maximum Coverage Option must be taken at the highest levels of Government. For the purpose of the present analysis, the Domestic Program combined with Option #1 will be developed as a phased program that will provide minimal essential levels of basic infrastructure and services to approximately 20 percent of the target population during Repelita III.

TABLE 3.5

TARGET POPULATION SERVED BY CITY-WIDE KIP

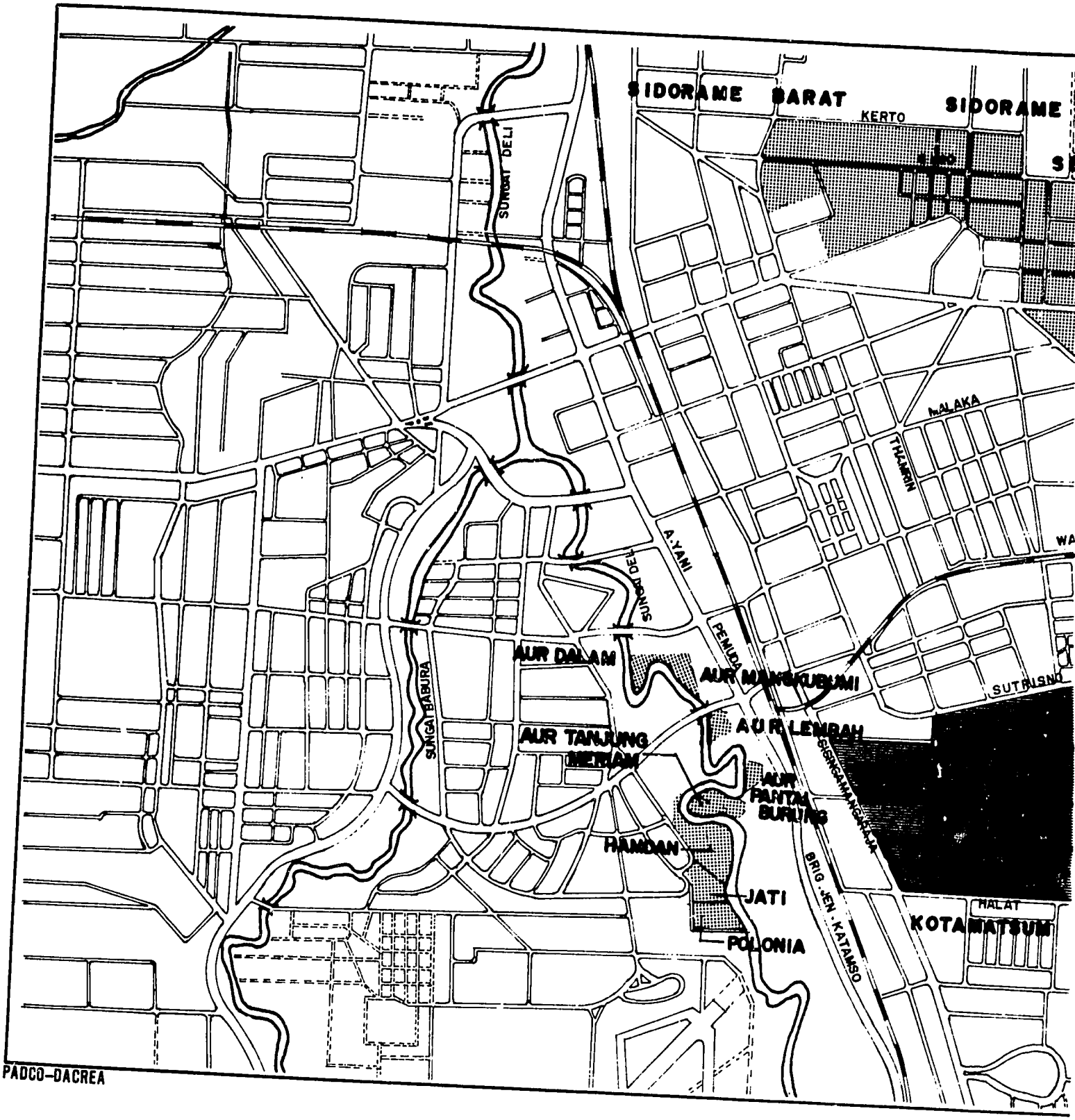
Repelita Program	III 1979/84	IV 1984/89	V 1989/94	VI 1994/2000	Total of Percentage of Target Group
Domestic	80,000 (11%)*	80,000 (11%)	80,000 (11%)	80,000 (11%)	320,000 (44%)
Option #1	140,000 (20%)	210,000 (30%)	245,000 (35%)	245,000 (35%)	840,000 (120%)
Option #2	300,000 (43%)	400,000 (57%)	245,000 (35%)	245,000 (35%)	1,190,000 (170%)

* Percentage based on a total target population of 700,000 persons.
Source: MUDS

3.4.3 Selection of Kampungs to be Improved

Based on our analysis of Medan's low-income kampungs, on conversations held with key members of local government, and on discussions with Cipta Karya officials in Jakarta, we recommended the improvement of the following ± 250 hectares during Repelita III (see Figure 3.3):

	Kampungs	Population 1979	Residential Area (ha)	Residential Density (person/ha)	Major Physical Problems
1.	Tegal Sari	15,000	59.1	260	Streets, Water, Sanitation
	Tegal Sari I	20,600	31.8	650	Solid Waste
	Tegal Sari II	4,900	24.1	200	
2.	Sei Kera Hilir	14,000	40.2	350	Water, Sanitation Solid Waste
	Sei Kera Hulu	6,400	22.5	280	
3.	Sidorame Barat	9,900	35.7	280	Water, Street, Flooding
	Sidorame Timur	5,900	28.1	210	



PADCO–DACREA

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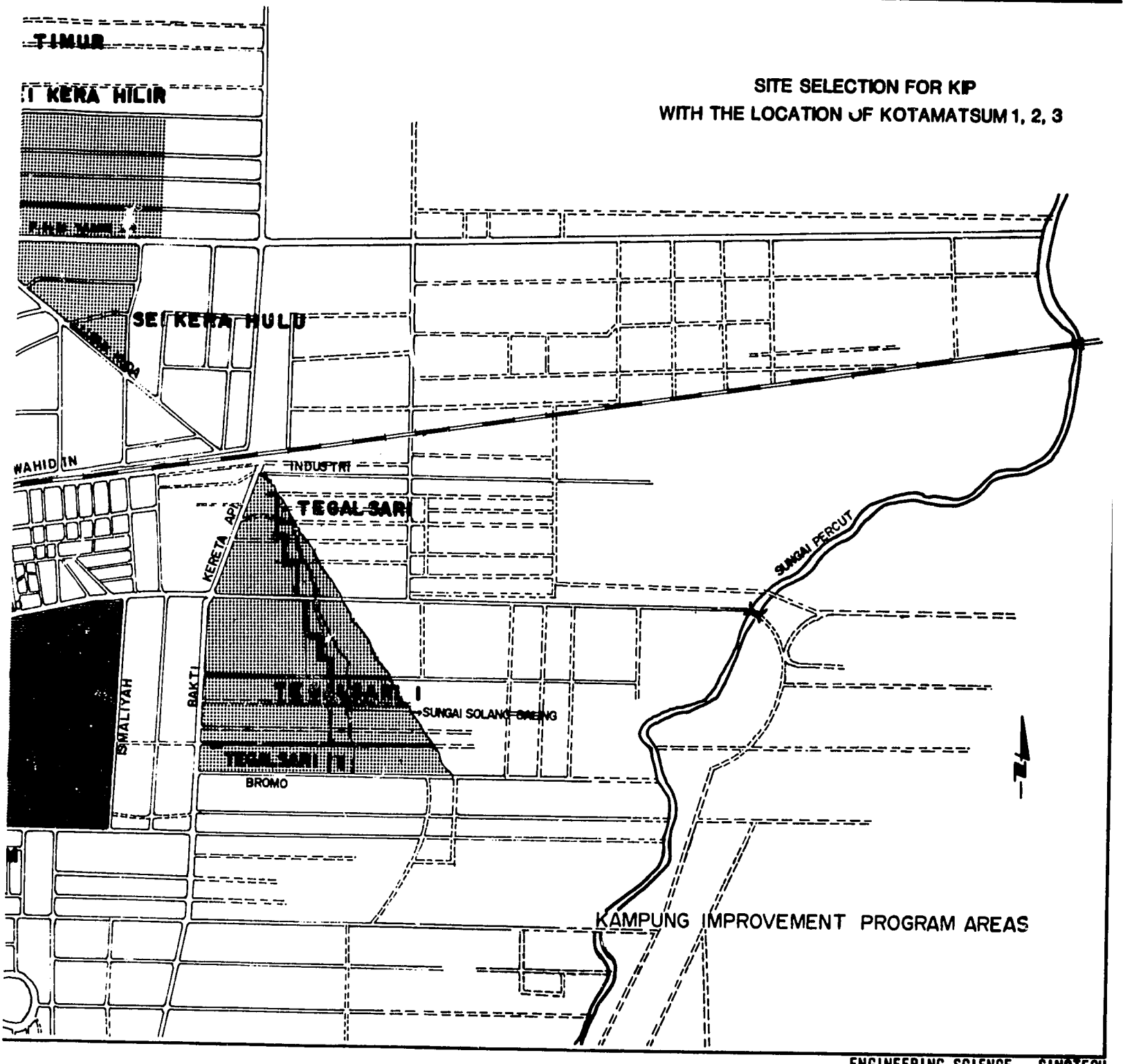
SITE SELECTION FOR KIP
WITH THE LOCATION OF KOTAMATSUM 1, 2, 3
TIMUR
KERA HILIR
KERA HULU
WAHID IN
INDUSTRI
TEGAL SARI
KERETA API
SUNGAI PERCUT
BAKTI
SMALIYAH
SUNGAI SOLANG-BAENG
BROMO
KAMPUNG IMPROVEMENT PROGRAM AREAS

Kampungs	Population 1979	Residential Area (ha)	Residential Density (persons/ha)	Major Physical Problems
4. Aur	3,600	7.7	470	Water, Street, Sanitation
Hamdan	4,700	9.9	470	
Total	85,500	259.1	330	

In addition to the 250 hectares selected above, the combined Domestic and Expanded Domestic/External Program recommends the improvement of an additional 100 hectares over Repelita III for Medan. The 100 hectares in Kotamatsum I, II and III presently in the final engineering design stage should be included within the overall financing package for Medan's Repelita III KIP program.

3.4.4 Planning Standards for KIP

The general Cipta Karya KIP standards for basic infrastructure and community facilities will be applied, and modified according to actual field conditions found in the selected kampungs.

3.4.5 KIP Administration

The administrative complexity and the professional staff requirements of a KIP program requires that the program be organized and scheduled in order to minimize the dislocations to the agencies presently involved in KIP related activities. Established institutional roles and responsibilities as well as ongoing programs and projects should be built upon and strengthened during the implementation of KIP. For this reason it is recommended that the following agencies be involved in the KIP:

1. Pre-construction (planning, programming, detailed engineering and coordination) - Provincial Cipta Karya, Bappeda, City Planning Department, City Development Office, PMD, and U.S.U. Research Institute*.

2. Construction - Building Information Center (BIC), PAM Tirtanadi, PLN, Public Works, Health, Education and Cleaning Departments.

3. Post-construction (management and maintenance) - Kecamatan Head, representatives from kampung/lorong, Desa Social Institution (LSD), KORAMIL, KOSEKTA, City Revenue and Agraria Departments, and U.S.U. Research Institute.

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* The participation of U.S.U. in any Medan KIP program is important, especially in the areas of planning and programming. The Centers for Population and Environmental Studies as well as the Research Institute should contribute to the program.

3.5 SITES AND SERVICES/LOW COST HOUSING (SSCH/LCH)

3.5.1 Potential and Constraints

Objectives and Purpose

The following general objectives serve as the guiding principles for the Perumnas SSCH/LCH program:

1. To initially provide a minimum standard shelter which can be afforded by designated target groups, with in-built flexibility so that the units may be expanded and modified as families' financial capabilities change.

2. To provide a secure living environment with appropriate health, educational and recreational facilities within a reasonable distance of employment opportunities.

Norms and Standards

Norms and standards for SSCH/LCH projects are only relevant when based upon the ability of low-income target groups' capacity to afford them. In the past, it has been estimated that the least expensive Perumnas house cost 40-50 percent more than a comparable house produced informally in the kampungs. This has partially been due to reliance on building materials produced with capital-intensive technologies, such as particle board. In the future, however, while a greater emphasis must be placed on the use of labor intensive, locally-produced building materials, greater flexibility must be shown with respect to project standards such as residential density, provision of minimal levels of public services, and core housing in order to enable households with total monthly expenditures of approximately Rp.20,000 to 25,000 to afford and be interested in SSCH/LCH houses.

Constraints of Land Cost and Acquisition

Land acquisition is presently the major problem facing Perumnas and the MUDS team with respect to SSCH/LCH. It is becoming extremely difficult to find anywhere within the boundaries of the Kotamadya large sites in the range of 100 to 200 hectares close to employment opportunities and health, educational and market facilities which may be easily acquired at a sufficiently low cost. The process is further complicated by stipulations that land acquisition must be coordinated between Perumnas and several local agencies. The experience of the short-term search for a large site for Medan III by the MUDS' team indicates that these constraints will undoubtedly result in potential locations being founded beyond the perimeter of the present built-up area of the Kotamadya.

