NO. 4

REPUBLIC OF INDONESIA

PHASE I REPORT ON THE STUDY OF LOW COST HOUSING PROJECT IN CENGKARENG

MARCH 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

THE STUDY OF LOW COST HOUSING PROJECT

IN CENGKARENG

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INTRODUCTION

INTRODUCTION

1. OBJECTIVES OF THE STUDY

In Indonesia, there is a remarkable convergence of the population towards the cities, especially the capital Jakarta. From the point of view of public welfare situations, a political solution to the housing problem caused by this convergence is desirable. Under the circumstances, the Government of the Republic of Indonesia decided to put into practice the development study in Cengkareng area which lies about ten kilometres west of the centre of Jakarta, where the land is already partly owned by the government. This is one step in the practical housing construction planning which plays a leading role in the third five year project (1979.4-1984.3).

This development study is divided into Phase I and Phase II, and the former, Phase I, consists of pre-feasibility study which has been carried out.

2. WORK ORGANIZATION AND PERSONNEL ORGANIZATION

(Japanese Advisory Committee)

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Mr. HAJIME SABO	Town Planner NAEC
Mr. SHUNJI KAWADA	Architect NAEC
Mr. SHUNRAN TAKAHASHI	Structural Engineer NAEC
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(Indonesian Steering Committee)

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(Japanese Housing Expert)

Mr. SHINSAKU KANETAKI

Mr. HAJIME YOKOBORI

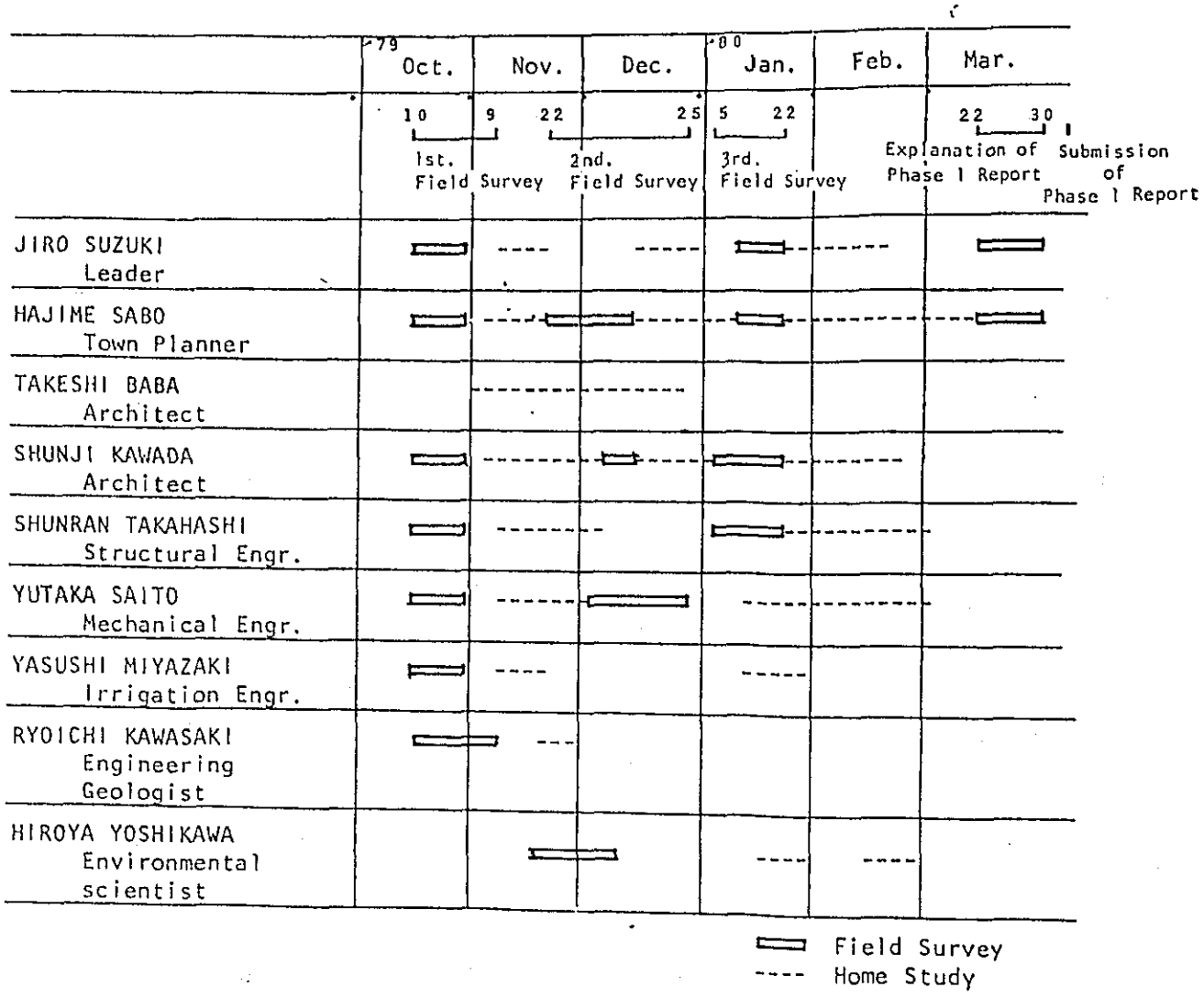
Mr. TOSHIO UETAMA

Mr. HAJIME OBATA

3. SCHEDULE

Studies including field surveys, which were carried out three times consecutively, were carried out according to the following schedule.

3-1. General schedule



3-2. Main items

1979 12th Oct.	Inception report discussion
16th Oct.	-do-
17th Oct.	-do-
18th Oct.	Arrangement of studies and schedule
26th Oct.	Inception report discussion and signature of the minutes on the discussion by Ir. Suyono,and Suzuki.
26th Oct.	Discussion on the results of the first field survey
27th Oct.	"
14th Dec.	Presentation report by the Japanese Study Team. (Joint conference with Indonesian Steering Committee and Counterpart.)
15th Jan.	Discussion on the results of the studies based on the first and second field surveys.
18th Jan.	Interim report by the Japanese Study Team. Joint conference of Indonesian Steering Committee, Counterpart, Japanese Advisory Committee, delegated experts, Japanese Embassy and JICA.
21st Jan.	Signature of the minutes on the interim report conference by Ir. Suyono,and Suzuki.

4. BACKGROUND OF THE STUDY

Indonesia stretches from latitudes 6° North to 11° South, and from longitudes 95°East to 141°E, and is the biggest archipelago in the world, spreading 1,888km from South to North and 5,110km from East to West. The number of islands is said to be 13,667, inhabited islands 6,000 and it,s area is about 2 millon km². The population is the fifh largest in the world, being about 130 million(1974). The climate is divided into a dry season from November to March, and the average amount of rain per year is atout 2,000mm. The Indonesian islands consist of mainly low and swampy areas.

The area of this housing project is an area which is about 10km west of the capital, Jakartâ. There is a remarkable convergence of the population towards the cities, especially on the capital Jakarta. From the piont of view of public welfare situations, a political solution to the housing problem caused by this convergence is desirable, and there is a big expectation of housing development.

The Government of the Republic of Indonesia has carried out the development of housing materials and standardized designs of 45m² type houses, and constructed pilot houses in PELITA I, then, laid emphasis on the policy towards housing in PELITA II, and has prepared a housing administration organization, and at the same time, a large increase in Public housing has been made. In PELITA III, the Indonesian Government expects to take a leading role by holding an important position in housing policy and supplying a large number of houses.

As one of the practical housing development studies, the Government of the Republic of Indonesia requested the Government of Japan to implement a study of Low Cost Housing Project (KTA-20). The Japan International Cooperation Agency (JICA) conducted the survey, having been entrusted by the Government of Japan to do the work.

The JICA dispatched a preliminary study team led by Mr. Kazuo Koida. director of Japan Housing Corperation, to the Republic of Indonedia in February 1979. During their stay, they discussed on the location of the project area and the scope of work. Finally, the location was decided in Cengkareng instead in Depok, former named area. Based on the result, the field survey began in October,1979.

This study, Phase I, is a pre-feasibility study finishing in March 1980, and Phase II, a feasibility study is expected to start later on.

5. SUBJECTS OF THE STUDY

5-1. Subject of Phase I

The study on the low-cost housing development in Cengkareng and the walk-up flats suitable for this district.

5-2. Location of the Cengkareng District and Problems relative to this District

The Cengkareng District is located 10 km west of the center of the Jakarta and covers residential and light industry districts developed along the Tanggerang Highway. At the master plan of DKI, there are many development projects covering construction of an airport in the near-by location and OUTER RING ROAD, etc., and accordingly, this particular District features an extremely high position in the positional potentialities. The planning area is a typical paddy field district located along the JAVA SEA and at this moment, paddy field cultivation works are being performed, and in comparison with other PERUMNAS housings this district is located in the positional high-graded potentiality and a defective condition attributable to the swampy area. The other special conditions are that the area acquired by the DKI JAKARTA since 1972 occupies only 127 ha out of the planned area of 330 ha, and, further, that this acquired area itself has many "holes" and uncertainty of implementation program drainage.

5-3. Preliminary Surveys of Problem Points and Analysis Thereof

•Problem concerning the Low and Swampy Area

In relation to the fact that the KLENDER and DEPOK Districts which have already been developed by PERUMNAS and which are located in the suburbs of JAKARTA are situated on the higher land, the Cengkareng District is situated in the low and swampy area near the sea coast and, accordingly, water drainage, filling and stabilization of ground are necessary for building of houses. Soil surveys have been made by boring and sounding. And at a later date, topographical surveys have been made by PERUMNAS.

As conclusions of the land development for living and partial construction of walk-up flats, the following points have been taken into consideration for the land development available for living:

1) Inflow of rain water and other water from the sources other than that of the housing district should be prevented:

2) Filling of soil should be made to the lease possible extent (average estimated filling height at this moment is 15 cm).

·For Supporting of Buildings

1) Supporting piles, 10 ∿ 15 m long, should be installed in accordance with the results of boring and sounding surveys for walk-up flats:

2) For low-rised houses, it was studies that by adoption of continuous footing and partial improvement of surface soil:
Further, an increment ratio of the foundation costs according to the aforesaid operations amounts by the trial calculation to the order of 5 ∿ 10 % under the condition which will be described in the following. As far as the present stage of pre-feasibility study is concerned, it can be estimated this plan has an overall possibility of realization.

·Problems concerning the Planning Area and Unaquired Land and the Implementation Program of Main Drainage System

The acquired land of the planned areas (DKI JAKARTA 400 ha, PERUMNAS 330 ha) is totaled to only 127 ha, corresponding to approx. 1/3 of the whole area and the land acquisition has been made without order and accordingly some decisive actions in purchasing and land readjustment are necessary in the coming period, if possible. Further, determination of the implementation program of the main drainage system by the PBJR has an important bearing on the determination of fundamental principle of the infrastructure plan of this master plan.

In this master plan, operation of the stage plan shall be taken up as one of the problems to be developed relative to the studies on implementation of this master plan in the future.

·Problems concerning Sales Prices and Definition of Purchaser Classes

With respect to the purchaser classes of low-cost houses studies have mode as to their incomes and related specifications as shown in the attached table. With the cross subsidy of the partial transfer of empty lots and

transfer of commercial land as considered in PERUMNAS, the persons of the middle zone will be able to afford to live in.

In the development plan in the following stage, the Government subsidies, partial payment by the upper-grade public operations and detailed study of cross subsidy need to be examined.

5-4. Positionings of Each Element by the Development Surveys and Evaluations

·Positioning of Each Element related to the Cengkareng District Low-Cost Housing Development Surveys and Evaluations

(Refer to the summary table shown in the following page.)

5-5. Summary in the Pre-feasibility Stage and Trial Calculation

The alternative plans have been developed using the change of arrangement of the community facilities and the community structure, especially as an coordinate axis derived from the overall study of land use, arrangement of the community facilities, specific density of houses, types of houses, community structure, infra-sturcture and preparation of housing site. Then, numerical evaluation is made at the total project cost, number of houses and sales prices.

As a stage of pre-feasibility evaluation, it can be estimated that the future detailed studies and further studies on the implementation will reveal possibility of realization of the plan.

·Condition of the Case Study

The area meant for construction of the houses shall be divided into 2 area, i.e. 300 ha and 200 ha, that include 40 ha meant for the commercial area and the habitation density be set as the following 3 kinds, and calculation be made on overall project cost, sales cost per house under influences of price change of land and cross subsidies.

This study includes transferred housing site of 10 % and excludes commercial area.

RESULT OF TRIAL CALCULATION

		Ratio of Housing Lot (%)	Housing Density (units/ha)	Number of Houses	
				Alternative-I	Alternative-II
Lowest Density	CASE-AX (40)	40	34	8,700	5,400
Average Density	CASE-BY (50)	50	52.5	13,400	8,400
Highest Density	CASE-CZ (60)	60	87	22,300	13,900

6. PROSPECTS FOR THE NEXT PHASE

The further development study should be placed on the study of implementation based on the result of the pre-feasibility study. And the following subjects need to be examined such as construction fund, determination of houses subjected to purchase, procedures of cross subsidy, financing plan, comparison of sales and rent, stage plan, etc. And also studies of district plan, house plan and construction cost which succeed the Phase I of the master plan within the range of already determined part of the area subject to the first stage development.