3.5.2 Repelita III Perumnas Program for Medan

Based on a population growth rate of 2.6 percent, it is estimated that Medan's population will increase by 150 thousand persons in the 1979-84 period. Assuming an average household size of 5.8, this estimate suggests an increase of 25,900 households. In addition to this estimate

of future housing needs, an existing backlog of about 35,000 dwelling units - caused mainly by over crowding must also be considered.

Of the 150,000 - 200,000 new dwelling units to be produced by Perumnas during Repelita III, it has been estimated that approximately 10,000 will be allocated to Medan. Considering the 8972 units which are to be built on the recently initiated Medan II site, it is evident that some 88 percent of Perumnas' estimate of housing production for Medan over Repelita III is to be constructed in Medan II. If present Perumnas' policies with respect to subsidies and target group (civil servants and military) are continued, Perumnas should encounter few problems in finding occupants for these units. If, on the other hand, an additional 12,000 units were produced in Medan III (200 hectares x 60 units/hectare), nearly 80 percent of the total demand of all new households in Medan over Repelita III would be met in Medan II and III. Since the total absorptive capacity generated by the increase in households over the period will be closely approached, site selection and market analysis must be carefully undertaken in order to avoid an unmarketable project.

3.5.3 Feasibility Analysis for Medan III

Site Selection Criteria

The following criteria are being used in the site selection process for the Medan III SSCH/LCH project:

1. Conformance to Medan's development plans.
2. Cost of raw land.
3. Facility of acquisition.
4. Topography of site.
5. Soil and erosion difficulties.
6. Proximity to existing infrastructure network.
7. Proximity to socio-economic infrastructure.
8. Proximity to employment centers.
9. Site area sufficient for project.
10. Site development costs.

Taking these criteria into consideration, especially those with respect to proximity to employment centers and socio-economic infrastructure, three criteria are being emphasized in order to locate a suitable site during the time frame of the MUDS project:

1. Cost of raw land must be kept to a minimum (Rp.500-1000) per square metre.

2. Feasibility of acquisition through the purchase of the site from one, or at most two, individuals or plantation estates.

3. Topography of site must not be too wet or level so as to present drainage and cost problems or too steep so as to place physical limitations on how structures can be fitted to the terrain without extensive grading costs.

Experience to Date

While a definite decision has not yet been made on a site for Medan III, three sites have been identified for further analysis by Perumnas and the Kotamadya. The three sites are the following:

1. Km 10 of Brastagi Road

A previous Memorandum gave a preliminary analysis of 160 hectares at km 10 of the Brastagi road. The site is currently used as a rubber plantation. It is traversed by one large stream and two smaller ones which flow in well-defined channels. The site is essentially located on three levels with varying degrees of developability:

- Narrow streams and their flood plains which are unsuitable for development

- Terraces possibly suitable for housing development and small valley floors which could be drained for agriculture or public uses

- Upland areas suitable for housing development

Of the total 160 hectares, it is estimated that roughly 127 hectares or 79 percent of the site could be used for housing development.

Soil conditions over the site appear to be uniformally silty clay which is generally unsuitable for sub-surface disposal of wastewater. However, the site is ideally suited for the installation of gravity sewers to treatment sites (waste stabilization ponds) which could be located on the terrace levels.

The slope of the site on the upland and terrace areas provides excellent drainage. Water supply is available from the water distribution system, approximately 3 kilometres to the north-east along the Brastagi road, or from deep wells drilled on site. Electricity could be supplied from planned secondary distribution feeders. The topography and configuration of the site will necessitate additional costs for channel improvements and for bridges and culverts.

The following costs are additional costs of site development attributable to the particular topography and configuration of the site:

Land: Assuming a unit land cost of Rp.750 per square metre with 79.3 percent of the site developable for housing, cost per developable square metre is Rp.946.

Drainage	Rp/sq m	
Channel improvements, Valley floor and lower terrace improvements Lump sum 8.8 million	= 6.9	
Access		
Bridges - 2 @ 5.3 million Rp. each	= 8.3	
Culverts - 4 @ 2.0 million Rp. each	= 6.3	
Additional main road costs - 7 metres/ hectare @ 8,000 Rp/m	= 5.6	
Total		27.1 Rp/sq m

2. Kampung Masyhur - Kecamatan Johor

Approximately 200 hectares are located between the Babura and Deli rivers in Kp. Masyhur, Kec. Johor, south of Polonia Airport. At the request of Perumnas, a very preliminary analysis of this site was undertaken. No cost estimates of site development have as yet been made. Approximately 20 percent of the site is poorly drained and presently used for rice cultivation. It would be difficult to use the entire 200 hectares of this site without extensive filling and grading. However, the site is divided into two fairly well-defined sections. The western section containing approximately 93 hectares is criss-crossed from north to south by rice paddies (27 percent of area) and would be extremely difficult to develop for SSCH/LCH. On the other hand, the eastern section, containing roughly 100 hectares is much more suited for SSCH/LCH development, with only 13 percent of the total area being poorly-drained. This 13 percent is found in two well-defined areas of the eastern section and could be partially filled depending on available funds and project requirements.

In summary, the site could be attractive to Perumnas in the event that approximately 100 hectares were needed. Further analysis will be required in order to determine more precisely the amount of usable land and the potential for the disposal of waste and surface water.

3. Site 10 kms to the Southwest of Pancur Batu

The first two sites are presently being discussed by Perumnas and local government. The third site was visited by the project team on June 23. Due to the roughly 30 kms that separate this site from downtown Medan, it should not be given further consideration for Medan III.

Next Steps

Before any decisions can be made with respect to the sites under consideration by Perumnas and the Kotamadya,a preliminary cost analysis in each of land, filling and grading, installation of infrastructure core housing, etc. must be undertaken. The cost per lot of usable land can then be estimated in order to determine whether these sites would be within the range of affordability of the target groups.

SECTION 4

WATER SUPPLY

4.1 EXISTING SUPPLY AND PLANNED IMPROVEMENTS

Existing municipal water supply sources include a combination of springs, deep water wells, and typical surface water treatment plant. These sources produce about 101,000 cu m/d (1175 l/s) of water supply [46,000 (535 l/s); 3,325 (40 l/s); and 52,000 cu m/d (600 l/s), respectively]. The remaining water supply for Medan residents comes from individual use of the rivers and shallow wells scattered throughout the city. Plans for new water supplies in the next five years focus upon expansion of the Sunggal Treatment Plant to the planned capacity of 130,000 cu m/d (1,500 l/s). Several wells are also planned for the east side of the city with a total capacity of 5,000 cu m/d (60 l/s). Continuous operation and expansion of PAM Tirtanadi wells in Belawan could add another 1,000 to 2,000 cu m/d (11.5-23 l/s) to supply. Thus, the existing and planned supply sources will produce a total of about 202,000 cu m/d (2,335 l/s) within the next five years. The location of existing and potential sources of water supply are illustrated on Figure 4.1. The construction of the first stage of a new treatment plant (100 l/s) on the Percut and another small plant on the Deli River (100 l/s) is also contemplated. Safe yield of the Percut River is estimated at about 90,000 cu m/d (1,000 l/s).

4.2 ALTERNATIVE SUPPLIES

Development of water supply alternatives has focused on major short-term increases and long-term overall supply. Springs, groundwater, and surface water sources within 35 kilometres of Medan have been reviewed as possible alternative water supplies.

Supply alternatives for the next five years have narrowed to surface waters from the Deli or Percut, additions to the Sunggal Plant, or groundwaters within eastern Medan.

Preliminary cost analyses indicate that continued expansion of the Sunggal Plant and local groundwater are probably the least-cost sources for the near future. It is felt that the flexibility of location and staging provided by wells probably outweighs the operational difficulties posed by their scattered nature. Continued expansion of the Sunggal Plant will reap the benefits of economies of-scale associated with a single large facility, but will require more cross-town transmission mains than wells or the Percut source.

42

A summary of alternative sources of water supply for the medium and long range needs is presented in Table 4.1.

TABLE 4.1

ALTERNATIVE FUTURE WATER SUPPLY SOURCES

Source	Distance from Medan, in Km	Probable yield cu m/d	l/s
Medan wells	0	200,000 to 300,000	(2,300 to 3,500)
Deli	5	150,000	(1,700)
with Percut	8	250,000	(2,900)
with Belumai	14	350,000	(4,100)
with Loehoena-Buaya	18	450,000	(5,200)
Belawan-Sunggal	7-15	130,000	(1,500)
with Binjai	13-15	250,000	(2,900)
Binjai-Wampu	20-30	700,000 to 1,000,000	(8,100 to 12,000)
Morawa-Ular	10-30	700,000 to 1,000,000	(8,100 to 12,000)

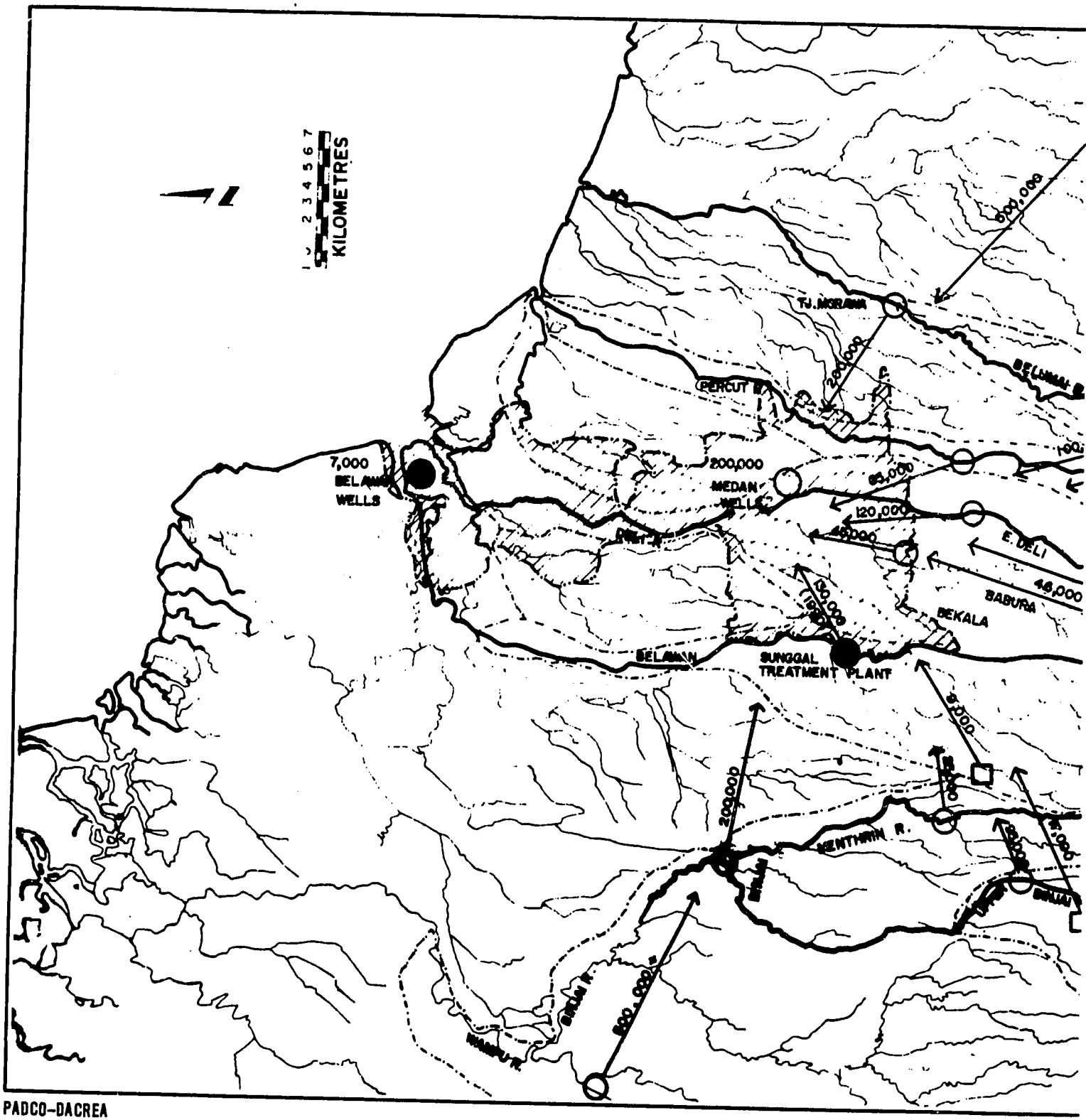
It is obvious from inspection of Table 4.1 that the potential water resources in the region are more than adequate for Medan's needs to and well beyond the year 2000. The relative merits and feasibility of developing these alternative sources is now being analyzed.

4.3 EXISTING WATER USE

Existing potable water use in the study area is summarized below:

Consumer Category	Estimated present (1978) water use, in l/s		
	Municipal	Non-municipal	Total
Domestic	469	709	1178
Institutional	135	16	151
Commercial/industrial/offices	161	190	351
Unaccounted for losses	252	296	548
Total Present Water Use	1017	1211	2228

43



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44

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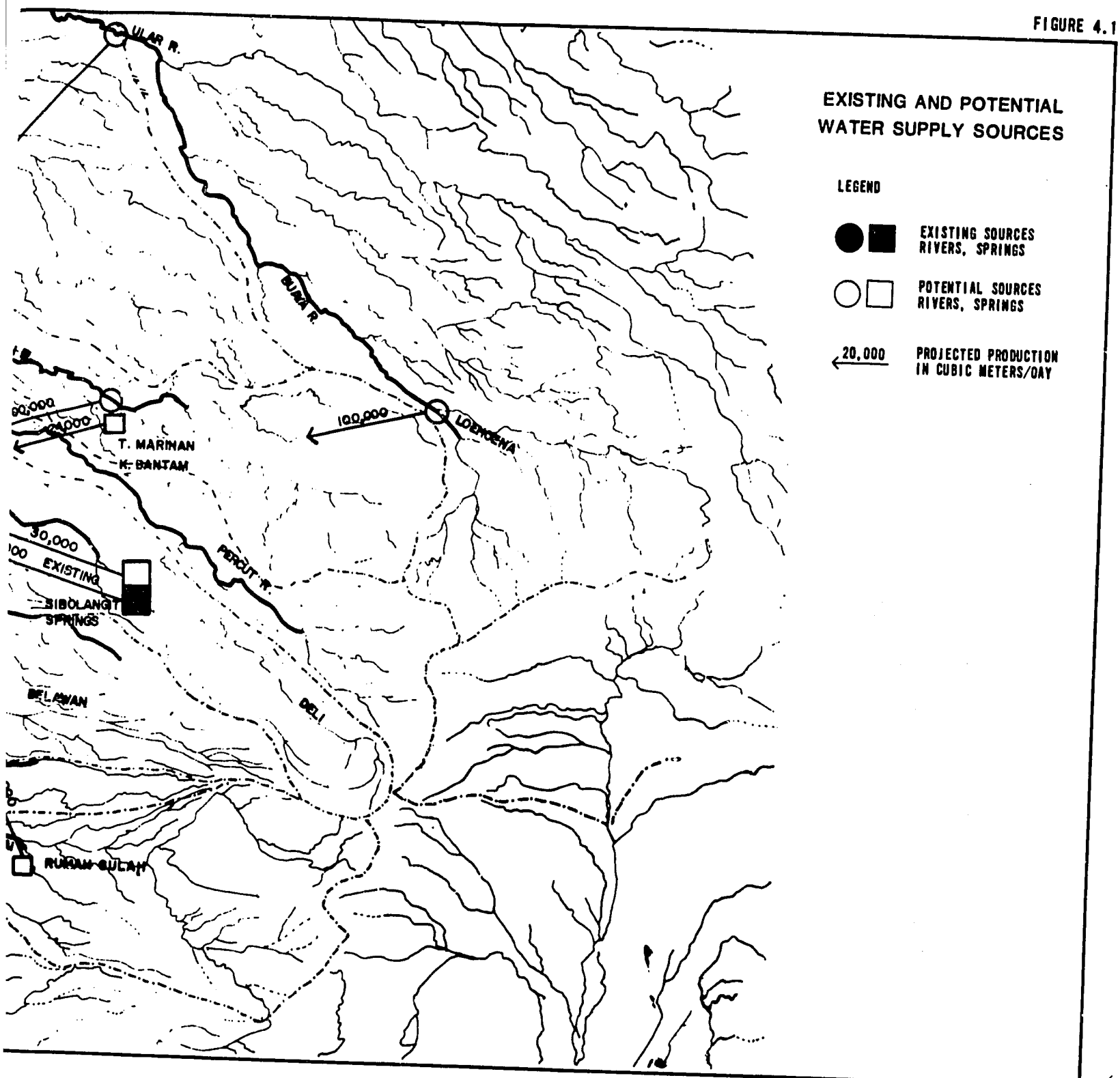
Best Available Document

FIGURE 4.1



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The municipal water system (Tirtanadi) provides around 40 percent of the total estimated domestic water requirement to about 25 percent of the population. The remainder of the domestic demand is met from privately owned wells and local surface water as indicated in Table 4.2. Tirtanadi also supplies about 59 percent of the estimated non-residential requirement. The remaining 41 percent is provided from private deep wells.

TABLE 4.2

PRESENT DOMESTIC WATER SUPPLY

Residential Category	Type of Water Supply	Present Unit Water Use (lpcd)	Present Population (1978)
Upper and middle income, permanent dwellings	Municipal, metered connection	176	270,000
Middle income, medium density	Individual household shallow well	100	696,000
Low income, high density	Rivers, standpipes, and shallow wells serving multiple dwellings	35*	150,000
			1,116,000

* These are very tentative estimates based on limited data. A field survey is in progress which it is hoped will allow refinement of this figure.

The municipal supply is now basically limited to upper and middle income groups. The ready accessibility of ground water (ground water levels are only 1 to 2 metres deep in many areas) and the relatively high cost of connecting to the municipal system (Rp.200,000 to Rp.300,000) presently serve as effective deterrents to the provision of municipal supplies to lower income groups.

4.4 WATER SERVICE EXTENSION STRATEGY

Shallow dug wells are often polluted, a fact borne out by both water quality analyses and the very high incidence rates of water related diseases prevalent in Medan. Surface rivers and streams are grossly polluted. Where provision of a public supply is feasible, conversion of domestic shallow well supplies to a safe municipal supply should be given a high priority in future infrastructure improvement programs, particularly with regard to those people using surface streams and public shallow wells and standpipes. Where open shallow well use will continue for a considerable time, technical aid programs aimed at providing covers and hand pumps should be instituted. Proposed strategies for extending water

service to the various residential consumer categories are illustrated in Figure 4.2.

Those people living in relatively densely developed areas who now depend upon surface streams and shallow wells serving more than one dwelling undoubtedly represent the greatest opportunity to extend potable water service to a maximum number of people with a minimum expenditure. The amount of additional water required to serve this group is only about 35 percent of the present municipal domestic supply, and it is estimated that most if not all of this group are located within or near to the existing distribution system coverage. Extension of service to this group would therefore require a minimal addition to present water supplies, and relatively few major main additions.

In order to induce people carrying water from a shallow well to utilize public taps, a level of service, convenience, and price close to that the original supply must be offered. The supply must be constant (intermittency of supply is believed to be a major reason for the low usage levels of existing public taps) and the carrying distance should be similar to the shallow wells being replaced. Since the cost to the consumer for water from shallow wells is extremely low once the well has been constructed, subsidy may well be necessary for public taps.

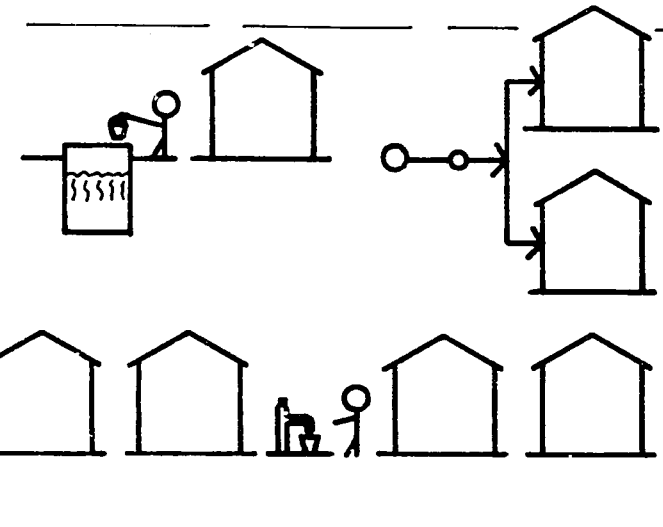
People with individual domestic wells may represent up to 65 percent of the present population or about three times the population presently served by the municipal water system. Individual service connections may be required in order to offer most of this group a service level equal to the one they already enjoy. Reduction of the present high service connection charges and/or provision of a low-cost basic water consumption allowance may be required to induce conversion of this group to the municipal supply.

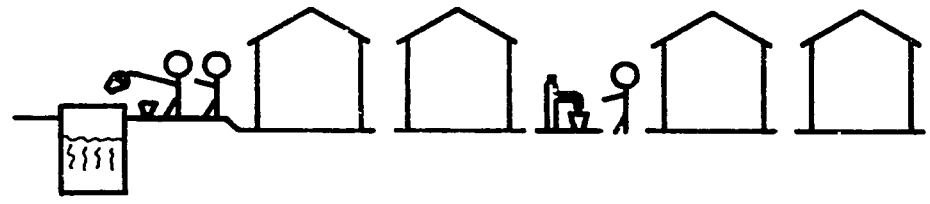
4.5 PROJECTED WATER REQUIREMENT

A summary of estimated total (municipal and non-municipal) water needs for Medan through the year 2000 is illustrated in Figure 4.3. It is estimated that municipal water production requirements would rise from the present level of 1085 l/s to 2300 l/s by 1985 and to about 4300 l/s by the year 2000. This estimate is based on the assumption that 60 percent of the population will be served by the municipal system by the end of Repelita III (1985) and 80 percent will be served by the year 2000. Residential unit water use figures utilized in making these projections are presented in Table 4.3. Water use for governmental, commercial, industrial, and institutional areas is estimated to be 41,000 l/ha per day.

WATER SERVICE STRATEGY

RESIDENTIAL TYPE	PRESENT POPULATION	WATER SUPPLY PRESENT FUTURE
UPPER MIDDLE INCOME	220.000	← MUNICIPAL →
LOWER INCOME MEDIUM DENSITY	700.000	
LOWEST INCOME HIGHEST DENSITY	150.000	





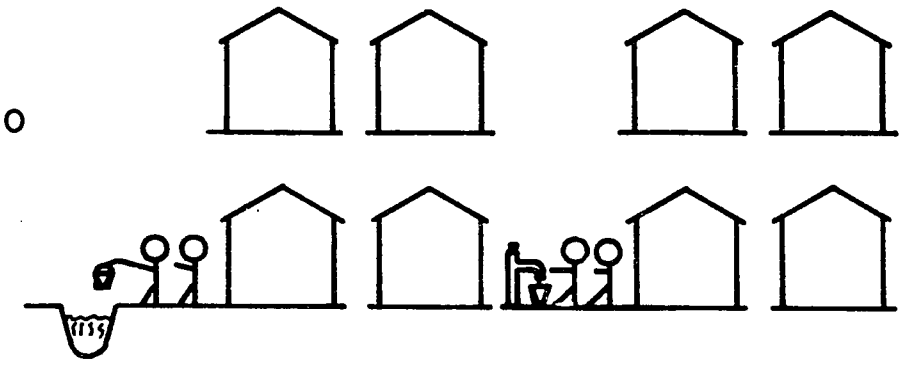


FIGURE 4.2

FIGURE 4.3

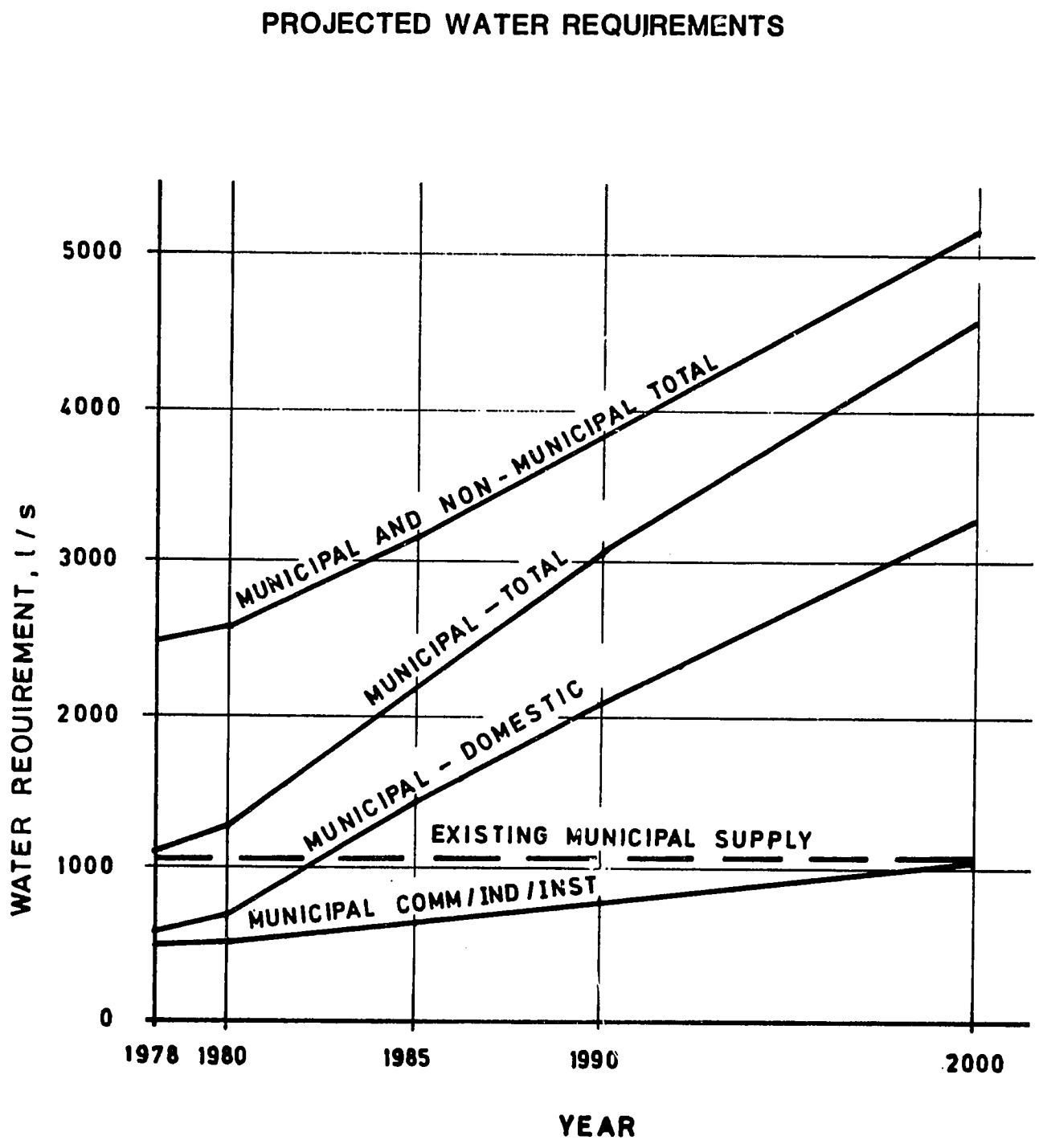

PROJECTED WATER REQUIREMENTS
WATER REQUIREMENT, l/s
5000
4000
3000
2000
1000
0
1978
1980
1985
1990
2000
YEAR
MUNICIPAL AND NON-MUNICIPAL TOTAL
MUNICIPAL - TOTAL
MUNICIPAL - DOMESTIC
EXISTING MUNICIPAL SUPPLY
MUNICIPAL COMM/IND/INST