SUMMARY LIST - SITE PLANNING (1)

	Present State	Preconditions	Basic Policy	Proposal	Future Subjects
1 LOCATION OF CENGKARENG	· Situated at an axis of cities between the center of JAKARTA and TANGGERANG. · Located 10 KM west to the center of the capital, JAKARTA. · Being subject to a sprawl in progress - the housing and very small factories. · Is one of the typical paddy field zone along the coast of JAVA Sea.	· JABOTABEK Plan · DKI Master Plan - new international airport, business, industry, housing, recreation, outer ring road. · Very high potentiality. · High developable pressure to paddy field zone.	· Supply of various types of housing - diverse groups, a variety of business-use land, residential type. · Establishment of lots for business-use. · Development, induction and control as corresponded with urbanization of existing communities. · Model of development of LOW SWANPY zone.	· Housing type - flats low rise houses, empty lots. business-use lots. CROSS-SUBSIDY POTENTIALITY	· Make obvious an outlook relative to the realization of various functions as in DKI Master Plan. · Anticipation of facilities demands. · Study of adjustment method in relation to regulation, induction, etc. as well as development method -- apply a brake to a sprawl.
2 PLANNING AREA	· Laid across KEL. KAPUK, KEL. CENGKARENG of KECAMATAN CENGKARENG (JAKARTA BARAT).	· DKI JAKARTA → 400 ha · PERUMNAS → 330 ha · Purchased land - 127 ha ↓ Bought in partiality, purchase of paddy fields is in progress, and communities and vegetation areas are partially bought. · Meaning of planning area. Business-use area + (induction + control) area applicability, outcome of building regulation, areas intended for purchase.	· Efficiency of adjustments of infrastructure. · Applicability of cross-subsidy. · Difficulty of undertaking (prospect) How to handle existing villages.	· 300 ha	· Change of administration district.
3 PROJECT AREA AND LAND ACQUISITION	· DKI JAKARTA has bought land since 1972 - 127 ha (as of 1979) ↓ PERUMNAS reassigned.	· Method of land expropriation. Distribution by exchange. Land readjustments. Purchase of land.	· At present, acquisition of land by purchase. · The first step is to acquire 30 - 50 ha. · How to incorporate existing villages into project areas. · Possibility of operation by KIP.	· Physical plan as corresponded with stage implementing plan. · Development by 15 ~ 20 ha units. 100 ha ↓ 200 ~ 300 ha → Purchase of land + α	· Prospect of land acquisition in the future - current price. · Possibility of some means other than buying method. ↓ Distribution by exchange. ↓ Land readjustment.
4 LAND USE	· Approx. 1/3 of the planning area is villages, green vegetation area and farms where locates higher above the sea than others. · About 2/3 is paddy field → chiefly crops of rice plant in two seasons harvest.	· Designation of the whole as housing use according to DKI Master Plan. · Land for business-use along outer ring road. · Industrial land such as factories adjacent to the outside of the area.	· Preserve existing green area → incorporate into part of city functions. · Various types of housing areas. · Concentration of business facilities at the area with high accessibility.	· Alternative - I 40 ha business-use 260 ha residential use 300 ha · Alternative - II 40 ha business use 160 ha residential use 100 ha existing GREEN 300 ha	· Anticipation of facilities demands.
5 COMMUNITY STRUCTURE	· Existing community is divided largely into two KELURAHAN. · Social organizations such as RT, RW, etc. are established. · 2,000 persons/primary school district (one (1) class/grade).	· Housing composition according to the facility adjustment model of DKL. RT = 250 persons RW = 3,000 persons KEL = 30,000 persons	· Correspondence of primary school district and social organization. · Coping with future substantiality of community facilities - improvements of facility adjustment standard and diversity of facilities. · Mixed community - multifarious groups, handling of existing villages. · A coping with construction program.	· One neighborhood unit; 4,000 persons (one primary school zone; one grade 2~3 classes) ↓ 4RT (settlement) x 4 · Alternative - I - incorporate existing villages into new housing area, to be en bloc. · Alternative - II - esteem and preserve existing villages. Constitute new housing area as an independent neighborhood unit.	· Matching with the adjusted model of DKI facilities. · Harmony between new and existing communities. Land Acquisition Method of Preservation
6 COMMUNITY FACILITY	Among the existing community, school mosque, dispensary, etc. are scattered - an degree of adjustments is low; the variation of future needs can not be met.	· Community Planning Standard of DKI JAKARTA - establish comparatively high standard for future purpose. for example, one (1) kindergarten/750 persons 500 m^2 one (1) primary school/3,000 persons 6,000 m^2 · Administration by DKI JAKARTA.	· Consideration that can meet various needs in the future - kind and content. · Measures for when just occupied and stabilized. · Land for use to be prepared by PERUMNAS, and the facility to be constructed and operated by DKI (except for private one).	· Acquirement of land for reservation. · (Example) scale of primary school one (1) primary school/4,000 persons Rate of children: 20% - 800 persons - 44 persons/class x 3 10% - 400 persons - 34 persons/class x 2	· Restudy of facility standards. · Measures to be taken in terms of softwares - management, operation - prepare plans for step-by-step countermeasures.

SUMMARY LIST - SITE PLANNING (2)

	Present State	Preconditions	Basic Policy	Proposal	Future Subjects
7 HOUSING TYPE DISTRIBUTION	· (Existing approx. 10,000 persons 1,700 houses) · The existing PERUMNAS community consists of one storied houses mostly and includes some two-storied and flat houses.	· Housing type One storied Two storied Flat Empty lot } Apply these on hand.	· Introduce various housing types into each neighborhood unit and constitute one (1) consolidated housing block with the neighborhood unit taken as a unit. · Positively introduce flat housing. · Check on the density of net area of housing lots and different types of houses by allocation ratio.	· Take measures for scenery and anti-inundation by introduction of flat housing. · Introduce two-storied houses in large quantities - meet high density · Alternative - I - New 12,800 houses Alternative - II - New 8,000 houses 1F →20% 2F →60% F →10% El →10% Existing 1,700 houses 9,700 houses	· Distribution method of flat housing and construction program. ↓ Concentrated distribution to the district center. · Development of new type housing as will meet high density - like court house.
8 ROAD PLAN	· Main roads are JAKARTA - TANGGERANG Road, JL. KAMAL RAYA, etc. · The roads in the existing villages are narrow roads such as farm road, village road, etc., and they are not properly equipped. · Traffic means - minibus, becha. · In the existing PERUMNAS housing area, pedestrial roads are appropriately equipped.	· Adjustments of main trunk roads according to DKI Master Plan - outer ring road and other. · Road planning standard of low-cost housing.	· Proper adjustments of road network in the area as will meet the improvement of future public transportation - especially measures to meet the introduction of bus system. · Separation of pedestrian and vehicle · The surrounding trunk roads are properly equipped by DKI JAKARTA. PERUMNAS maintains and repairs the roads only in the community.	· Road network that can allow access to bus route within the range of 400 ~ 500 meters. · In 4RT (250 persons x 4 = 1,000 persons - 1 settlement), space for pedestrians, as a rule.	· Prospect of demands of parking lots in the future.
9 HOUSING DENSITY	· Existing community is net 150 persons/ha approximately. · DKI JAKARTA · JAKARTA BARAT · PERUMNAS housing area 250 persons/ha Tanah Aban 1,250 persons/ha	· The density in this area according to DKI JAKARTA Master Plan is 200 persons/ha. ↓ However, this value is not fixed.	· Balance of high density and residential environment standard. ↓ ↓ Preparation of several alternatives. Meet future extension.	· 50 units/ha.	· Take measures against high density by introduction of flat housing. ↓ A coping with high current price - application of flat housing.
10 INFRASTRUCTURE ① Drainage	· K. Kapuk Muara which flow into Angke river is the drainage line for this area, but not sufficiently provided and drainage capability is also lacking. · Although the low land area is inundated during rainy seasons, no damage has been caused because of the land use as paddy fields. A relatively high land area will not be inundated.	· Even after development of this planning areas, the existing drainage line is liable to give rise to damage on the surrounding area due to inundation. · The new drainage system plan including this area is now in progress by PBJR. The water will be directly discharged from the area north into Java Sea by the new drainage system in the future.	· The plan should conform finally to the new drainage system by PBJR. After completion of the new system, accordingly, all drainage water from this area is to be discharged thereto, neither to western Baujir Canal nor to Angke river.	· In view of the new drainage system plan and local planning, two preferable local drainage lines are to be constructed, provided that the construction cost will be borne by DPU. · In order to permit water to flow into these two drainage lines, open gutters are provided, and such flow control functions as will be able to retard the flow rate of rain water are provided at distributed positions.	· The completion time of new drainage system is so far unknown, and consequently, if housing construction goes in advance, it is essential to study the stage plan of drainage best suited for the scale of development while aiming at utilization of the system as ultimate means.
② Water Supply	· There is no facility from PAM. Shallow wells are main water source. · In the existing villages, the amount of water for use is considerably little. The neighboring canal is used for washing, and the density of housing is not so much high. These reasons supplement shortage of water amount.	· In a large scale, high density comman · In a large scale, high density community as in this planning, shallow wells are very liable to run dry and tend to result in a health and sanitary problem. · According to the water supply master plan, 800 ϕ piping facility is scheduled to be provided along JAKARTA - TANGGERANG Road by 1990.	· It is planned to allow water to be supplied from PAM at a final stage. · Shallow wells are provided ready for stoppage of water supply.	· If water supply from PAM is possible it is proposed to provide a direct-connecting system or a central distribution system, provided that only the construction cost in the site be borne by PERUMNAS. · If water supply from PAM fails to get in time, deep wells will be used. · Average daily water supply per 1 household: 400 liter/day.	· Since the time of water supply available from PAM is so far unknown, the related authorities should coordinate each other in the future. · When housing construction proceeds in advance and deep wells are to be utilized, it is necessary to study the developable scale in connection with the problems of allowable pump-up water amount and subsidence of ground.
③ Sewerage	· Sewerage waste is now discarded without treatment or percorated into the underground. · It is a big problem as considered from health and sanitation.	· There is and will be no development plan by the authorities. · The low land area is geologically poor to permeability, therefore, the percoration type is not reasonable.	· Local sewerage system is to be provided. · Sewerage water is neither caused to discard nor percorated. It is to be discharged into the drainage after treatment.	· Sewage and rain water are discharged on separate systems. · It is of a combined treatment system. · Discharge of sewerage water by gravitation is topographically impossible, and pump stations are provided at several places (with independent generation sets). · Lagoon System	· It is necessary to study the sewerage treatment system in close connection with the stage development scale and its related adjustments of drainage line.

SUMMARY LIST - SITE PLANNING (3)

	Present State	Preconditions	Basic Policy	Proposal	Future Subjects
④ Solid Waste.	· The waste collection service is insufficient, and in most cases, it is locally discarded. · A dumping of waste into the river bed brings about a big social problem relative to the degradation of drainage capability of the river.	· It is a service area by DKI JAKARTA.	· Solid waste is collected by garbage trucks in DKI JAKARTA and accumulated at an off-site space.	· The collection system is to be set up in the area. · Amount of waste generated per 1 household: 10 liters/day (net)	· It is required to study management and operation systems in the area. · Take measures against the lacking of accumulation lands in the future
⑤ ELECTRICITY	· No power is supplied from PLN, and so use generator sets or petroleum lamps. · Electric 20 KV line is under construction at the surrounding roads of the area and expected to be completed by 1981.	· The completion of electric 20 KV line now in progress is deemed to be achieved in time for housing construction. According to PLN, the consumption amount in the area is sufficient in capability.	· To be supplied from PLN.	· The housing, respective facilities and street lights are to be supplied. · Average power consumption per household: 300 w/hr (net).	

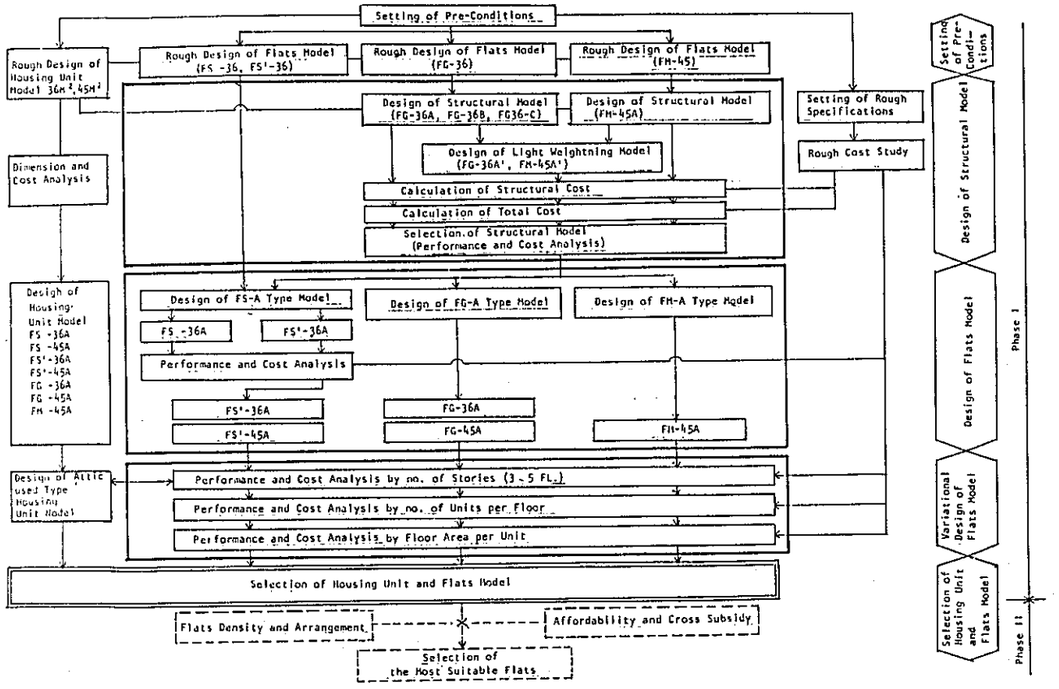
SUMMARY LIST-STUDY OF VARIOUS TYPES OF HOUSE