TABLE 4.3

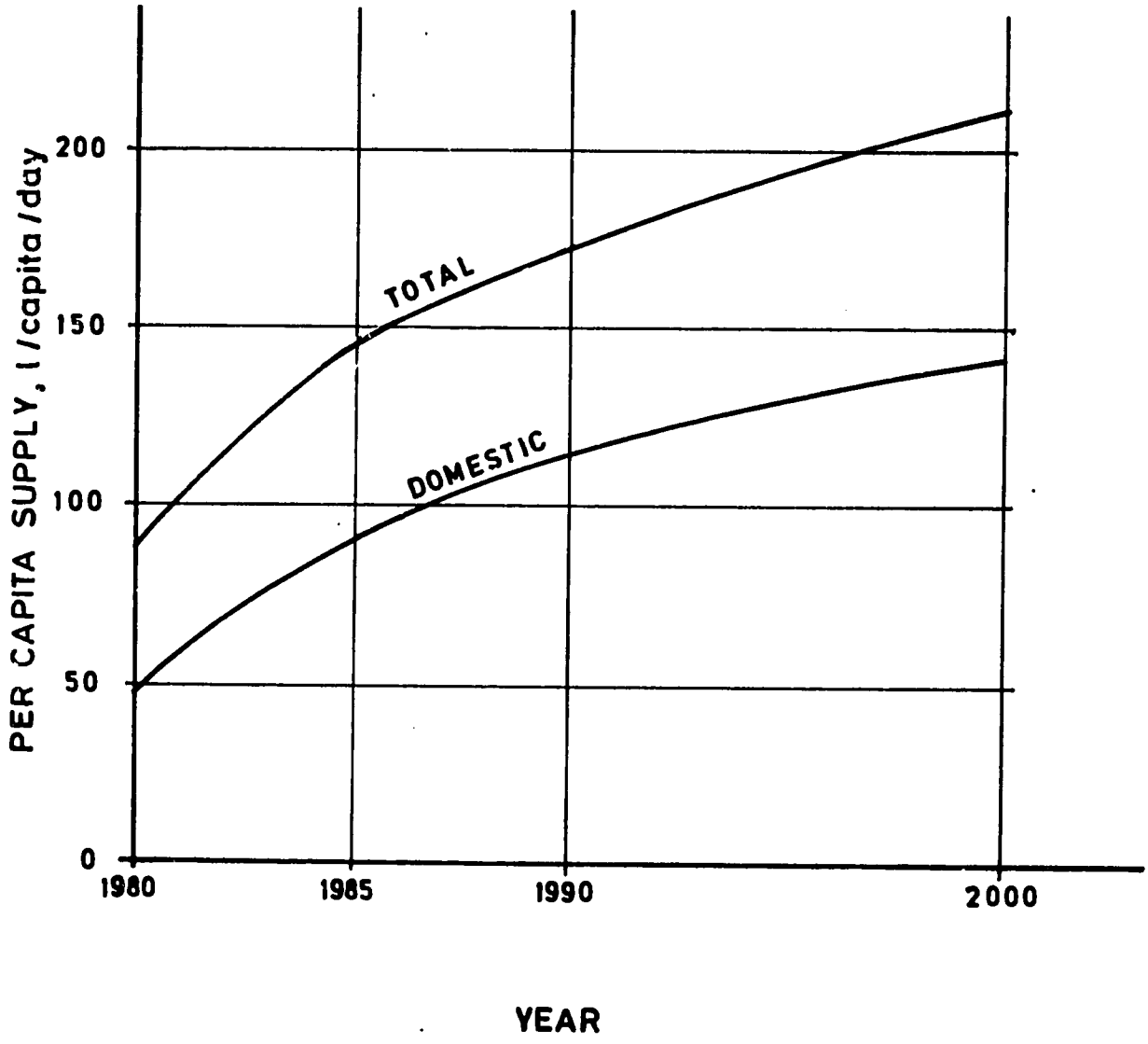
UNIT WATER USE VALUES

Residential type		Unit Water Use, in l/c.d				
Income	Density	1978	1980	1985	1990	2000
high	low	265	265	275	285	300
high	medium	265	265	275	285	300
med	low	215	215	225	240	260
med	med	215	215	225	240	260
med	high	145	145	160	175	200
low	low	145	145	160	175	200
low	med	100	100	115	125	150
low	high	35	35	35	35	35

Projected increases in per capita domestic and total supply which will have to be supplied by the municipal water utility under the above assumptions are illustrated in Figure 4.4.

FIGURE 4.4

PROJECTED UNIT MUNICIPAL WATER SUPPLY



SECTION 5

WASTEWATER

5.1 EXISTING WASTEWATER SYSTEM

At the present time wastewater collection and disposal is provided by individual systems such as pit latines and septic tanks. Soil conditions in the study area generally severely restrict subsurface disposal of wastewater. Separation of wastewater flows into grey and black water components is typical throughout the city. Grey waters are discharged to the surface drainage system, open roadside ditches, or underground drainage conduits. Black waters (toilet wastes) are discharged to septic tanks/soak-away pitswhich perform with only limited efficiency. Visual inspections suggest that a considerable quantity of septic tank effluent finds its way directly or indirectly into the surface drains. In many of the more densely populated areas of the city the connection of septic tanks directly to underground drainage conduits is allowed by special permit. Prior to 1969 the connection of raw sewage discharges was common in a limited area of the city which can be considered now to be served by a system of combined sewers. This area is shown in Figure 5.1.

The results of a social and economic survey carried out in Medan in 1978 and 1979 jointly by Bappeda S.U. and the provincial census and statistics office indicated the following levels of service for disposal of sanitary wastes.

Households with toilet	84.3 percent
Households without toilet	15.7
Streams	5.8
Joint use	2.8
Yard	1.3
Public toilet	1.1
Fish pond or rice paddy	0.2
Other	4.5

A sanitary survey field inspection carried out as part of this projct identified high density low income areas of the city in which there are virtually no household toilets and in which extensive use is made of streams, public toilets (some of which were out of service) and open latrine areas for excreta disposal.

The grossly polluted ditches constitute both a nuisance and a health hazard to the residents of the city of Medan. The Deli river, the major receptor of all wastewater flows, is extensively used for bathing and individual water supply.

5.2 WASTEWATER QUANTITIES

Wastewater generation rates are closely related to the type of water service and sanitary waste disposal facilities used in each area of the city. The analysis of wastewater generation is now in progress on a kampung by kampung basis.

5.3 WASTEWATER SERVICE EXTENSION STRATEGY

Priority should be given to those elements of the wastewater management program which minimize public contact with human wastes.

In high density low income areas which now have poor sanitary facilities, improvements in the form of better latrines or MCKs (Community bathing, clothes washing, and toilet facilities) should be pursued.

In some areas it may be practical to consider the construction of separate sanitary sewers to provide for the collection of wastewaters from MCK's and private facilities. For example, in upper income, commercial areas (high density), the installation of a sanitary sewer system should be feasible. A concentration of these types of land uses exists in the central part of the city (see Figure 5.1) where the search for areas where a separate piped sanitary wastewater collection system is financially viable is being concentrated. The general wastewater service extension strategy for the various domestic service categories is illustrated in Figure 5.2.

As funding priorities permit, wastewaters from sewered areas can be conveyed by new interceptor sewers to a treatment facility to be located to the north of the city and treated wastewaters discharged to the Deli River (see Figure 5.1). The interceptors would also be able to collect dry weather flows from existing open drains which carry large amounts of greywaters and septic tank effluent.

In other areas of the city an effort should be made to improve open drains by frequent cleaning, lining, enlargement and covering to facilitate isolation and containment, and to prevent the ponding of wastewaters.

Financial constraints will undoubtedly inhibit rapid development of a conventional sanitary sewerage system for most of the developed part of the city. However in areas of the city where development will occur in advance of the development of the central sewerage system soil conditions are such that the application of individual subsurface disposal systems should be approached with considerable caution. Alternatives which can be considered are individual systems of special design or community-scale sanitary sewerage systems with disposal facilities operating indepedently of the central sewerage systems. Facilities of these types will be developed in conjunction with the housing sector of this study.

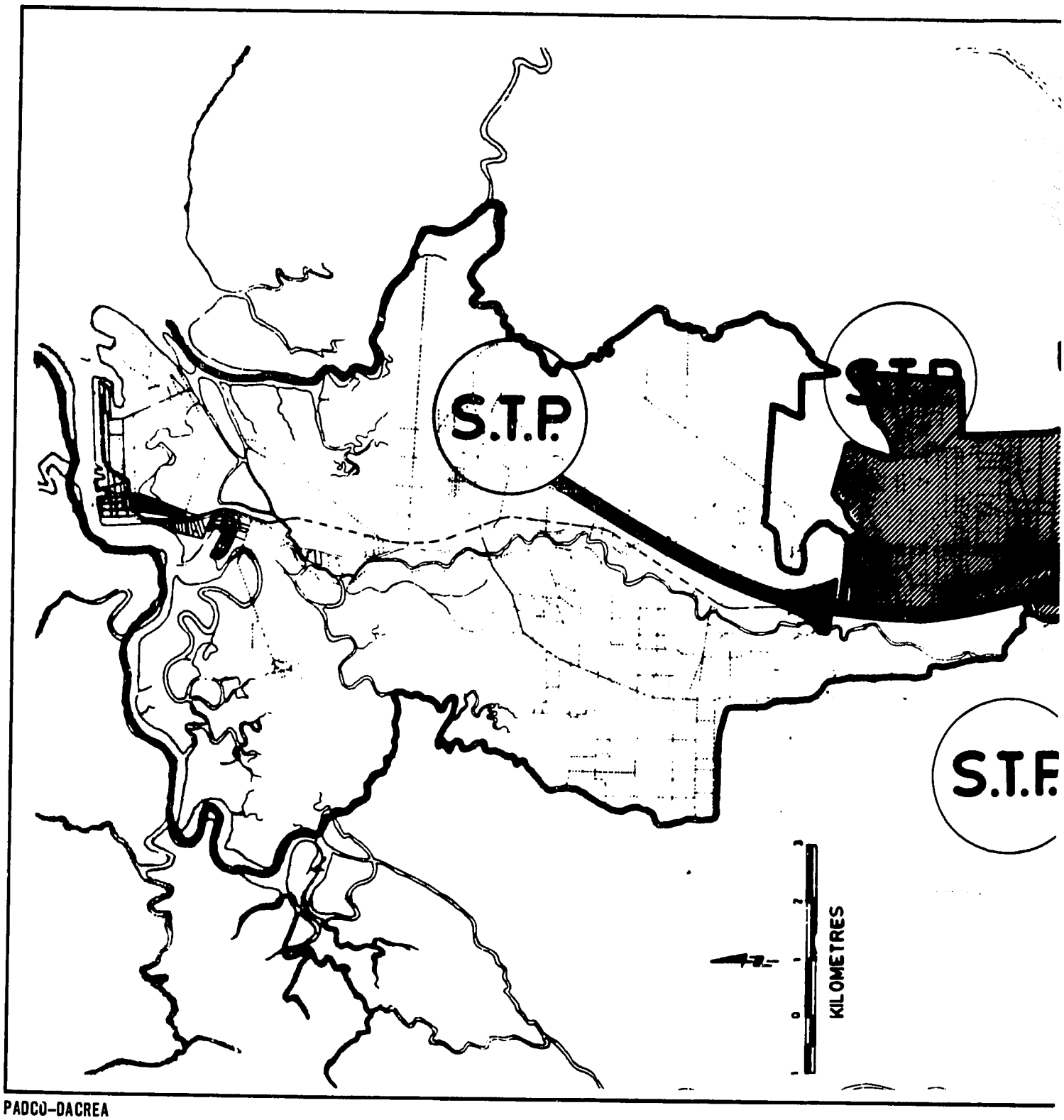


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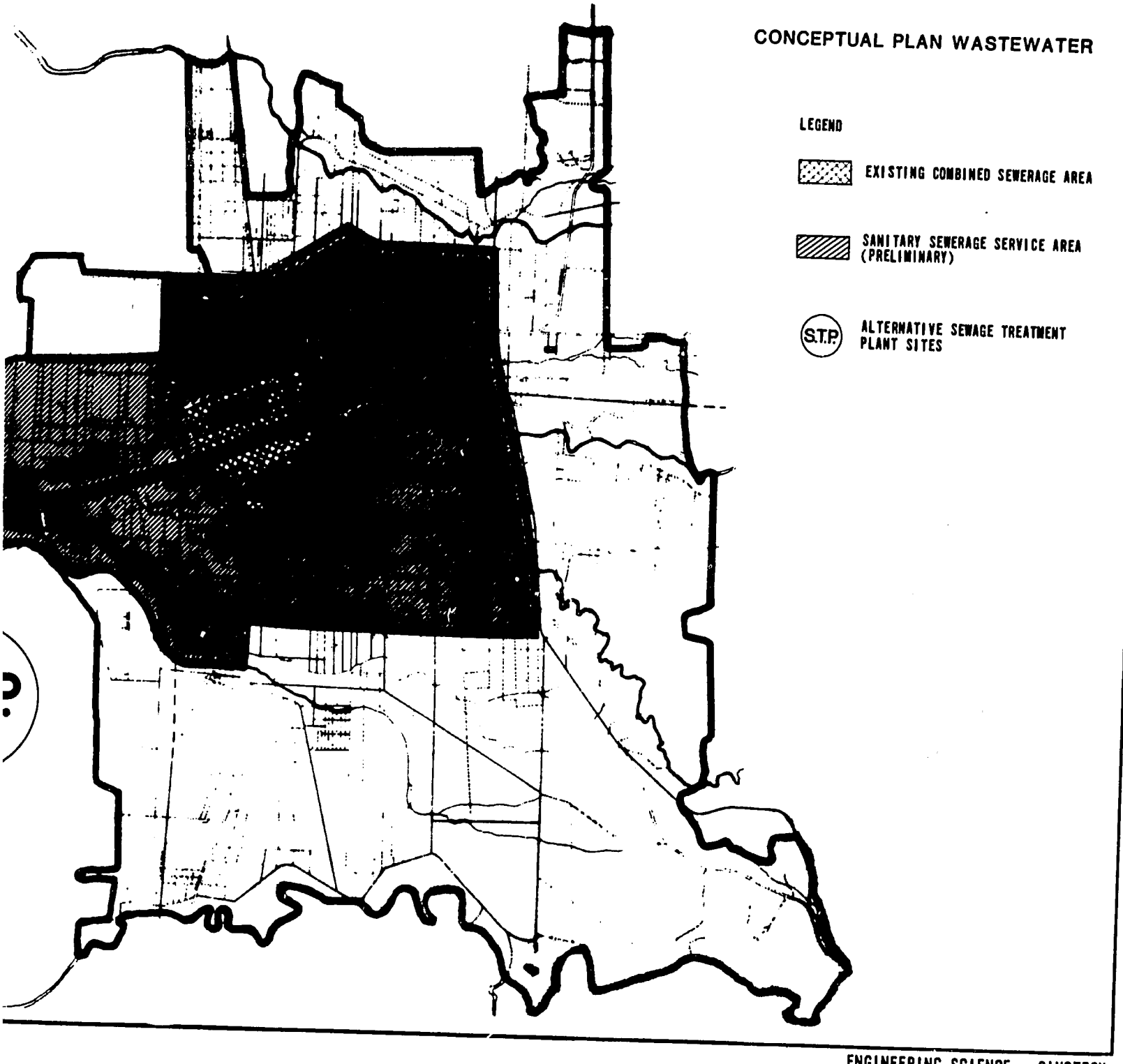
FIGURE 5.



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WASTEWATER SERVICE STRATEGY

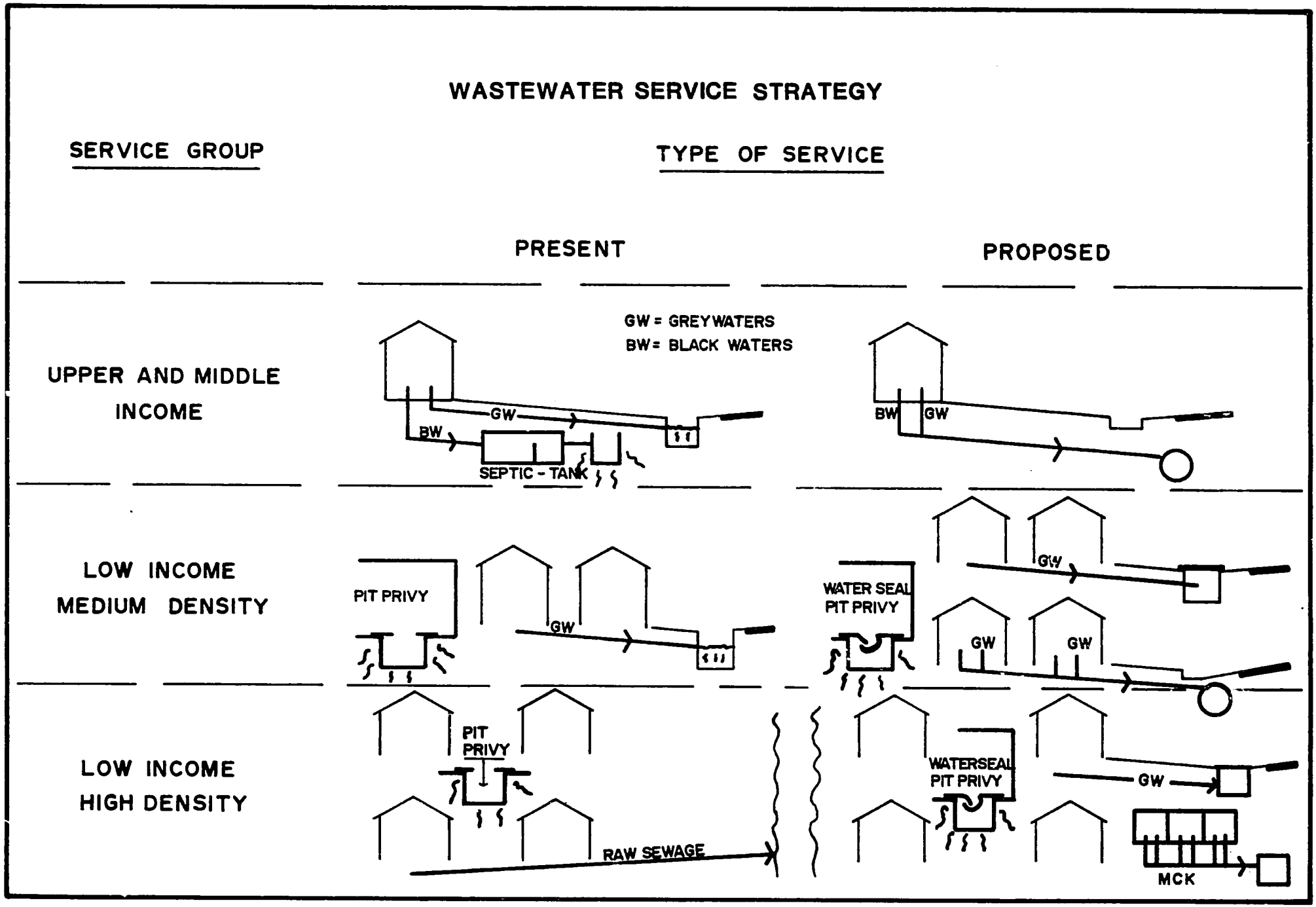


FIGURE 5.2

SECTION 6

DRAINAGE

6.1 EXISTING DRAINAGE SYSTEM

Principal natural drainage channels in the Study Area include the Percut, Kera, Deli, Babura, and Belawan rivers. These rivers constitute the waterways to which storm water drains from the city of Medan, as shown in Figure 6.1. All these rivers flow from south to north, have little slope, and frequently meander to a great extent. Solid wastes from urban areas and silt and sand carried by the streams settle and reduce their discharge capacity. In some densely populated areas there are some bank improvements and dikes but most river reaches are unimproved.

Due to the limited capacity of Medan's existing drainage system and frequent high intensity rain falls, many areas are prone to flooding. Property damage and traffic hindrance due to flooding are common events in the city. Almost all of the local surface drains are of the open channel type and many are blocked with refuse. The surface drains receive much of the grey water component of the wastewaters generated in the Study Area, and some sanitary wastewater and trade wastes. Stagnant water in these drains provides a breeding ground for mosquitos and other insects and poses a significant health hazard to the community.

The existing drainage system, as shown in Figure 6.2, serves primarily the central urbanized area. Almost all of the drains in the urban area are open channel ditches located at the edge of the road. A few circular conduit drains have been built recently under major streets. There are approximately 373 kilometres of local surface drains, 12 kilometres of which are of the circular conduit under-street type. These drainage channels carry commercial and domestic wastewater and storm water. The drains discharge directly into the nearest river.

Areas subject to regular flooding have been identified based on the available departmental information and field inspection, as illustrated in Figure 6.3. Records of flooding frequency and extent of damage, are, however, inadequate to determine the relative severity of flooding for each specific trouble area.

The major factors which cause serious flooding problems in Medan are as follows:

1. Only about 35 percent of solid wastes generated within the urban area are presently collected and removed. Much of the remainder is deposited in the open drainage channels.

2. Almost all of the existing drainage channels are, given the existing channel slopes, inadequately sized to handle even relatively high frequency storm flows.

3. The drainage system management organization Dinas Pekerjaan Umum (DPU) does not have enough man-power and equipment for adequate cleaning of the drainage channels. The DPU only employs one engineer (the Director), one experienced technician, 11 office staff and about 45 men in the maintenance section for the entire city of Medan.

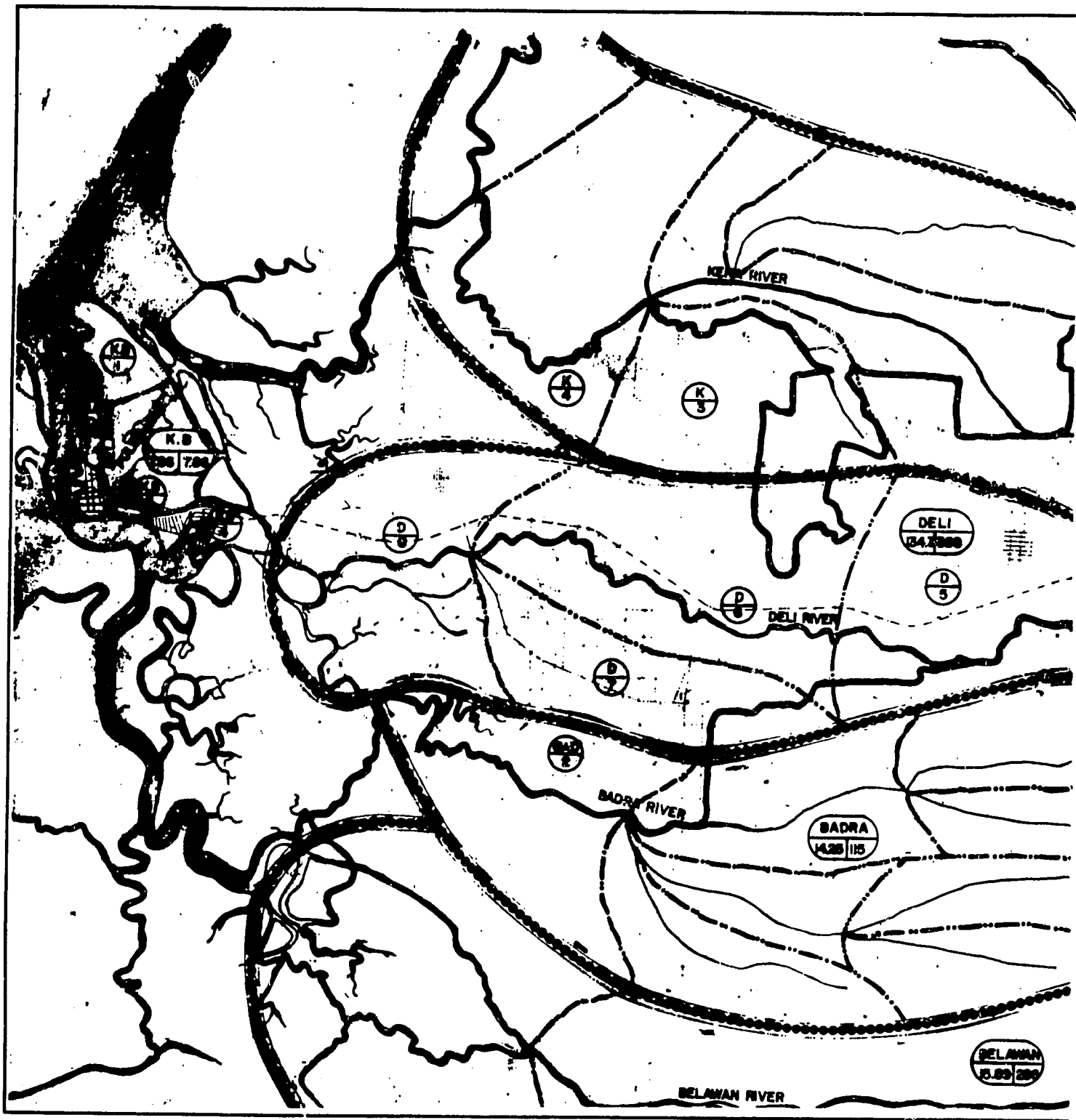
6.2 DRAINAGE SYSTEM IMPROVEMENT STRATEGY

Given the present drainage system situation, and taking into account the probable constraints upon financial and trained manpower resources under which the system must operate, and the Governments desire to extend infrastructure improvement benefits to the lower income groups, the following guidelines should be observed in formulating solutions to drainage problems in Medan.