	EXISTING CONDITION	BASICAL CONDITION	FUNDAMENTAL POLICY	SETTING OF FUNDAMENTAL CONDITION
1. LINING STYLE AND FAMILY IMAGE	o Average number per family is 6~7 persons in existing PERUMNAS project. o Two families often share the same house. o Tendency of increasing average number of person per family in DKI JAKARTA o Close relationship to neighbours, friends & relations o Living style of enjoying outside life. - gardening - expansion of veranda o Wind direction - rainny season NW - dry season E o Solar direction - summer - from N - winter - from S o Public taste for brick houses o Public dislike for bamboo houses o Public preference for low rise houses	BASICAL CONDITION o Average number of person per family is 5 in housing policy decision. o Coping with close human relationship o Introduction of outside life to LCH especially to flats. o Requirement of good ventilation o Small influence by building direction of S-N side.	FUNDAMENTAL POLICY o To aim the plan capable of coping with an average of six people per family. o Typical family composition parents + 3 children + 1 servant o Establish the hierarchy of privacy o Application of veranda o Organic distribution of outside space o Preference of cross ventilation to inside house privacy o Avoide direct sunshine o Seeking for colourfull outlooking of houses o Consideration to psychological preference of target people.	o Combination of Veranda + access (access - veranda - living room - bed room) o Unified or separated application of service and living veranda by the grade of housing type o Functional and spacial study of footpath o Fixed slit system of upper parts of partition, door and window o Avoid of direct sunshine by canopy -esp. in flats. o Adoption of brick and unglazed brick roof tile - esp. in flats o Harmony of white (plaster) and red (brick + clay tile)
2. SPACE REQUIREMENT	o Popularity of do it yourself expansion o Tendency of decreasing of housing unit floor area ($36M^2$ → $24M^2$) o Storage space is quite small o Confusion of living level o Popularity of living room sleeping o Non-separation of eating and sleeping	o Continuity of Do it Yourself System o Lowered target group and decreasing of floor area in recent housing policy o Space requirement of each room by CIPTA KARYA STANDARD	o $45M^2$ target floor area + covered veranda after completion of expansion. o Space requirement for durable consumer's goods popular at present and in future. o Setting of sleeping level	o Flat Starting from $36M^2$ → physical posibility of expansion Starting from $45M^2$ → no expansion o Low Rise Houses Starting from $24M^2$ → 2 rooms expansion + veranda Starting from $36M^2$ → 1 room expansion + veranda Starting from $45M^2$ and over → only expansion of veranda
3. MATERIAL & CONSTRUCTION METHOD	o High price of reinforcing bar and other steel products o High price of cement o Unstable quality of RC aggregate o Problem of the safety of BATACO Wall o Requirement for the use of forest resources o Popularity of improvement of house by inhabitant itself o Bad soil conditions of Cengkareng Bearing layer of $50t/m^2$ - 10M~14M deep Middle bearing layer of $3~10t/m^2$ - ~7M deep and unstable with discontinuity Surface soil - less than $3t/m^2$ further test is needed possibility of expansive soil	o Continuity of Do it yourself System o Flats - needs piles o Row rise house - without pile o Row rise house - needs soil improvement	o Necessity of RC-work control o Minimization of volumes of cement and reinforcing bar o Countermeasure for safe masonry structure o Improvement of durability of wooden structure o Light weighing of inside floor slab o Minimization of outer & inner finish o Architectural and material planning easy to cope with expansion o Study of effective foundation & soil improvement system suitable for surface soil conditions o Study of drainage and land development system in accordance with site planning	o Comparison of structural cost and total cost by structure system o Comparison of con-block and bataco o Wood reserving treatment for necessary parts of structural wood o 1F floor system (Comparison of slab on grade and raised slab) o Adoption of wooden floor slab into middle floor of units o Flat - simplification of inner finish - completion of outer finish Low Rise House - simplification of inner and outer finish o Adoption of bamboo matts as removable partition wall o Adoption of RC pile made at the field o Comparison study of following systems ∘ Pile method and dry-up method ∘ Batu Kali and RC foundation ∘ Raised slab and slab on grade ∘ Masonry wall and wooden frame wall ∘ 1 storied and 2 storied

SUMMARY LIST-STUDY OF VAUIOUS TYPES OF HOUSE

	EXISTING CONDITION	BASICAL CONDITION	FUNDAMENTAL POLICY	SETTING OF FUNDAMENTAL CONDITION
4. STANDARD & REGULATION	o No regulation for flats o Load regulation exists o No sound insulation regulation o Fire-proofing regulation is not clear o Site regulation on Cengkareng is not finally decided		o Flexible adoption of Indonesian regulations o Discussion with DKI needed with the results of study on the site regulation of Cengkareng	o Line load & seismic load is adopted from Indonesian regulation (seismic intensity 0.1 for flats all over Indonesia) o Transmission loss of unit wall 35dB (1000 Hz) and expect the improvement by residents o Fire-proofing regulation flats - non bearing wall, roof - FR ½ hr. - other main structure - 1 hr. low rise (duplex) - basically fire-proofing structure low rise (row house) - fire proofing only where is a danger of fire spreading
5. EQUIPMENT & FURNITURE	o Shallow well etc. is used in Cengkareng district at present o Draining condition of Cengkareng is bad o Garbage collection is not seen in Cengkarent district o No electric power supply from PLN at present in Cengkareng o Popularity of possession of sofa set o Popularity of sleeping in bed o Popularity of using motorcycle for individual use	o Water supply, sewerage, power supply, garbage treatment is needed	o Water supply will be done by piping into individual unit o Sewage shall be disposed o Garbage collected by container (bucket) from each house to deposit for each 12 units o Premised electric power supply by PLN o Energy supply and storage by each unit - kerosene etc. o Public telephone equipment will be supplied o To set up outside fire-hydrant o Space requirement for the furniture and durable consumers goods with high possession ratio at present o Consideration to the furniture and durable consumers goods with possible high possession ratio in future	o 2 points (kitchen and WC/M) of water supply o Conventional water closet + mandi without shower set o Toilet mandi and kitchen sewerage are discharged on the same pipe system and treated together o Separated sewer and rainwater system o 40ℓ container (plastic bucket) carried by residents themselves o Average capacity of electric power per unit 300W for lighting, fan and radio o On the premise of bed sleeping and sofa set possession o Popularity of possession of radio iron and foot pedal sewing machine o Storage space for more than $36m^2$ type o Outside parking for motorcycle and bicycle

STUDY PROCESS OF FLAT HOUSING STUDY



CONCLUSION & RECOMMENDATION

- Roughly no big difference in total cost by structural system
- C-Type structural model is recommendable with it better performance
- Light weightning of non-structural parts, especially outer wall & wall between two units is not succeeded because competitive wall material to bataco or con-block is not available
- Among FG-Type, FM-Type, FS-Type & FS'-Type flat building, FS'-Type flat is advantageous.
- 5 storied flat is economical but has demerit
- Attic used type is attractive for cost down and 5 storied flat as attic used type is advantageous (FS'-45R)
- Number of unit per floor is in FS'-Type → 8 unit/floor
- Cost down by increasing floor area is available effectively if the increase is up to $45m^2$

PROBLEMS & SUBJECTS IN NEXT PHASE

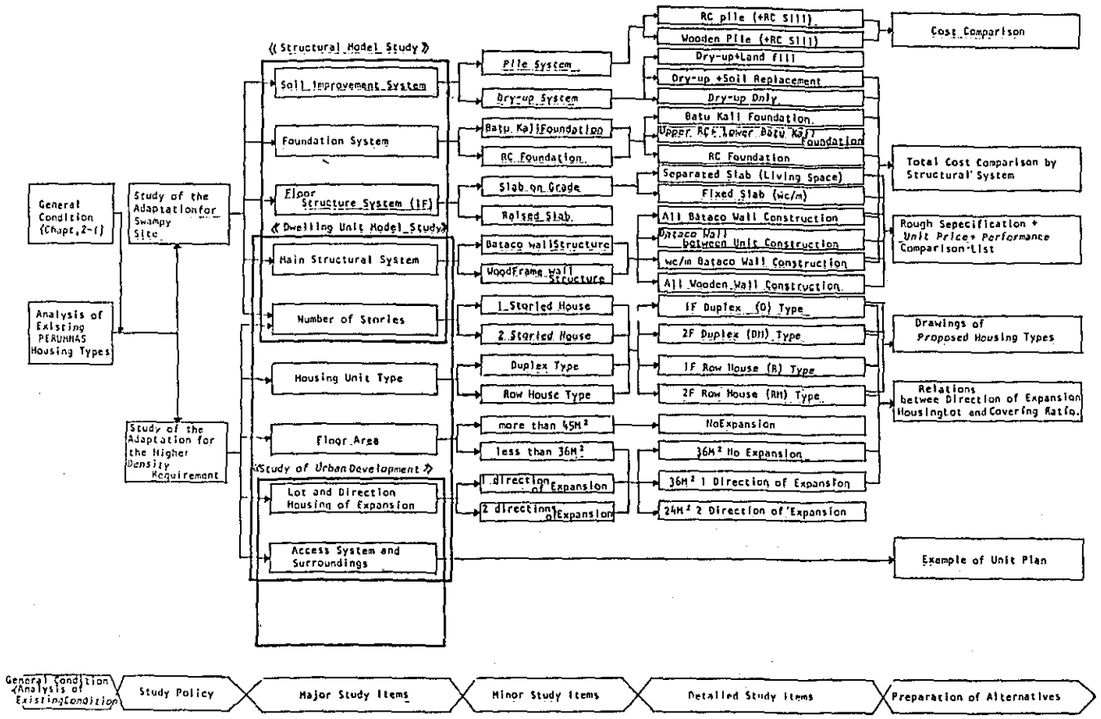
《Problems》

- Physical expansion possibility in FS or FS'-Type flats.
- Starting floor area in flat($36m^2$or $45m^2$)
- Technical problems for using attic space (sun-heat, roof leak)
- Sellection of 1F floor system will due consideration to flood damage, soil condition.

《Subjects in next Phase》

- Study of the relations between Land price increase, density and Saling price of walk-up flat
- Study of the possibilities of cost down and to higher density requirement by developing the flat building type
- Study of the possibilities of cost down by introducing the new constructing method or materials.
- Study of walk-up flat from the point of view of site planning and landscaping
- Clarification of walk-up flat in housing policy and the possibility of implementaiton
  - Walk-up flat as higher class housing
  - Walk-up flat as low cost housing with experimental meanings of non-flamable and higher density housing.

STUDY PROCESS OF LOW RISE HOUSING STUDY



CONCLUSION & RECOMMENDATION

- Batu Kali foundation is not safe if differential settlement is considered and from economical point of view mixed foundation type of Batu Kali and RC is recommendable

- For land development method following items shall be studied

  1 dry-up method
  - -dry-up only
  - -dry-up+soil replacement
  - -dry-up+land fill

  2 pile method

- Against possible expansive soil damage following minimum countermeasure is advisable in this stage.

  1. Separation of foundation and living space floor
  2. Floor jount in large floor slab
  3. Connected slab-foundation+junction pit in WC/m
  4. Pre-wetting befor floor work

- In 1 storied house Bataco(without reinforcement)house is cheaper than wooden frame structure house

- In 2 storied house Bataco and wooden structure houses anr nearly same in cost estimate

- As 1 F. floor system slab of grade system is advisable from economical point of view

PROBLEMS & SUBJECTS IN NEXT PHASE

Problems

- Foundation, soil improvement cost are calculated based on the supposed bearing capacity of surface soil because of lack of surface soil data.

- The Countermeasure to possible expansive soil shall be studied further

- Sellection of wall material, like bataco concrete block or wooden frame structure based on the further cost study and structural and other performance study

- Expansion controle from environmental hazard protecting point of view shall be studied in detail

《Subjects in Next Phase》

1. Low rise houses suitable for Cengkareng area(Swampy area)
   - Study of land development, land improvement relating to drainage system based on the topographical maps and datum of surface soil condition
   - Sellection of wall, roof material
2. Low rise houses suitable for higher density requirement
   - Study of low rise houses as a mass
   - Expansion controle ($24m^2$type, $36m^2$ type)from environmental and hazard protecting point of view
     - —building line, form and scale of lot, expansion method etc.
     - —administrative and managemental aspect
   - Study for new series of housing type
     - — R-series,small size RM-series

: TOTAL COST COMPARISON BY DIFFERENT SYSTEM OF UPPER STRUCTURE, SOIL IMPROVEMENT AND FOUNDATION

Unit Type (floor Area)	Wall Structure System		1F Floor Slab System		Foundation System			Expected bearing capacity of soil after dry-up (without soil replacement) 2t/m²					Expected bearing capacity or soil after dry-up +soil replacement by sand under foundation 4t/m²					SELECTED TYPE
	BATACO	Wooden	Slab on grade	Raised slab	RC	Batu Kali	RC+ Batu Kali	EW	INSEC	F	US	TOTAL (10^3Rp/m²)	EW+SI	INSEC	F	US	TOTAL (10^3Rp/m²)	
1F D-20 (23.80m²)	O		O	O	O	O		0.5	-	4.5	27.7	32.7	0.9	-	1.0	27.7	29.6	O
	O							0.9	-	8.5	32.3	41.7	2.0	-	1.5	32.3	35.8	
		O	O			O		0.3	0.7	2.5	36.3	39.4	0.9	0.7	1.0	36.3	38.9	
		O		O		O		0.3	1.9	2.6	40.9	45.7	0.9	1.9	1.0	40.9	44.7	
1F D-36 (37.25m²)	O		O	O	O	O		0.5	-	4.5	23.1	28.1	0.9	-	1.0	23.1	25.0	O
	O							0.9	-	8.5	25.3	34.7	2.0	-	1.5	25.3	28.8	
		O	O			O		0.3	0.4	2.5	28.9	32.1	0.9	0.4	1.0	28.9	31.2	
		O		O		O		0.3	1.5	2.6	31.0	35.6	0.9	1.5	1.0	31.0	34.4	
2F DM-24 (23.94m²)		O	O	O		O		0.3	0.8	2.3	33.4	36.8	0.9	0.8	1.0	33.4	36.1	O
		O						0.3	1.4	2.4	36.2	40.3	0.9	1.4	1.0	36.2	39.5	
	O		O	O	O			0.7	-	6.2	29.2	36.1	2.5	-	2.5	29.2	34.2	
	O							0.9	-	8.5	32.1	41.5	3.9	-	5.0	32.1	41.0	
2F DM-36 (34.56m²)		O	O	O		O		0.3	0.5	2.3	29.9	33.0	0.9	0.5	1.0	29.9	32.3	O
		O						0.3	1.0	2.4	32.8	36.5	0.9	1.0	1.0	32.8	35.7	
	O		O	O	O			0.7	-	6.2	27.3	34.2	2.5	-	2.5	27.3	32.3	
	O							0.9	-	8.5	30.2	39.6	3.9	-	5.0	30.2	39.1	
2F M-45 (44.88m²)	O		O		O			0.7	-	6.2	(26.3)	33.2	2.5	-	2.5	(26.3)	31.3	O
	O			O				0.9	-	8.5	(29.2)	38.6	3.9	-	5.0	(29.2)	38.1	
2F M-45A (47.70m²)		O	O			O		0.3	0.3	2.3	28.8	31.7	0.9	0.3	1.0	28.8	31.0	O
		O		O		O		0.3	0.7	2.4	31.8	35.2	0.9	0.7	1.0	31.8	34.4	

EW : Earth work cost SI : Soil replacement INSEC : Insectisidation F : Foundation cost
US ; Upper structural cost ( )* : Estimated cost from DM-36

LIST OF HOUSING TYPES SELECTED IN PHASE I

			Type	No of Story	Floor Area (M²) Net floor Area (A) Living Area	Veranda	Total	Common Floor Area	Gross (B) Floor Area	(A)/(B) %	Cost (x10³R) Total Cost/Unit (C)	(C)/(1)	(C)/(A)
Duplex	Improved Existing Type	O	D-20	1	24	-	24	-	24	100	710.4	29.6	29.6
			D-36	1	36	-	36	-	36	100	900.0	25.0	25.0
			D-45	1	45	-	45	-	45	100	1125.0	(25.0)	(25.0)
			D-54	1	54	-	54	-	54	100	1350.0	(25.0)	(25.0)
			D-70	1	72	-	72	-	72	100	1800.0	(25.0)	(25.0)
Duplex Massonette	New Type	O	DM-24	2	23.9	-	23.9	-	23.9	100	862.8	36.1	36.1
		O	DM-36	2	34.6	-	34.6	-	34.6	100	1117.6	32.3	32.3
Massonette	Improved Existing Type		M-45	2	45	-	45	-	45	100	1406.3	(31.3)	(31.3)
			M-70	2	72	-	72	-	72	100	2250.0	(31.3)	(31.3)
	New Type	O	M-45A	2	47.7	-	47.7	-	47.7	100	1478.7	31.0	31.0
Flat	Gallery Access Type		FG-36	4	37.4	4.7	42.1	11.8	53.9	78	3524.9	65.4	83.7
			FG-45	4	45.0	7.1	52.1	11.8	63.9	82	4117.2	64.4	79.0
			FG-45R	5	43.1	10.0	53.1	10.8	63.9	83	3747.9	58.7	70.6
	Stair Case Access Type		FS-36	4	37.7	5.2	42.9	5.3	48.2	89	3197.1	66.3	74.5
			FS-45	4	47.7	5.2	52.9	4.1	57.0	93	3707.8	65.0	70.1
		O	FS-45R	5	47.7	5.2	52.9	4.1	57.0	93	3337.0	58.5	63.1
	Massonatte Type		FM-45	4	42.8	5.4	48.2	9.3	57.5	84	3744.4	65.1	77.8

FG-R : Attic used Type Flats.
O : Sellected Type for the rough project cost estimate.

PART I

STUDY OF URBAN DEVELOPMENT

PART I. STUDY OF URBAN DEVELOPMENT

1. REGIONAL SETTING

1-1 Location

1-1-1 Natural and Climatic Situation

DKI Jakarta is situated on the northern coast in the western part of the Island of Java covering the area of 577 km^2, where the tropical weather featuring only a little change of seasons is predominant, and divided roughly into the dry season from April to October and the rainy season covering the rest of the months. Rainfall during the dry season is extremely small, for the monthly rainfall in this season is less than 100 mm, while in the rainy season, there are heavy rainfalls, but normally each rainfall in this season continues for only a short time though it falls concentratively at a time. For instance, the annual rainfall in this area is about 1,900 mm.

Annual average of temperature is about 27°C, and the temperature remains almost around this level throughout the year, though it becomes highest at the turning of the seasons, and tends to fall a little in the rainy season.

Average wind velocity is extremely samll, for it is only less than 2 m/sec. As for the direction of wind, east wind is predominant in the dry season, while wind blows from northwest in the rainy season.

Next figures show the weather data for this area. (FIG. 1-1-1)

1-1-2 Topographical and Geological Situation

- DKI Jakarta can be divided into three major regions in light of topography; the mountainous region in the upper reaches of the Ciliwung River of more than 150 meters above the sea, the upper coastal region between 150 and 5 meters above the sea where rivers are topographically clear, and the coastal region of alluvial plain of less than 5 meters above the sea where Cengkareng is located.
  The region of less than 5 meters is generally flat and contains many swampy land, and rivers are topographically unclear in many portions. Historically, this region was formed after the coastline moved northward due to deposition of sediment, and now spreads as an about 6 to 10 km wide belt from the coastline.
  In Cengkareng, the north side of the Jakarta-Tanggerang Road corresponds to this region. (Fig. 1-1-2-A)

- In light of geology, the upper coastal region of more than 5 meters above the sea comprises mainly volcanic rocks (tuffaceous sandstone and volcanic conglomerate) and volcanic sediment (tuffsand, lahar deposite, pumis flow, etc.) of Tertiary Pliocene to Diluvium. However, volcanic rocks are generally very weathered, and are covered with weathered soil of laterite.
  In the coastal region of alluvial plain of less than 5 meters above the sea where Cengkareng is located, the geology mainly comprises volcanic sediment and volcanic rocks as in the upper coastal region of 5 meters above the sea, but they are covered with thick alluvial sediment unlike those of the other region. The alluvial sediment mainly comprises cohesive soil high in cohesion and low in soil bearing capacity (alluvium) and holds a sand layer partially, being dotted with old coastal ridge of sand layer like islands. (Fig. 1-1-2-B)

1-2 Urban Activity

1-2-1 Location

- Cengkareng is located about 10 km in the west from the urban center of Jakarta and about 12 km in the east from Tanggerang, being apart from Java Sea about 4 km. The location of Cengkareng, compared with others, is as shown in Fig. 1-2-1-A, being very close to the urban center.

- As for administrative area, Cengkareng belongs to Jakarta Barat Kotamadya located in the west of DKI Jakarta which consists of 5 kotamadyas. This Jakarta Barat Kotamadya is located on the left bank side of Western Banjir Canal (Terusan Banjir Canal) and has an area of about 100 km^2, facing Tanggerang on the west. In this kotamadya, Cengkareng is located in the north end, and is adjacent to Jakarta Utara Kotamadya.

1-2-2 Spread of Population

- Jakarta formed at the mouth of the Ciliwung River in the 16th century developed gradually, and especially in recent years it shows a sharp increase in population. At the beginning of 1960, the total population was about 3 million, but 10 years later, it reached about 4.5 million. Now, it is estimated to have numbered about 6.5 million. The population increased at a rate of about 50% per decade. (Fig. 1-2-2-A)
  As for the density of population, at present, the mean density of DKI Jakarta as a whole is estimated to be about 100/ha, showing a very high value for the total area of about 600 km^2 of DKI Jakarta.

- With the growth of total population of DKI Jakarta, the increase in the density of population spread from the center to the environs, and on the contrary in Jakarta Pusat Kotamadya, population tends to decrease. In 1965, there were many kecamatans of 500/ha or more in Jakarta Pusat Kotamadya, but in 1972, there was no kecamatan of 500/ha or more. On the other hand, in Jakarta Barat Kotamadya where Cengkareng is located and other surrounding kotamadyas, excluding Kebayoran Baru Kecamatan, there were many kecamatans which had a population density of 50/ha or less in 1965 but had more than 50/ha in 1972. Some kecamatans showed values close to 200/ha.

- The above sprawling of population to the environs occurred at considerably different points of time among the respective kecamatans. In 1950s, Kebayoran Baru Kecamatan was developed, and the drift of population to southern kecamatans was remarkable. In 1960s, the drift of population to the east was observed as in Pulo Gadung Kecamatan of Jakarta Timur Kotamadya. In this movement, while the increase in the density of population started relatively early in the urban side of the Angke River, urbanization occurred little on the left bank side, with a present population density of about 50/ha. However, the sprawling in recent years is considerable, and the advance of houses in kecamatans near the Jakarta-Tanggerang Road is remarkable. (Fig. 1-2-2-B)

1-2-3 Land Use and Distribution of Major Facilities

- The land use of DKI Jakarta can be roughly classified into three types. The first type of use is urban use for dwelling houses, commerce, business, manufacturing industry, etc. The second type is agricultural use, and the land of alluvial plain is mainly used for paddy fields and the south area of DKI Jakarta with relatively high altitudes is used for upland farming and tree planting. In the coastal portion of 2 meters or less above the sea, since most of the land is swampy land unsuitable for agricultural or urban use, it is used for fish ponds. (Fig. 1-2-3-A)
  As for the land use in Jakarta Barat Kotamadya, the right bank side of the Angke River is almost urbanized. However, on the left bank side, while vermiculated urbanization has started, most area remains to be paddy fields with colonies spread like islands.

- Some details of characteristics of distribution in urban land use are as follows. As for residential quarters, while they are densely distributed in Jakarta Pusat Kotamadya and in the right bank side of the Western Banjir Canal in Jakarta Barat Kotamadya, they are not pure residential quarters but contain commercial facilities. On the other hand, also in Menteng Kecamatan and Kebayoran Baru Kecamatan which are high-class residential quarters, dwelling house areas and office areas exist together. In DKI Jakarta, there is no pure residential quarter of a vast scale and residential quarters exist among or with areas used for other purposes, as a feature of DKI Jakarta.

- Commercial facilities are distributed generally in the center of DKI Jakarta in correspondence to the above distribution of residential quarters. Especially a large-scale shopping center is not established in a specific kecamatan, but commercial centers are scattered in various areas, for their respective limited commercial territories. It is characteristic that commercial facilities do not cover wide territories with mass transport means, but they are distributed to cover relatively small territories due to lack of mass transport means.

Furthermore, the development of route commerce including street stands, etc. is remarkable, and such commercial facilities are observed in various areas of DKI Jakarta.
In Cengkareng, though a shopping center is located to cover the area along the Jakarta-Tanggerang Road, there is no area where commercial facilities intended for a wide territory are densely built.

- Offices are distributed in specific kecamatans unlike commercial facilities, viz. in three kecamatans of Gambir, Menteng and Kebayoran Baru. However, in this case, as mentioned before, the kecamatans are not exclusively used for offices, but have favourable residential quarters around them.

- The manufacturing industry has been sharply increasing since the beginning of 1970, but most factories are medium to small. Many of these factories do not show the clear land use as factory zones, but are densely constructed in the center of DKI Jakarta together with dwelling houses, etc.
In Cengkareng, medium and small factories are constructed mainly along the Jakarta-Tanggerang Road, and are being constructed also along the Cengkareng-Teluk Naga Road.

1-2-4 Traffic System

- Some of first grade trunk roads of DKI Jakarta were developed already in 1960s, and the total length reached about 400 km in 1975. Second grade trunk roads were rapidly improved in 1970s, and during 5 years from 1970 to 1975, about 600 km of roads were improved. As of 1975, the total length is about 1,300 km.
  Of these trunk roads, for example, JL. Thamrin, JL. Senen, JL. R.S. Said, JL. R.J.G. Subroto, etc. are typical, being sufficiently wide under satisfactory maintenance. However, with the increase of traffic volume, the intersections of those trunk roads cannot meet traffic volume, forming largest bottlenecks.

- Trunk roads in and around the center of DKI Jakarta are formed as radial and outer ring roads. In Cengkareng, Jakarta-Tanggerang Road, a radial road is arranged as an important trunk road connecting Jakarta with Tanggerang and other western Java areas. (Fig. 1-2-4-A)
  Af for roads for everyday life, in Cengkareng as well as generally in DKI Jakarta, many roads are yet to be improved, considerably hindering the safety and convenience of the kotamadya. However, in recent years, the improvement of pedestrian roads has progressed remarkably by Kampung improvement program.

- As public transport means, bus service is established over the entire DKI Jakarta, though not quite satisfactory. At present, 9 bus terminals are provided for inner service in the city and 4, for outer service with the city. There are two bus routes of general buses and mini-buses, respectively spread over the entire city based on the bus terminals.
  In Cengkareng, two routes of general buses and mini-buses are arranged based on Grogol bus terminal in the Jakarta-Tanggerang Road. On the other hand, in Cengkareng-Taluk Naga Road, there is a mini-bus route based on Kota bus terminal, for service for the entire kotamadya.

- With regard to railway network, lines for the respective districts of Java Island are developed based on Jakarta Kota station. Further for Depok and Bogor in the south of Jakarta, the function as a commutation railway is rising, with the increase of commuting population destined for Jakarta. However, in general, railways are low in the function of urban traffic like the railway passing through Cengkareng to Tanggerang.

1-2-5 Infrastructure

A. Drainage

- The most important drainage canal in DKI Jakarta is Western Banjir Canal constructed in 1920. It connects the Ciliwung River with the Angke River, functioning to discharge most of rainwater in the upper reaches to Java Sea. However, the existing drainage system including the Western Banjir Canal cannot catch up with the speed of urban expansion, though it has been extended in the effort to meet the expansion. Now, it cannot satisfy urban functions. Furthermore, many of existing rivers and drainage canals are shallow in the bottom, due to insufficient maintenance by dredging and dumping of refuse, and cannot demonstrate their function sufficiently.
  For this reason, in various regions of DKI Jakrta, especially in the eastern region, floods and inundations occur often, and become a major urban problem of DKI Jakarta.