- Staging: Priority should be given to correcting local urban flooding problems, particularly in areas with generally poor environmental and socio-economic conditions such as are being identified under the Kampung Improvement Program. Cleaning of clogged drains in these and other areas of the city and identification and removal of capacity bottlenecks in the existing major drains should be included in the first stage improvement programs to reduce flooding and to minimize the ponding of wastewaters during dry weather periods. Replacement of existing intermediate sized drains with facilities of adequate capacity should be given a secondary priority with a staged program depending upon funding availability. Although clearing debris and solid wastes from major river channels should also be given a secondary priority, major dredging and channel-straightening operations should, because of the large financial commitment involved, be approached with some caution.

- Relatively modest design criteria should be utilized in designing drainage facilities in order to provide an acceptable degree of flood protection within the financial capability of the community. The selection of appropriate levels of flood protection for various parts of the city is a subject currently being investigated.

- Develop criteria for use in implementing local drainage improvements which are carried out in conjunction with road widening programs to ensure compatibility with the drainage and flood control Master Plans for major channel improvements.



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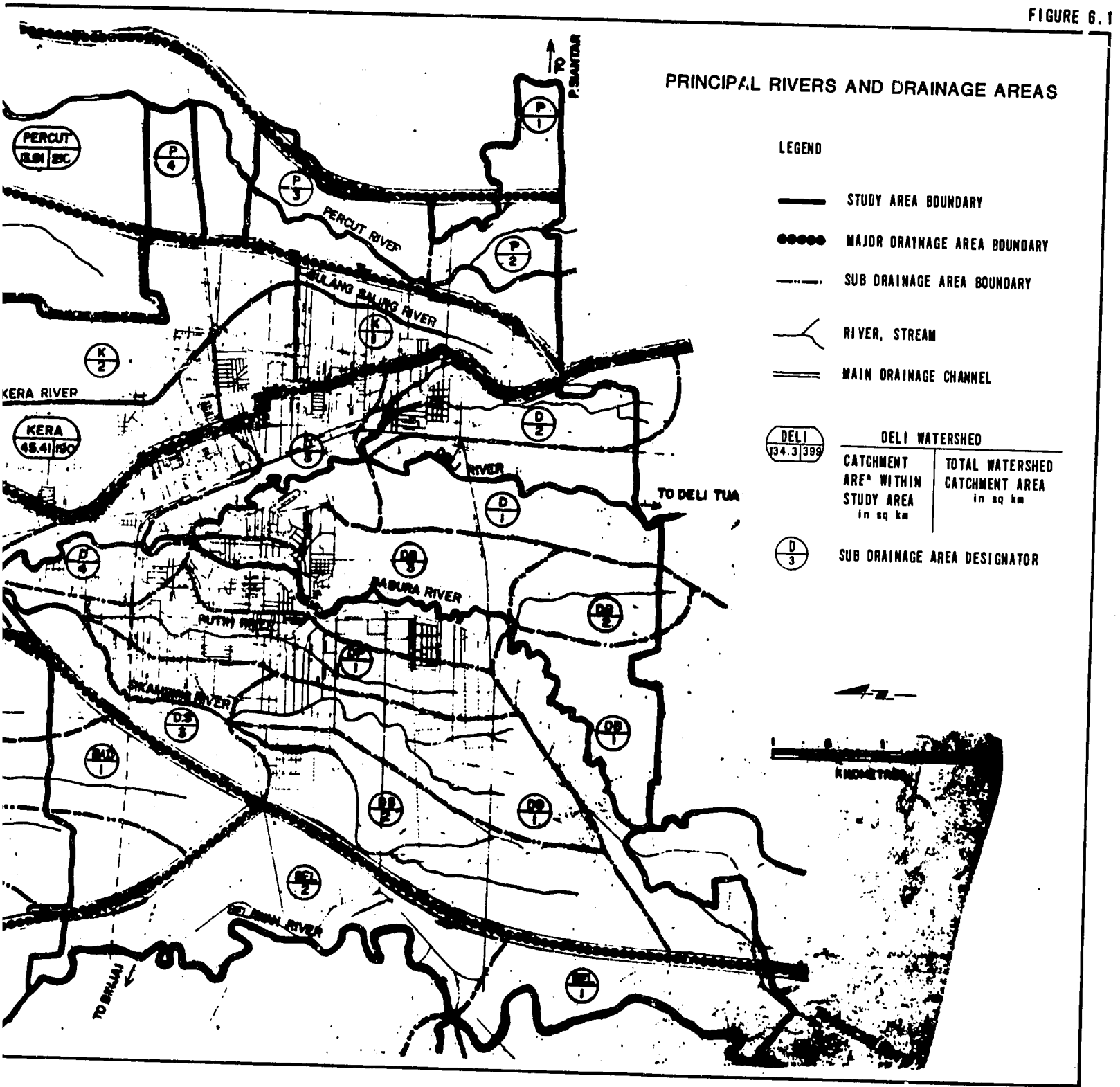
59

FIGURE 6.1



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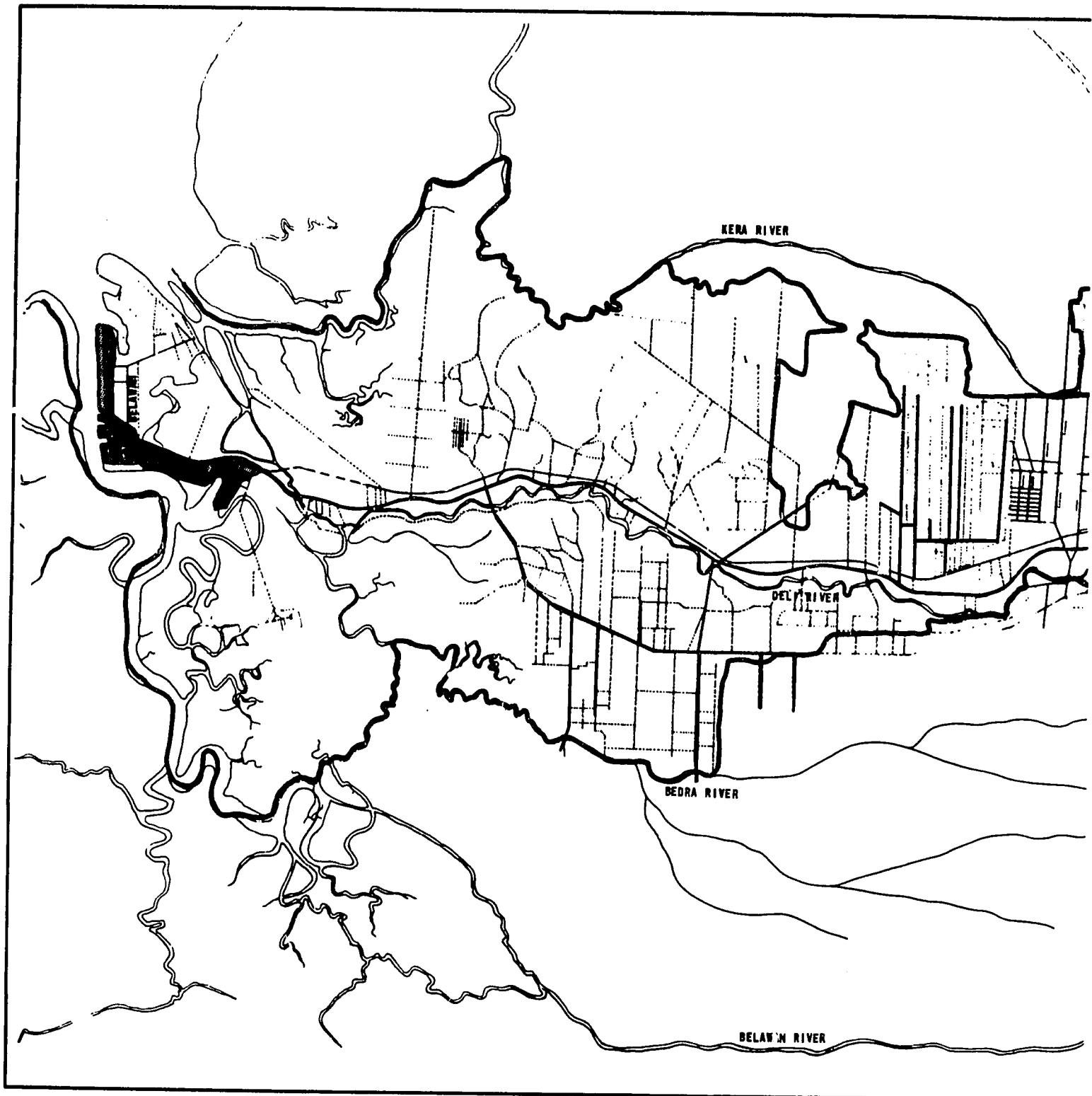

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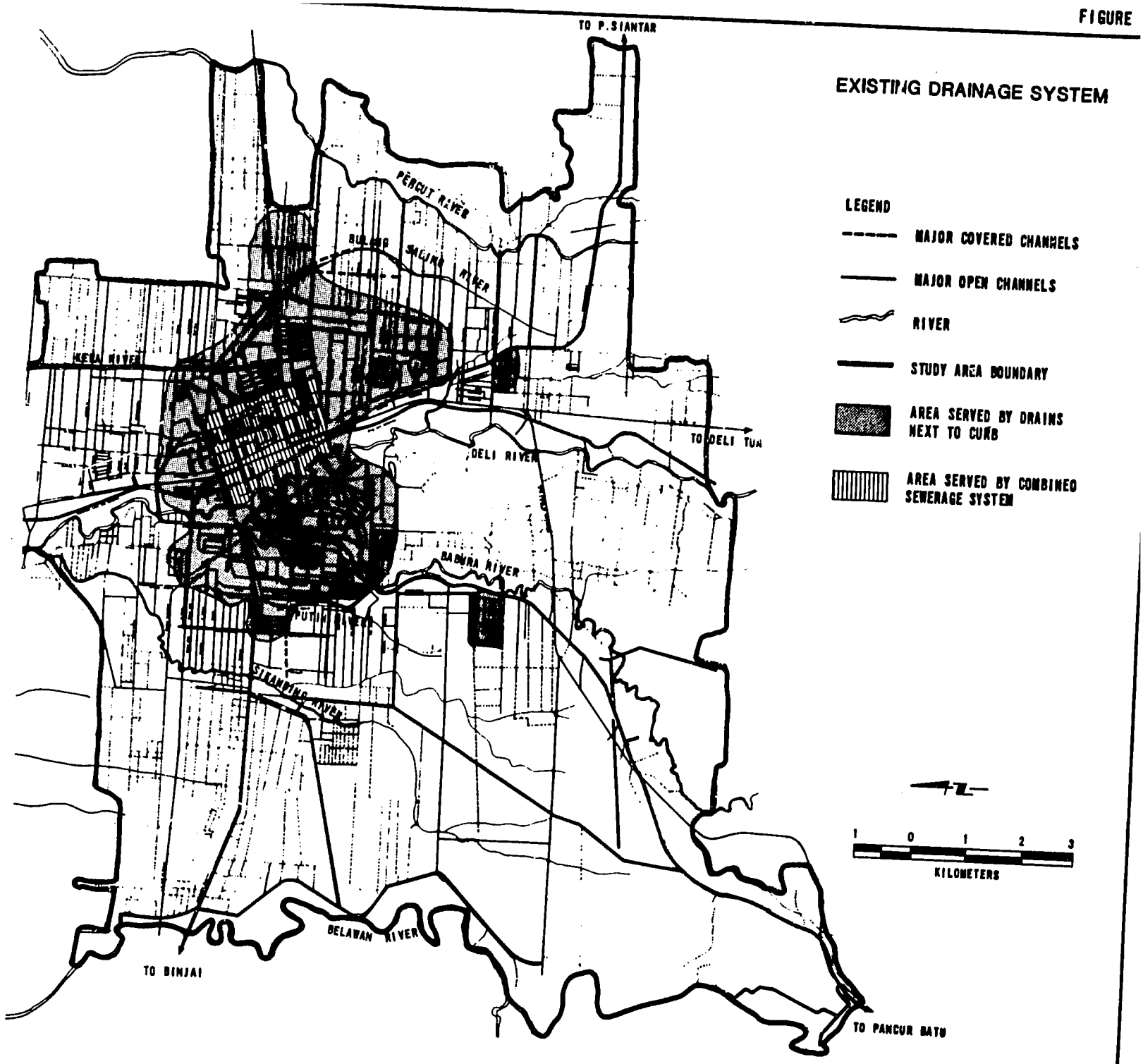
61