- Therefore, in February, 1965, for the purpose of discussing urban drainage planning, the disposal of drainage from the upper reaches and the disposal of stangnation in the dry season, a task force called Proyek Pengendalian Banjir Jakarta Raya (P.B.J.R.) was organized in the Ministry of Public Works and Electrical Power. (D.P.U.T.L.) This committee decided to make a drainage plan in line with the DKI Jakarta Master Plan intended for 1985 to 2000, assisting DKI Jakarta.

B. Water Supply

The management body of waterworks of DKI Jakarta is PAM. (local water supply authority) Main facilities are constructed by CIPTA KARYA, and are transferred to PAM after completion.

The water from PAM is supplied to about a half of the total population of DKI Jakarta, and others buy water from water vendors or use private water sources (shallow wells, etc.)

Present water sources of PAM are a spring at Bogor and the Ciliwung River at Pejompongan, and the total capacity of both is 5,300 lit/sec. They do not have a generator set. Since the pipes are old and small, the water pressure is generally low, and in many areas, pipes are buried. Private water sources are mainly deep wells and shallow wells, but their quantity of water cannot be said sufficient.

As for water quality, the Ministry of Health, (KESEHATAN) CIPTA KARYA, etc. have specified standard values, but it is difficult for others than PAM to conform to the values.

C. Sewerage

At present in DKI Jakarta, they do not have a sewerage treatment plant, and sewerage is discharged finally into Java Sea through rivers and floodways.

Sewerage from toilets of houses is treated in a septic tank or cesspool, being made to percolates into the ground or is discharged directly into rivers, etc. In Kampung, there are many houses without toilet, and they discharge outdoors or into rivers. Thus, the environment is very insanitary, and the life sewerage is a large element of urban pollution. Regulations for the quality of water to be discharged are now prepared as a draft.

D. Solid Waste

Solid waste is collected and treated by Cleansing Div. of DKI Jakarta, and the volume handled by them accounts for about 60% of the total generation in DKI Jakarta. Other waste is mostly dumped illegally into vacant land and rivers. The dumping into rivers is not only insanitary, but also narrows river channels, causing floods.

With regard to the general collection of waste, waste is once stored in garbage storages for the respective houses or areas, and are collected by garbage trucks, to be dumped for accumulation.

E. Electricity

The main management body of electric power service is PLN (National Electric Company) and the power supplied in 1975 amounted to about 1.2 million Mwh. in DKI Jakarta.

High-voltage transmission is made generally at 150 kV and 70 kV which are transformed to 20 kV, and further to 220/380 V to be supplied to individual houses.

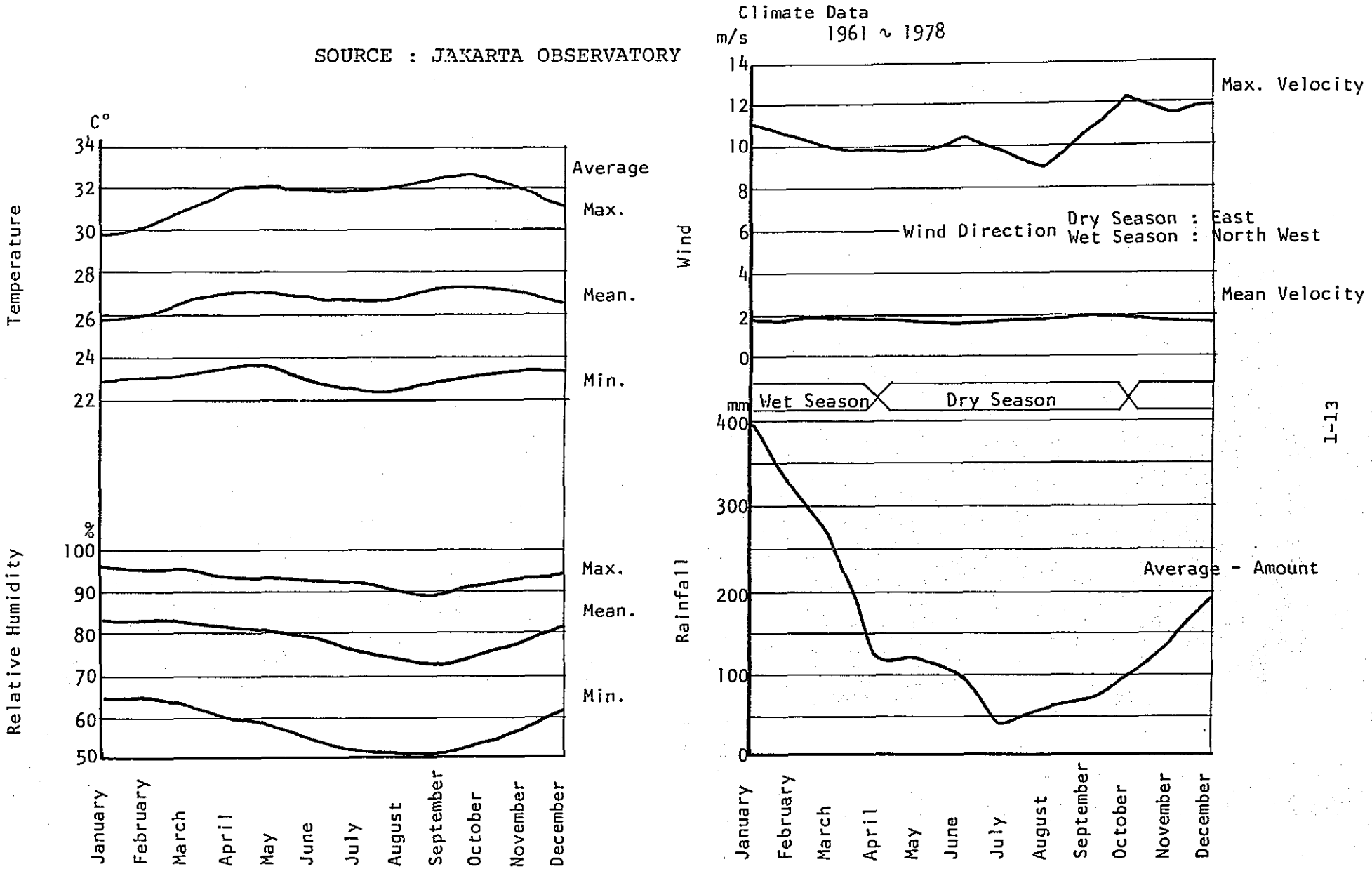
Now, the supply by PLN is not sufficient, and in the areas where electric power is not supplied, independent power plants or oil lamps are used.

1-2-6 Problems of Living Environment

- All the problems of living environment in DKI Jakarta are attributable to the sharp gravitation and increase of population of 50% in the past decade.
  Thus, rapid sprawling of urban areas and the increase of slum areas appeared and highly dense residential quarters with low quality houses and insufficient urban infrastructure were formed in various regions of DKI Jakarta.
  Kecamatans deeply involved in this problem in DKI Jakarta are Kemayoran, Taman Sari, Matraman, etc., and in these kecamatans, while low quality houses account for 30 to 50%, the population density exceeds 300/ha. Therefore, there are little vacant land and roads, with low quality one-storied houses densely built up, providing a large problem in light of safety and health. In case of Cengkareng, in 1975, while low quality houses accounted for nearly 60% of the total dwelling houses, the population density was about 50/ha, and the environmental level of the residential quarter is not so lowered. However, sprawling already reaches Cengkareng beyond the Angke River, and if the natural urbanization is left uncontrolled, this kecamatan, too, is very likely to be aggravated in environment like the kecamatans named above.

FIG. 1-1-1 CLIMATE DATA - JAKARTA

SOURCE : JAKARTA OBSERVATORY



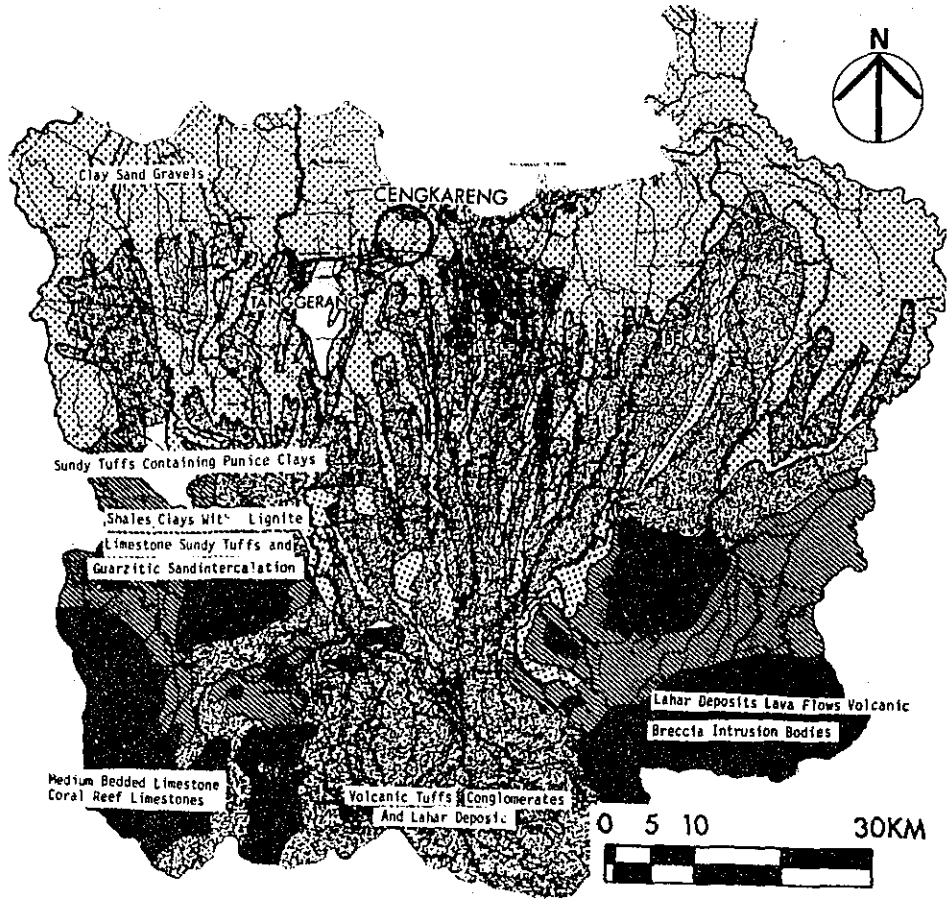


FIG. 1-1-2-A
TOPOGRAPHY
AND
MAJOR RIVERS.

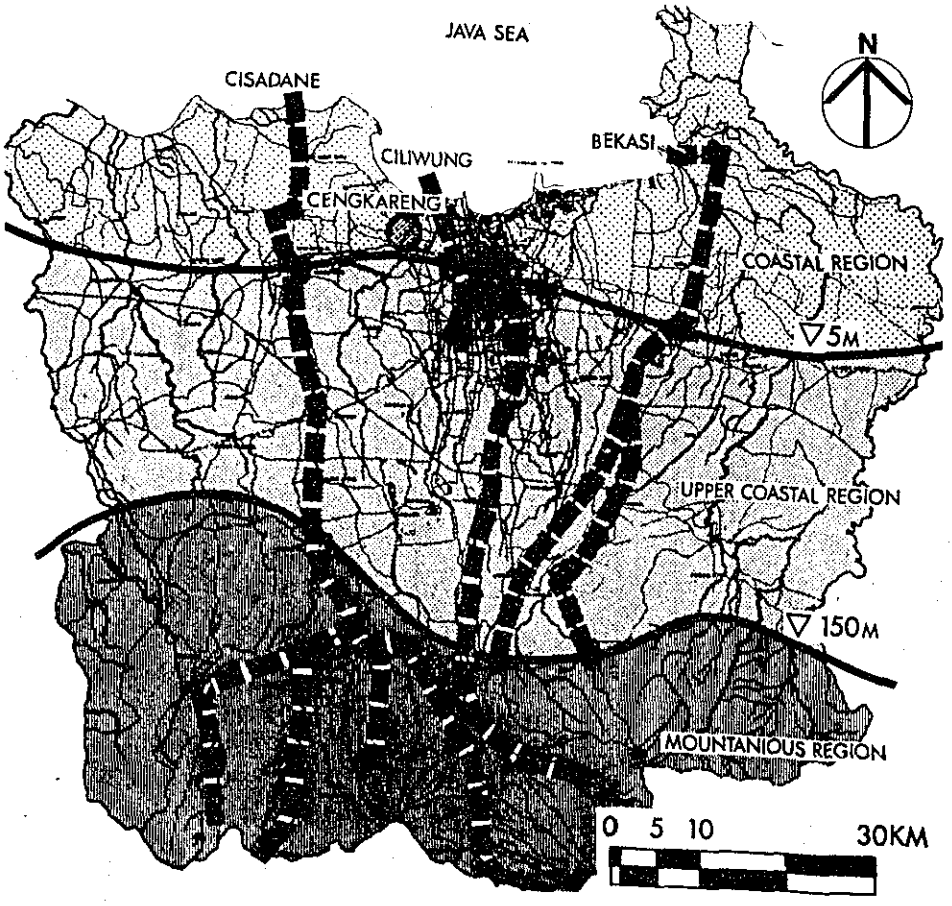


FIG. 1-1-2-B
GEOLOGICAL MAP

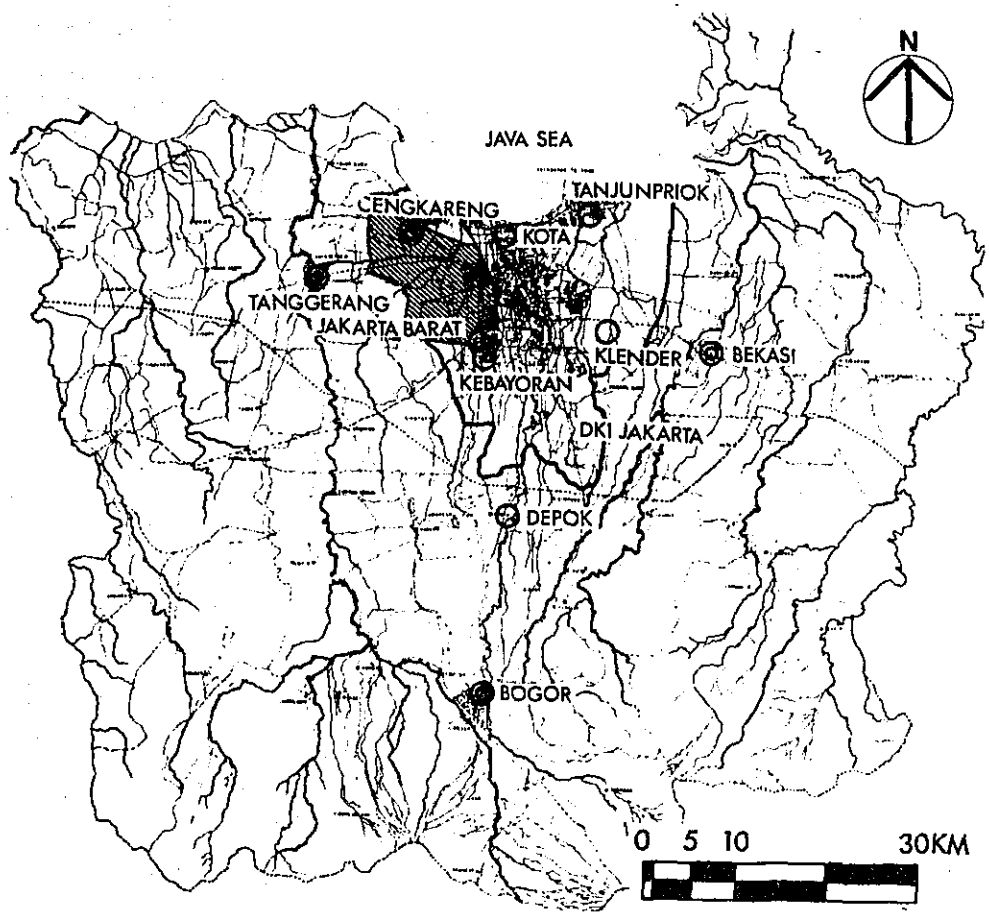


FIG. 1-2-1-A
LOCATION

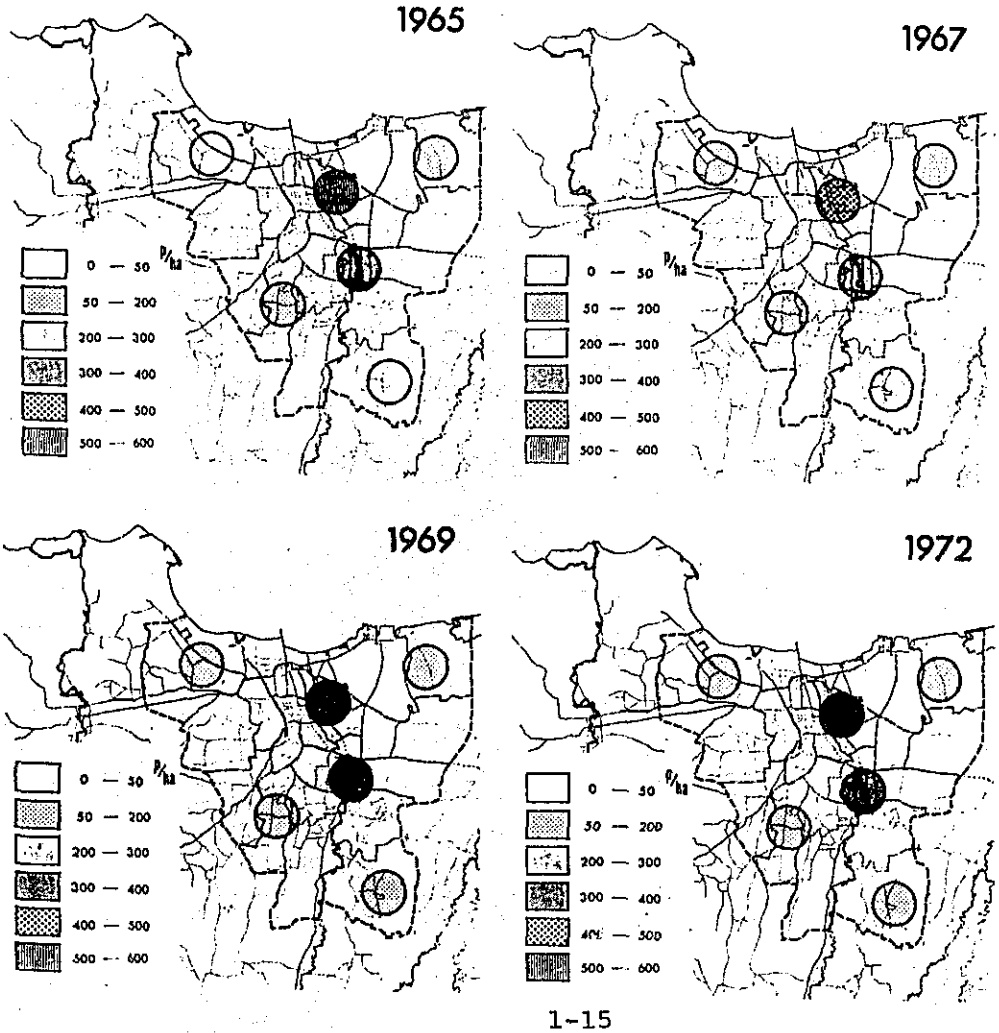


FIG. 1-2-2-A
CHANGE OF
POPULATION

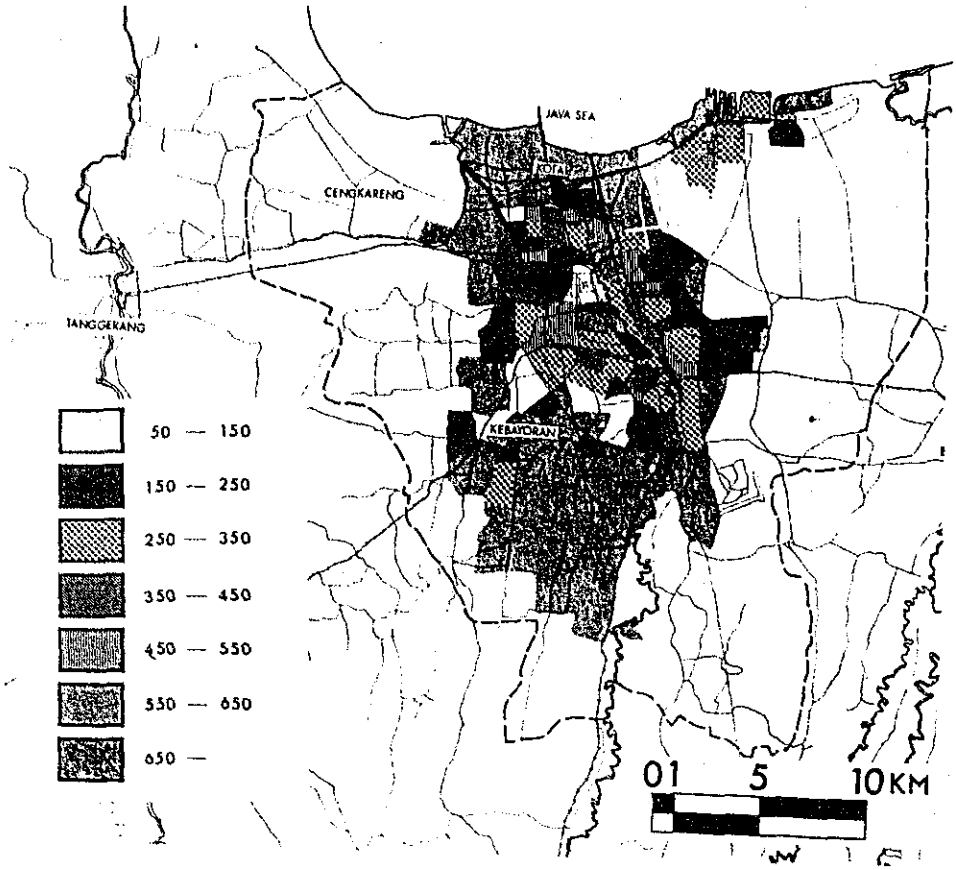


FIG. 1-2-2-B
POPULATION DISTRIBUTION (1975)