FIGURE



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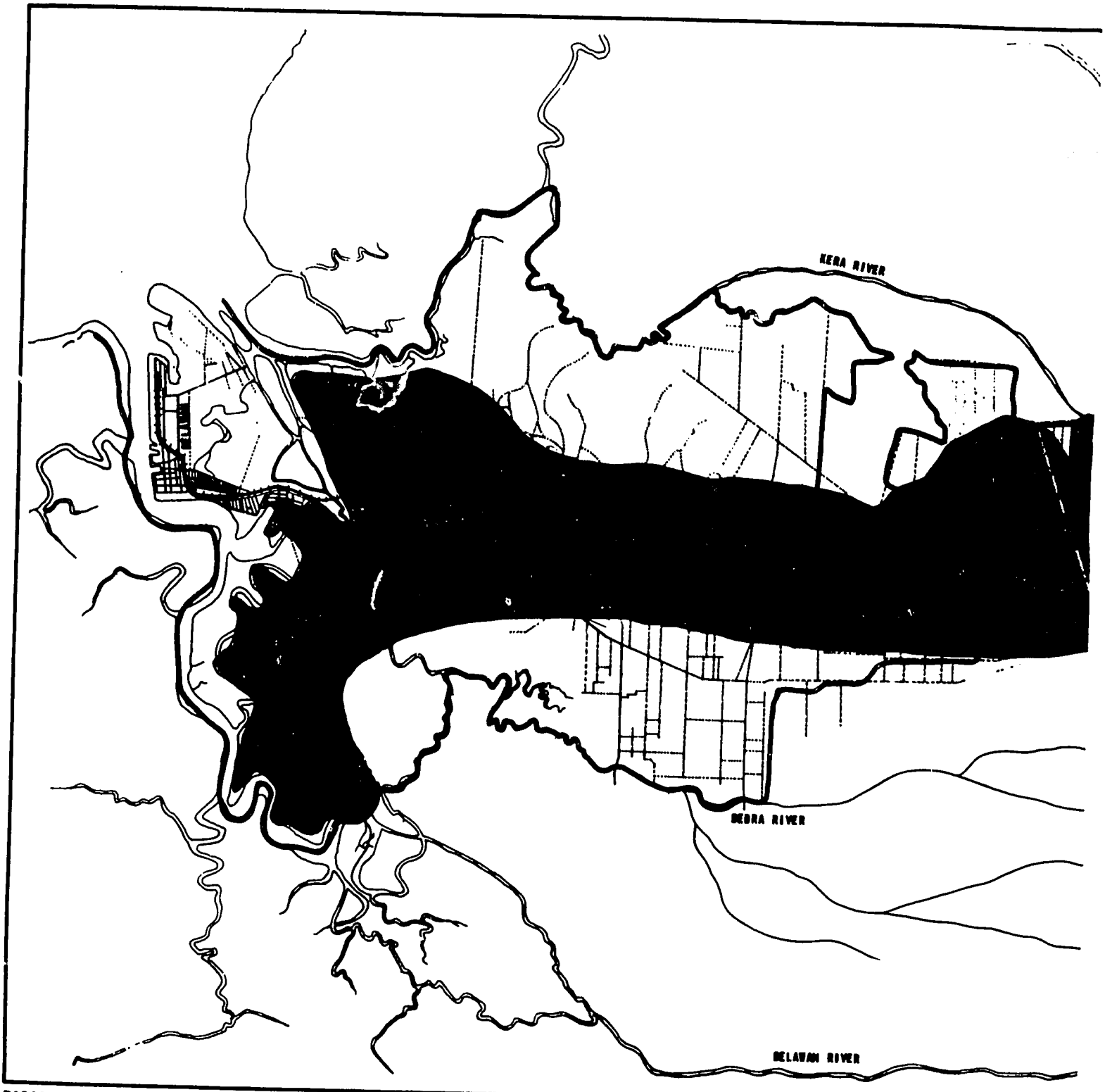

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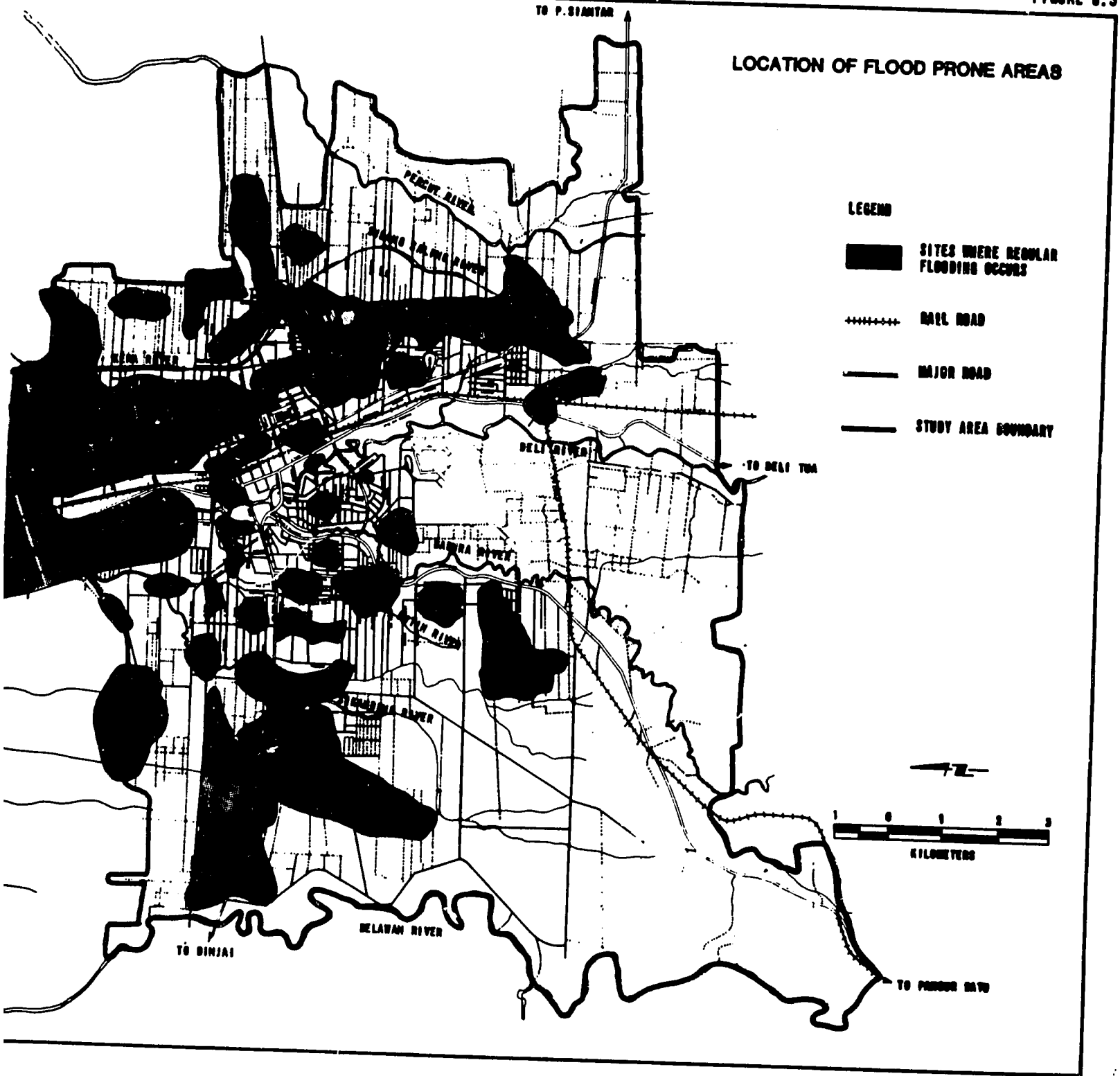
FIGURE 6.3



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64

SECTION 7

SOLID WASTES

7.1 EXISTING SOLID WASTES SYSTEMS

At the present time, municipal solid wastes collection and disposal facilities are provided to only heavily urbanized portions of the study area. Figure 7.1 shows the boundaries of the present solid waste service area. This area is divided into two categories: (1) The primary area; and (2) The secondary area. Dinas Kebersihan Keindahan Pertamanan (DKKP) provides all labour and equipment for solid waste collection transfer and disposal in the primary area. However, the collection service is organized and controlled by the kampung administration. In the secondary area, DKKP provides transfer of solid wastes to disposal areas on an irregular basis.

7.1.1 Collection

The types of collection services currently provided by DKKP are follows:

House to house - solid waste collection workers enter the compound and carry the solid wastes to a collection truck or gerobak.

Kerbside - householders place solid wastes in a container located at the edge of the road on front of each house or shop. The solid waste collection worker empties the container and places the solid wastes into a truck or gerobak. There are many types of roadside containers in use and most are in advanced state of desrepair.

Community Pool - householders or a contractor, acting on behalf of a cooperative group, carry solid wastes to a central location where it is stored until picked up by a solid wastes collection vehicle.

The level of domestic service presently being provided is illustrated by the following results of an area social and economic sample survey carried out in Medan by Bappeda Sumatra Utara and the provincial statistics office in 1978 and 1979.

Household Disposal Method	Percentage of Households
Solid waste container which is removed at a certain time	6.67
Burned at certain time	56.00
Thrown out for burial at a certain time	7.8
Thrown out to a solid waste pool	16.29
Thrown out to a stream, river or ditch	12.38
Other	0.86
	100.00

Observation made during sanitary survey field inspections in various areas of the city confirm that the level of collection service and consequent rise of inadequate local disposal methods constitute a significant health hazard and nuisance to the residents of the city.

7.1.2 Transportation and Disposal

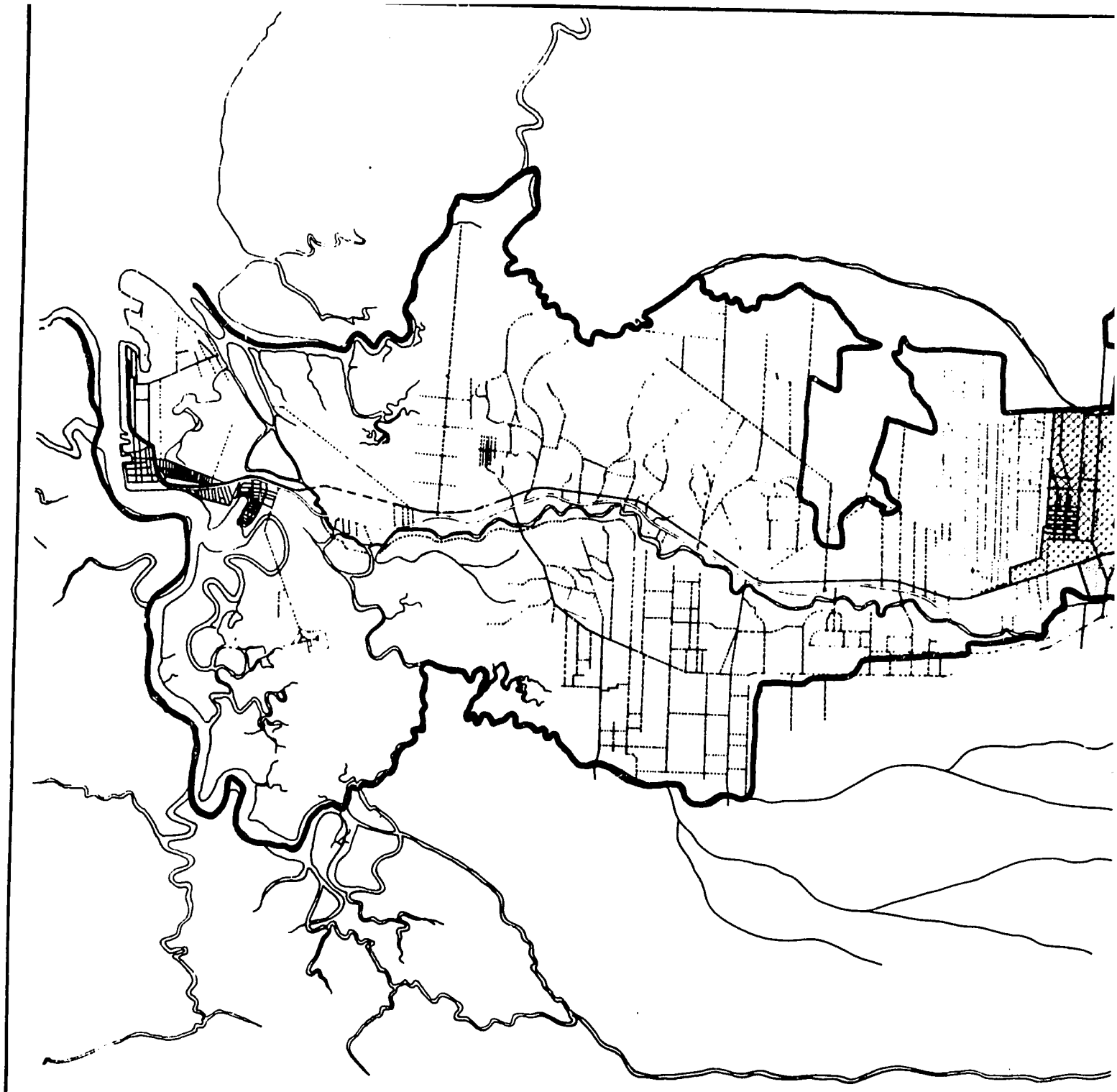
Solid wastes collected by gerobak are transported to a pool site to which householders may also carry their wastes. There are also pool sites servicing the markets of the city. At the pools, wastes are transferred to trucks and transported to the disposal sites.

With the exception of market pools,the pool sites are little more than an allocated space at which solid wastes accumulate and at which few facilities are provided to facilitate gerobak unloading, storage, and truck loading.

At some of the pool sites visited, solid wastes were stored in the open for periods of several days constituting a serious health hazard and nuisance to nearby residents.

At the present time, there are many informal salvage operations located at the various pool and disposal sites. Materials salvaged include plastic, metals, glass, wood and bones.