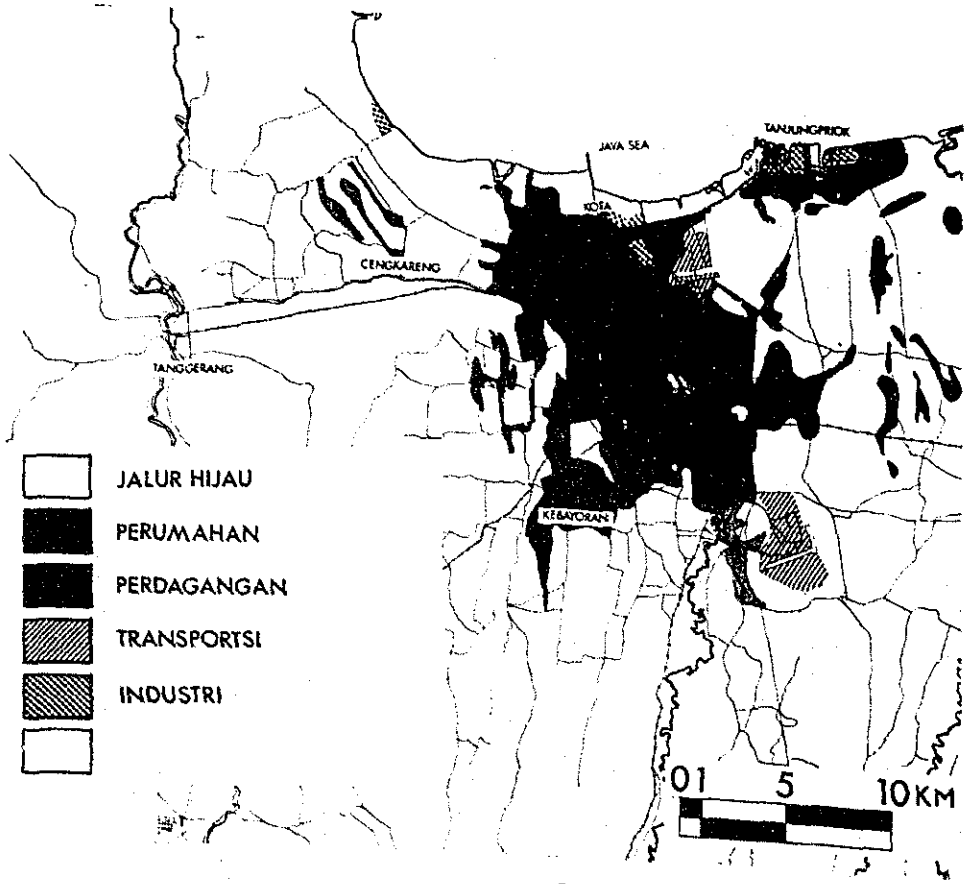


FIG. 1-2-3-A
PRESENT STATE OF LAND USE

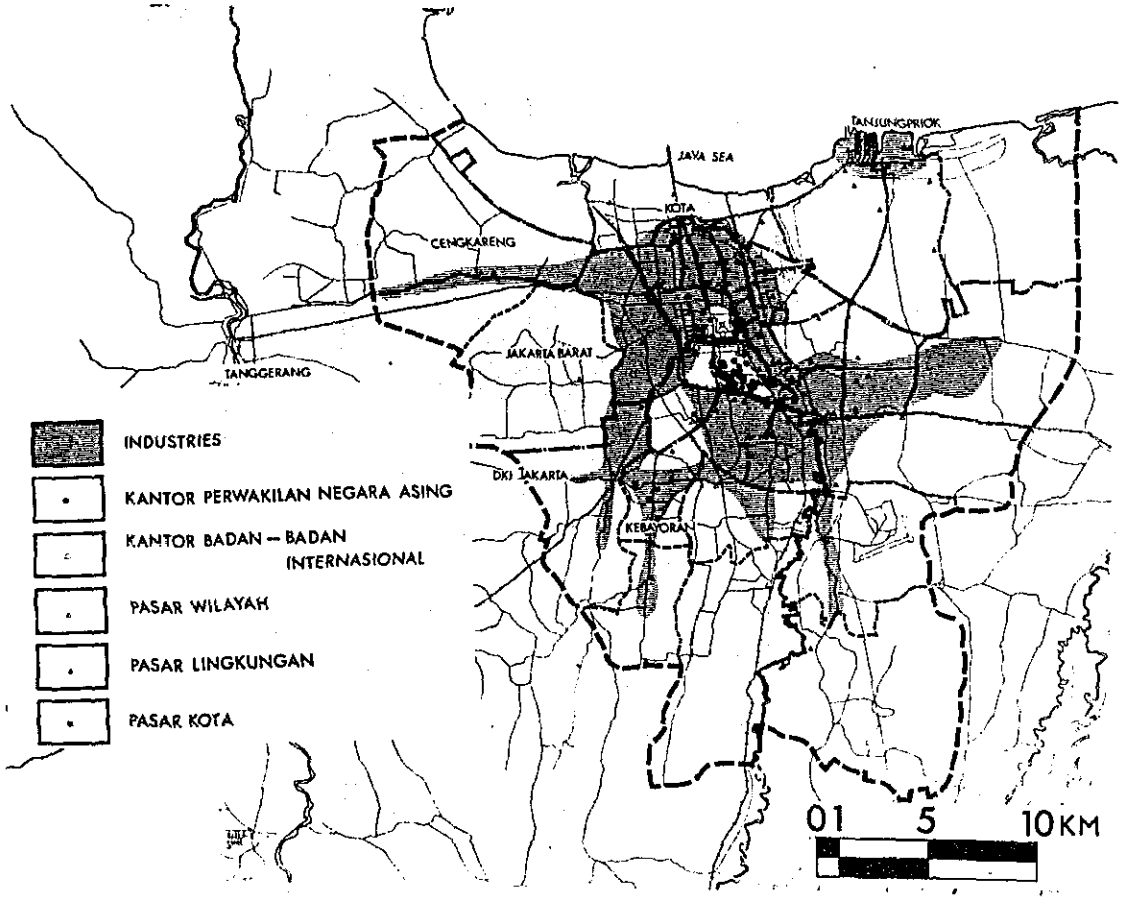


FIG. 1-2-3-B
DISTRIBUTION OF
MAJOR FACILITIES

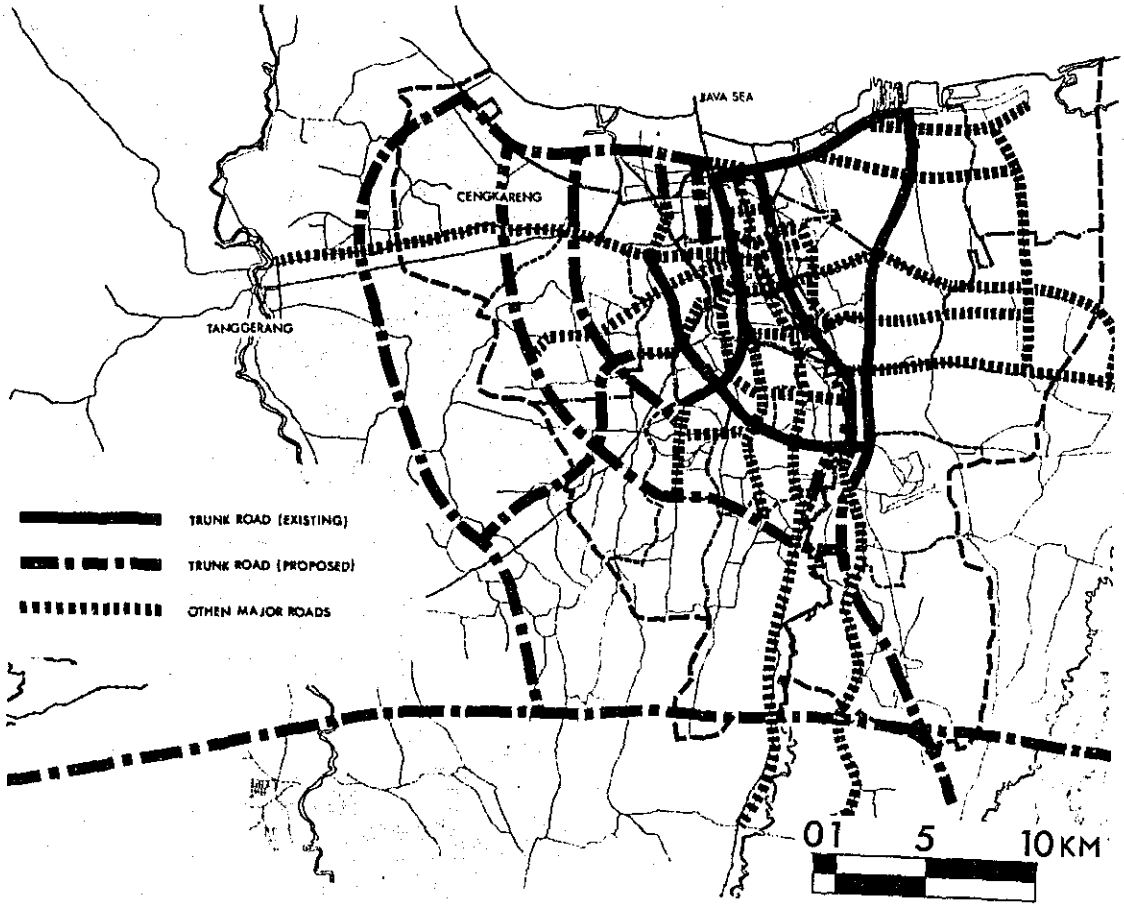


FIG. 1-2-4-A
PRESENT STATE
OF
ROAD NETWORK

FIG.1-2-4-B
BUS NETWORK

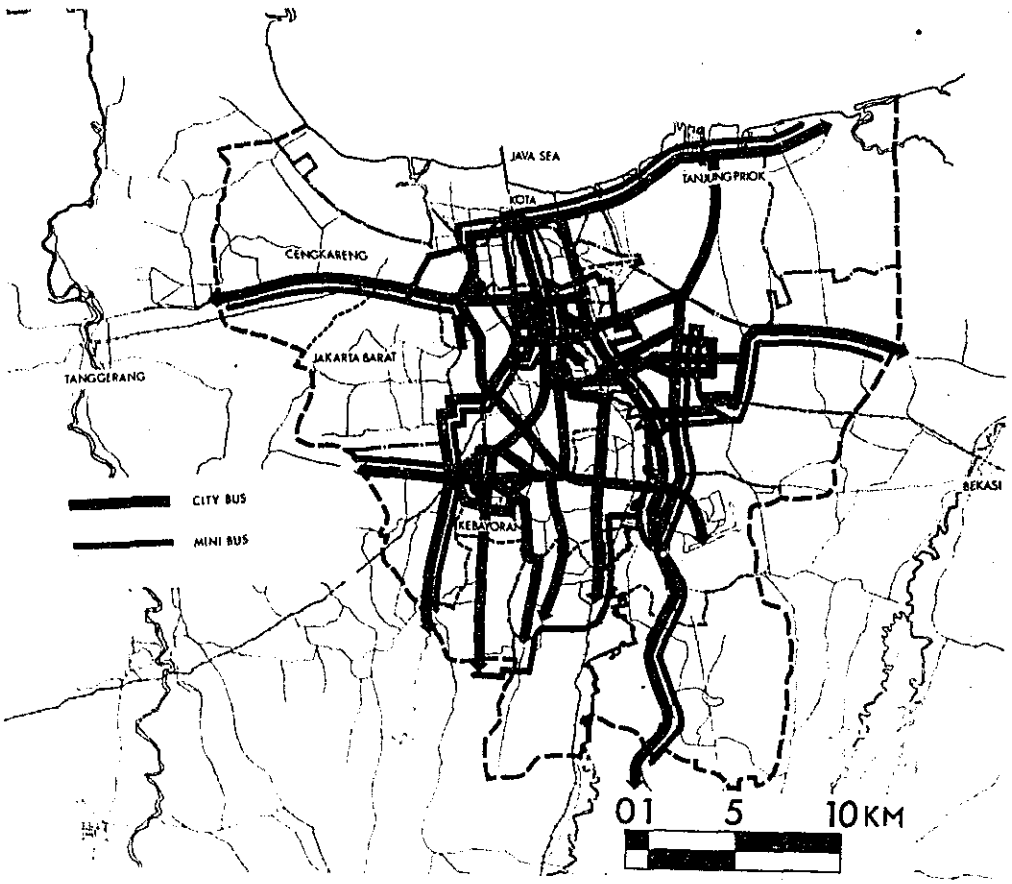
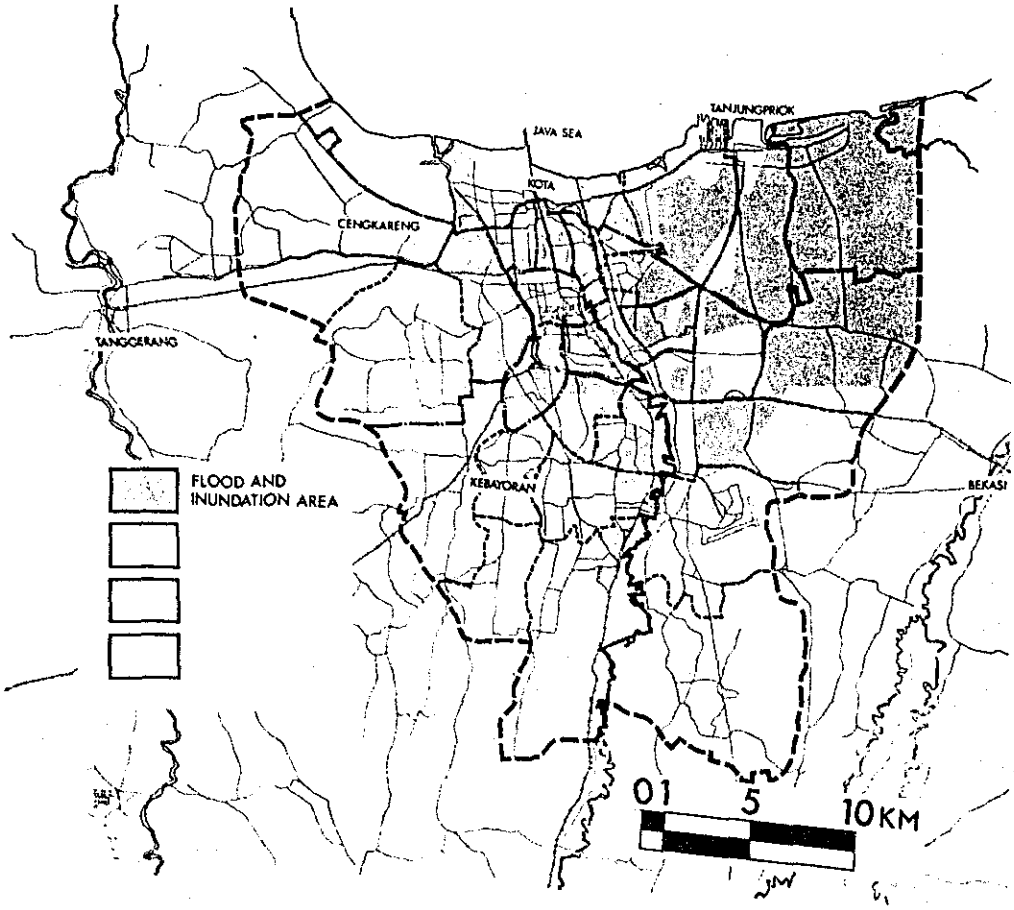


FIG. 1-2-5-A
FLOOD AND
INUNDATION
AREA



1-3 Review of Future Planning

1-3-1 DKI Jakarta Master Plan

- The DKI Jakarta Master Plan was formulated in 1965, and according to this Master Plan modified to some extent up to now, various city projects are executed.
  A wide area plan to support the DKI Jakarta Master Plan is JABOTABEK conception. It is intended to elevate the function of existing bases, Bogor, Tanggerang and Bekasi in a 30-km area around the center of Jakarta, for the alleviation of extreme gravitation to central Jakarta and establishment of stable Metropolitan area.
  At present, industries based on manufacturing industry and housing complexes are located and constructed in these regions. (Fig. 1-3-1-A)

- The DKI Jakarta Master Plan has a framework of trunk roads connecting the above bases with Jakarta, viz. radial roads and outer ring roads intersecting them at right angles.
  In the framework, such central functions as business and administration are arranged along the trunk roads in the urban center.
  On the other hand, the manufacturing industry is planned to be located on a large scale in the east edge of DKI Jakarta to allow access to Tanjung Priok Port and Jakarta-Bekasi Road. Furthermore, in the west and southwest regions of DKI Jakarta, medium-scale manufacturing industry quarters are planned to be established along the radial trunk roads.

- As for residential quarters, new development is planned mainly in the west and southwest regions of DKI Jakarta. They are planned to be developed like islands in existing agricultural land.
  The area used for the above urbanization is kept within 15 km from the urban center, and the area beyond it is planned to be preserved as an area for agricultural land and recreation.