A cooperative study of collection and transfer method is being carried out jointly by the Government of Indonesia and the Dutch Government in four cities in Indonesia. The objective of that project is to obtain basic information with respect to: (1) The quality and quantity of solid wastes in the four cities and (2) The most suitable equipment for collection and transport of solid wastes in Indonesian circumstances. The types of equipment being evaluated are summarized as follows:



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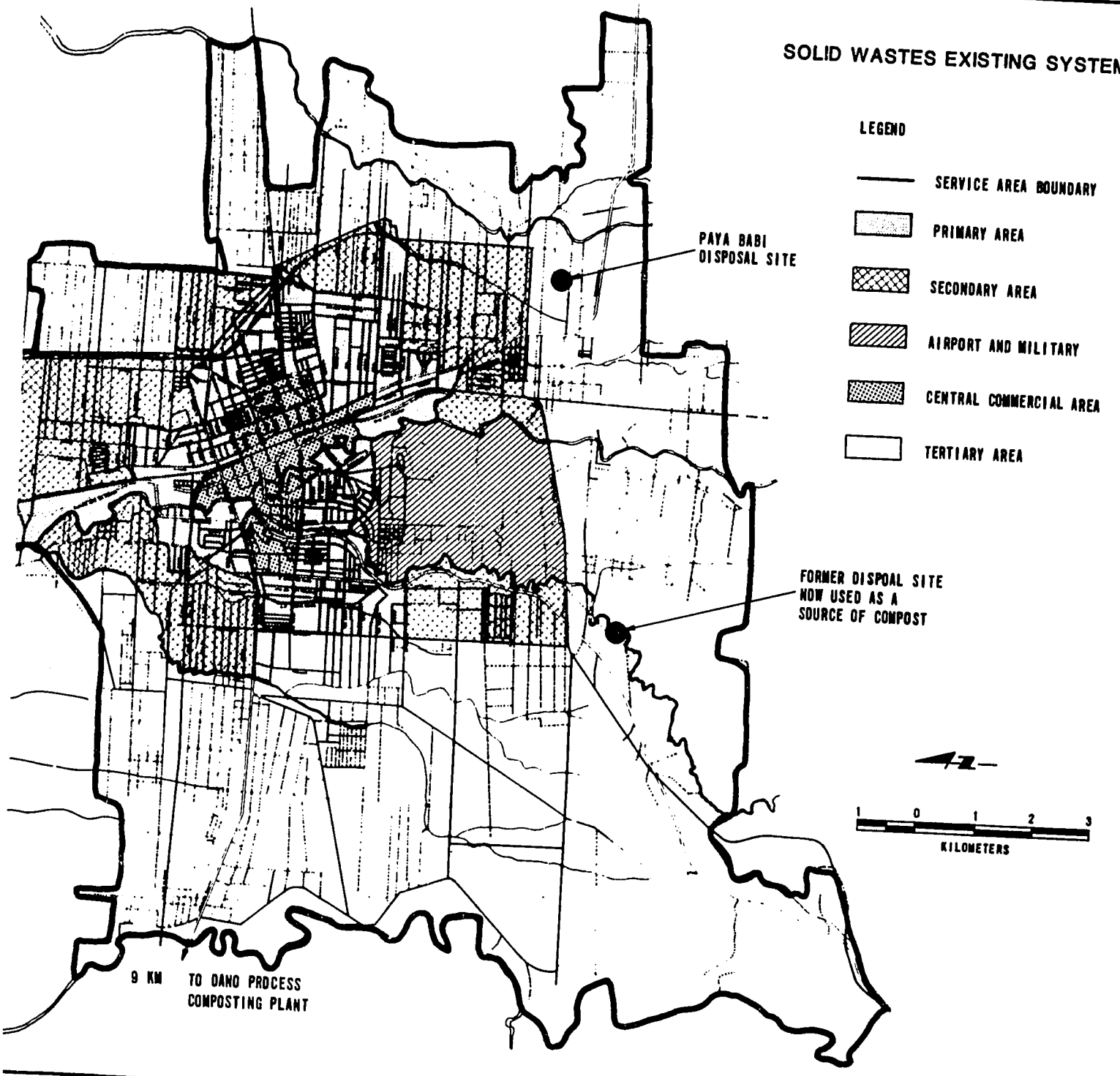
67

FIGURE 7.1



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65

City	Equipment Evaluated Type	Description
Bandung	DAF-K11RO	Wheeled containers emptied into a truck with a rotating drum type of compactor (truck contains 30 cu m uncompacted waste)
Medan	Bennes Marrel System with containers	Solid wastes are bought to a 14 cu m container - wastes are transferred to the large container which is hydraulically loaded unto the transfer truck
Pontianak	International Harvester-Fahr combination	Tractor trailer combination. Trailer hydraulically lifts 5 cu m containers
Ujung Pandang	Nooteboom System	Truck hydraulically loads 5.6 cu m and 8.5 cu m containers.

To date the results of the study indicate that the Medan: Bennes Marrel System and the Pontianak: International Harvester - Fahr combination offer the possibility of reduced transfer costs. However, as applied during the test program, problems associated with the transfer of solid wastes from the gerobak or small containers to the larger containers become evident and will require further evaluation.

Municipal disposal is to the Paya Babi dumping site located to the south east of the city. Market wastes are transported to a commercially operated composting site to the west of the city.

The Paya Babi disposal site is located in a low swamp area near residential development and is operated as a dump site rather than as a sanitary landfill in that there is no attempt to cover the wastes with earth or to control the discharge of leachate to ground or surface waters. A weigh scale has been provided at this site.

Recently the site was inoperative because spreading equipment was not available and access to the dumping site was restricted by mounds of solid wastes. A rental bulldozer has now been obtained to correct this situation.

The commercial composting plant utilizes the "Dano" process and is capable of handling about 100 tonnes of refuse per day.

A second commercial compacting operation extracts composted solid wastes from a former municipal disposal site and produces about 10 tonnes of compost per day.

7.2 SOLID WASTES - CHARACTERISTICS

The Dutch study has provided per capita solid waste generating rates and on the basis of this data present solid wastes quantities have been estimated as follows:

Area	Population	Unit Generation Rate (tonnes/capita/day)	Total Solid Wastes/Generated (tonnes/day)
Shopping Areas	111,800	0.83	92.8
Markets	-	-	75.0
Residential Areas	1,088,200	0.50	544.1
Total	1,200,000	(0.59)	711.9

Of this total amount about 415 tonnes per day are generated in the primary and secondary areas, served by DKKP.

According to 1978 and 1979 operating records about 150 tonnes per day are collected, that is about 36 percent of wastes generated within the service area.

Solid waste densities were measured by the G.O.I./Dutch programme as follows:

Market wastes 0.240 kg/cu m (DAF system)
Other wastes 0.280 kg/cu m

Future solid waste projections, as shown in Figure 7.2, were based upon the foregoing generation rates and the population projections developed under this study.

7.3 COLLECTION SERVICE IMPROVEMENT STRATEGY

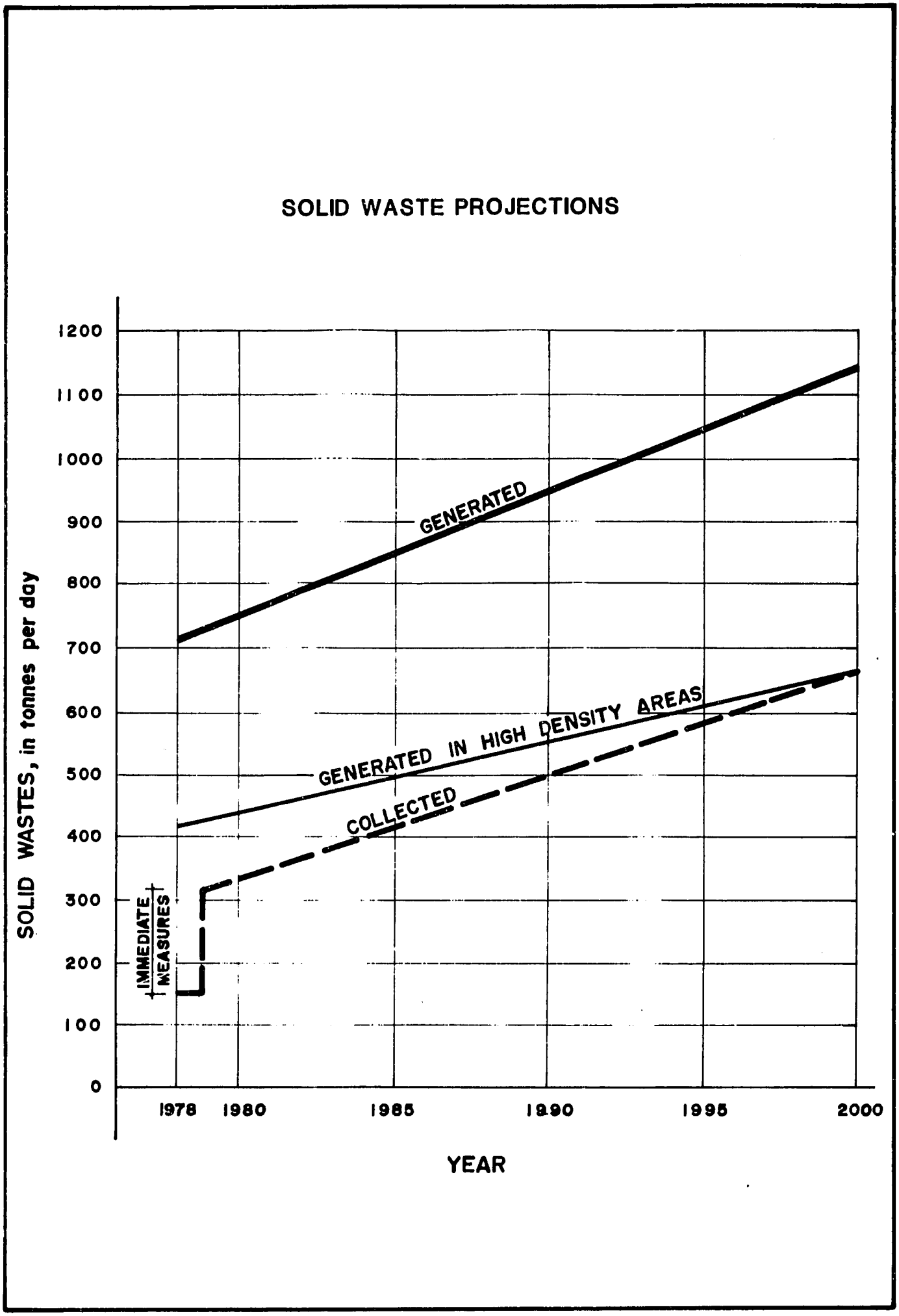
The existing solid wastes management system requires substantial expansion to:

1. Increase the quantity of solid wastes collected.

2. Provide a higher standard of service, particularly in relation to the operation of the pool and disposal sites.

3. Provide for the adequate disposal of solid wastes collected.

70


SOLID WASTE PROJECTIONS
SOLID WASTES, in tonnes per day
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
GENERATED
GENERATED IN HIGH DENSITY AREAS
COLLECTED
IMMEDIATE MEASURES
1978
1980
1985
1990
1995
2000
YEAR

To extend the collection service to include all of the densely populated areas of the city will require three times the level of efforts now being applied. The form of collection service to be applied in various parts of the city should be varied to suit the requirements of each area, the physical constraints (such as vehicular accessibility), and financial capabilities. The collection process will continue to be a predominantly labour intensive operation with gerobaks and sweepers performing the collection for any future expansion.

The following is a summary of the strategies which it is recommended be applied to the various residential groups.

Service level

1. House to house truck - upper income, low density, residential
   - upper and middle income, medium density, residential
   - commercial

2. Kerbside (a) truck - middle income, medium density, residential
   - commercial
   (b) gerobak - middle income, lower middle income, medium and higher density, residential
   - commercial

3. Lorong (a) gerobak - lower income, higher density, accessibility limited
   (b) truck - lower income, higher density, better accessibility

The collection service should generally not be more than once every two days and at least twice per day in the commercial areas.

7.4 TRANSFER AND DISPOSAL ALTERNATIVES

For areas which will continue to be served by gerobak, it will be necessary to provide transfer facilities at which the gerobaks will be emptied into collection vehicles or large containers. Wastes should be removed from the transfer facility at least once per day. The design of the transfer facility should incorporate the following features and alternatives:

- Ease of unloading gerobaks and loading trucks and containers
- Design of containers for use in residential areas, commercial areas and markets
- Arrangements to facilitate access and cleaning

12

Specialized container and container handling systems such as those included in the G.O.I./Dutch program.

Many informal dumping areas could be changed to transfer sites with some development to facilitate vehicle loading.

Sanitary landfill will undoubtedly prove to be the optimum method of solid waste disposal and alternative disposal sites will be identified and evaluated including the possibility of simultaneous operation of more than one site. Emphasis will be placed upon selecting sites which will facilitate good operations.

7.5 IMMEDIATE ACTION PROGRAM

The immediate action program for improvement of the solid wastes system should concentrate on the following:

1. Acquisition of Equipment:

   - Trucks - 37
   - Gerobaks - 150
   - Spreading equipment for landfill operations - one tracked bulldozer - other earth moving equipment as required when a disposal site with cover material has been acquired.

2. Additional Technical Support for Vehicle Maintenance and Repairs. At the present time, only approximately 35 of the total of 60 potentially operable vehicles are in service.

3. Identification and acquisition of landfill sites.

   The selection and development of good sanitary landfill sites are of primary importance. Expansion of collection service without improved disposal facilities will greatly intensify existing disposal problems.

4. Identification, acquisition and development of transfer sites.

Implementation of the immediate action program would be most logically carried out within the existing city administrative structure. The Medan Urban Development Water Supply and Sanitation Project will be able to offer advice on the desirable characteristics of sanitary landfill sites and to assist in the evaluation and selection process of various types of collection and transfer vehicles and transfer site designs. Detailed technical assistacne in implementation is, however, outside of the present project scope of work.

73