- In the above consideration, Cengkareng is planned as a residential quarter surrounded by radial trunk roads and outer ring roads. Planning in addition includes the location of manufacturing industry and business function along the above trunk roads, and the new construction of recreation facilities in the coastal region and a new international airport along the administrative boundary between DKI Jakarta and Tanggerang. (Fig. 1-3-1-B)

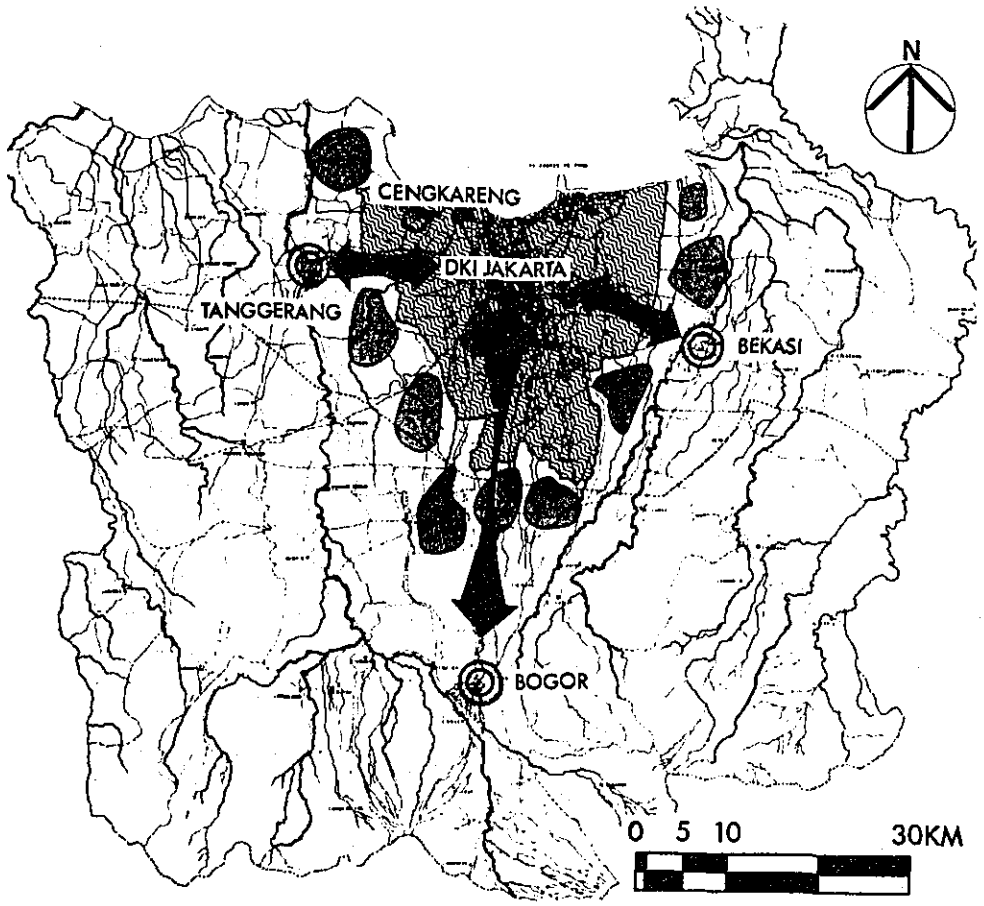


FIG. 1-3-1-A
PROPOSAL MAP
OF JABOTABEK

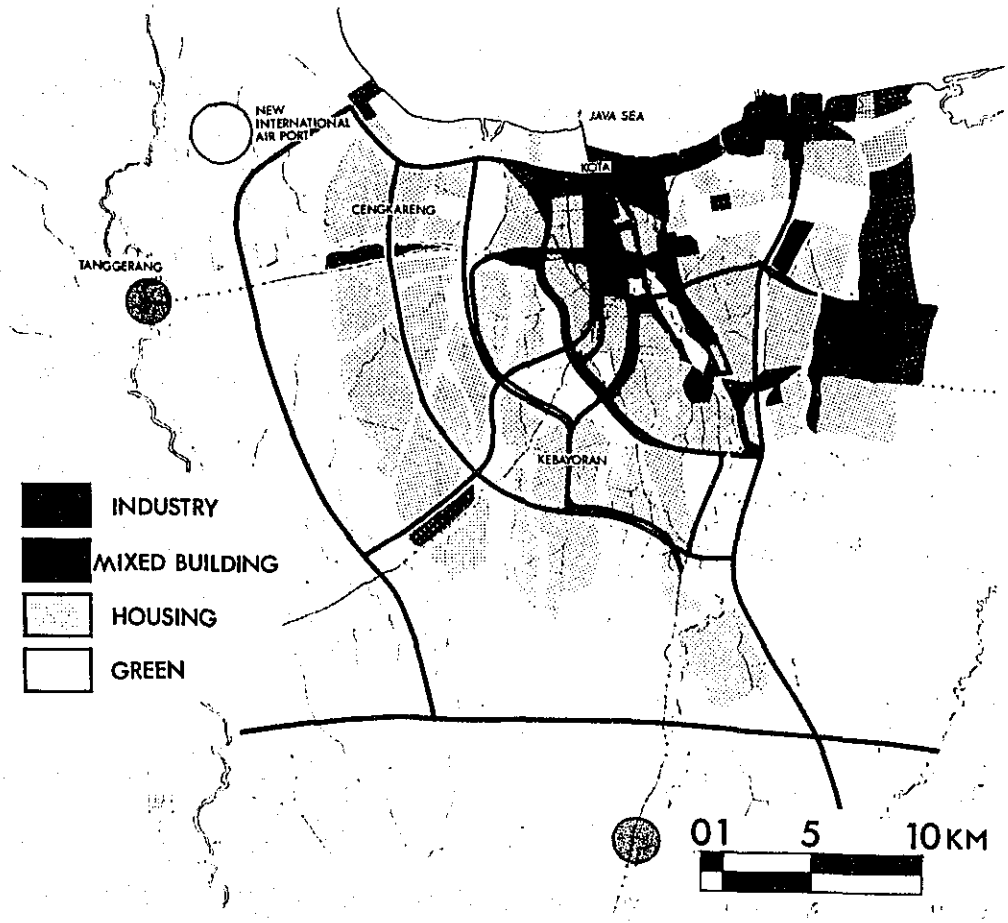


FIG. 1-3-1-B
DKI JAKARTA
MASTER PLAN

1-3-2 Infrastructure

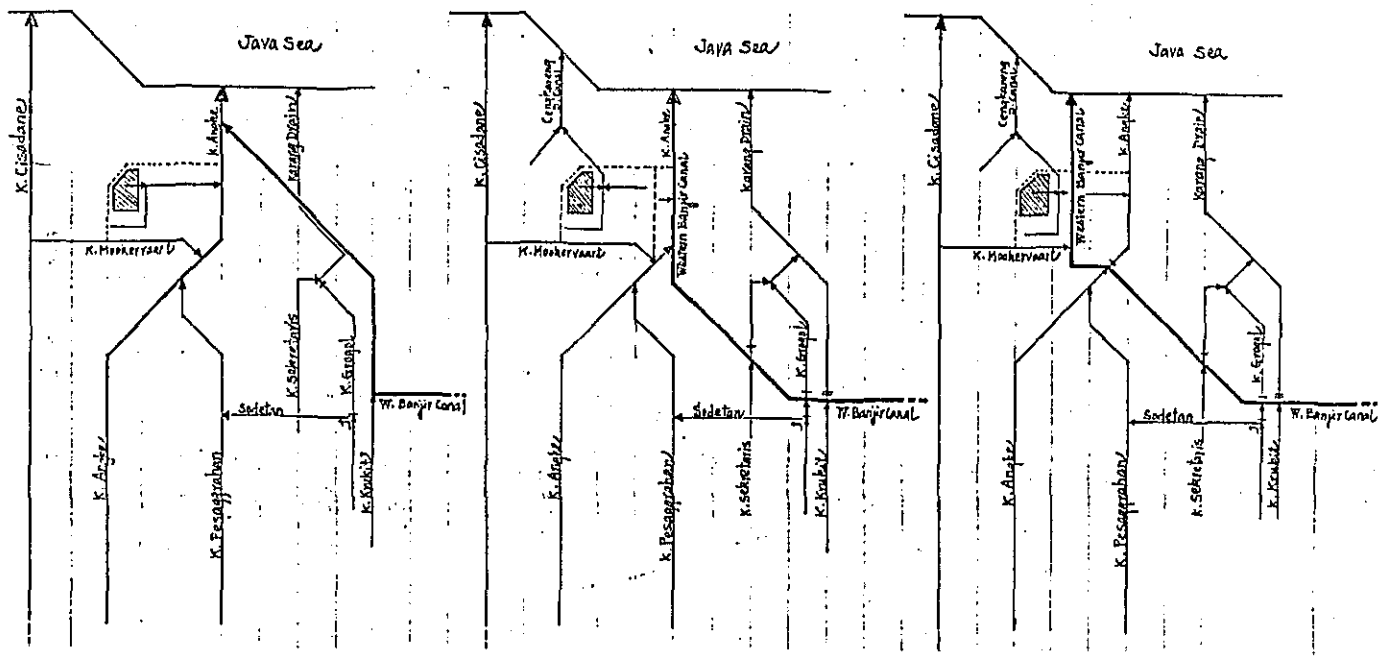
A. Drainage

- After the large flood in February, 1970, the formulation of drainage plan became an urgent problem. Therefore, in November, 1972, PBJR made the first master plan including several alternative in cooperation with the Government of the Netherlands. Then as a result of coordination with various parties concerned, "Master Plan for Drainage and Flood Control of Jakarta - By PBJR and NEDECO" was formulated as the final report in December, 1973.

- According to this master plan of December, 1973, the existing Western Banjir Canal is to be extended further to the west at a point where it turns to the north, and to be connected to the Angke River, surrounding the lowland in the urban area. This enables the drainage in the upper reaches to be received more widely, to lower the influence to the lower reaches.

- Hydraulical data given in the master plan of December, 1973 are summarized below.

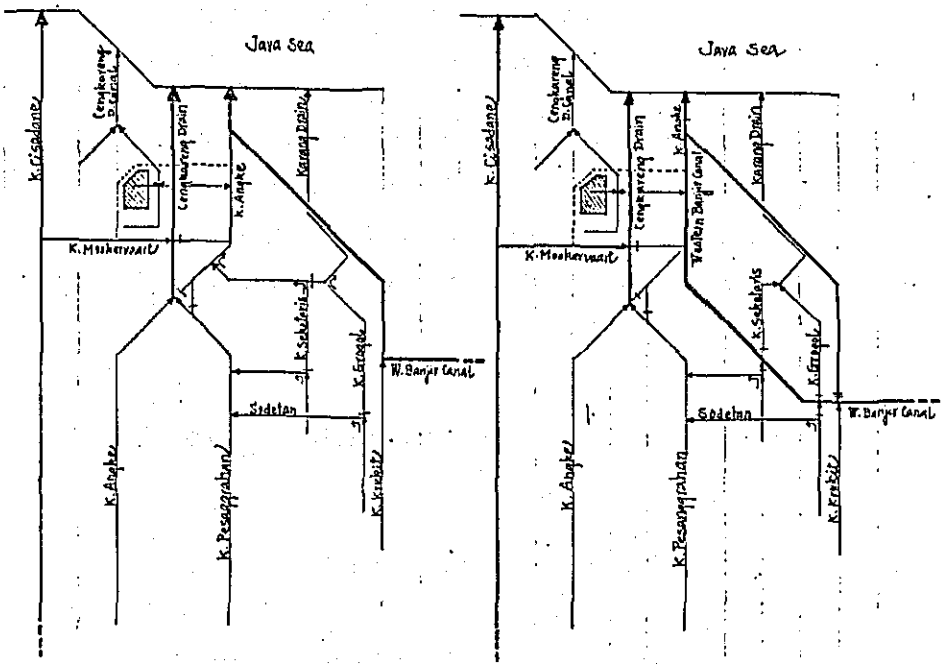
River	Catchment Area		-do- Accumulated		Design Flood		
	(sq.km)	(%)	(sq.km)	(%)	Q2	Q25	Q100
					(cu.m/s)		
Ciliwung	347	41	347	41			
Cideng	8	1	355	42			
Krukut	98	11	453	53			
Grogol	13	2	466	55			
Secretaris	8	1	474	56	150	270	370
Pesaggrahan	110	13	584	69			
Angke	263	31	847	100	190	400	525
Total	847	100	-	-			



1 Existing

2 Proposed: NEDECO MASTER PLAN, 1973 NEDECO CENGKARENG, 1976

3 Proposed : PPBJ, 1979 (1)



4 Proposed : PPBJ, 1979 (2) Alternative I

5 Proposed : PPBJ, 1979 (2) Alternative II

Legend :

- Flushing Gate
- Flushing Gate & Emergency Outlet
- Study Area

Flood Control and Drainage System in the Western Jakarta

- Further in March, 1979, the improvement by widening the Angke River was stopped due to the difficulty of land acquisition, and it was decided to set a new canal in the west of the Angke River. In October, 1979, two major proposals were made by PBJR concerning the modification plan.
  They are concerned with the location of the terminal point, and one proposal is to simply change the alignment of Western Banjir Canal, moving it westward, while the other proposal is to construct a new independent Cengkareng Drain without letting Western Banjir Canal receive all the drainage.
  These alternatives are now being discussed mainly by PBJR, and design is scheduled to be completed in 1980. Furthermore, in 1980 or 1981, the construction is scheduled to be started.

B. Water Supply

In September, 1972, "Master Plan for Jakarta Water Supply System" was formulated by CIPTA KARYA.

The plan covers upto 2000, and is to be executed in three stages of emergency project, first stage project and future project. The contents and periods of these stages were modified as necessary.

The main contents of the plan are the construction of supply facilities, and the renewal and construction of pipes, and water supply is scheduled to be increased from present 5,300 lit/sec to 6,900 lit/sec by 1982, and further to 9,900 lit/sec in future.

C. Sewerage

In September, 1977, "Jakarta Sewerage and Sanitation Project" was formulated.

The project covers upto 2000, but does not reach the stage of enforcement plan. Cengkareng is included in the project area, but not included in the enforcement area. In the area where sewerage pipes can be laid, a population of about 2.6 million is covered,

and for the others, sludge is collected from septic tanks, etc. by vacuum tank trucks, being discharged into sewerage facilities. The sewerage is planned not to be treated, but to be directly discharged by pumps out in Java Sea.

D. Solid Waste

The increase of garbage trucks, the construction of garbage treatment pilot plant, etc. are planned. Space left for accumulation becomes small, and in this state, solid waste will not be able to be disposed in future. In DKI Jakarta, they are at a loss how to cope with the situation, and seem to consider the introduction of compactors as one solution.

E. Electricity

The increase of facilities is planned, and the main contents are the construction of power plant, substations and 20 kV lines.

1-4 Setting of Regional Potentiality

- One conception to indicate the future of DKI Jakarta is JABOTABEK conception. In it, it is depicted that functions subsidiary to the central functions of DKI Jakarta are partially located in Tanggerang. Therefore, the corridor between the center of DKI Jakarta and Tanggerang will be one large "urban axis" and the urban activities in this kotamadya are estimated to be brisk in future. Thus, the potential of Cengkareng located along this corridor can be said to be very high.

- On the other hand, in the DKI Master Plan, an outer ring road passing through Cengkareng is proposed, and a survey for its realization is being made. This is a major trunk road in the suburbs of DKI Jakarta, and this construction involves a far-reaching effect. Business suitable for location in suburbs is estimated to advance in this area.

- A new international airport is scheduled to be constructed near the boundary between Tanggerang and DKI Jakarta in the near future. Together with the construction of the international airport, the redevelopment of the traffic system for communication with the urban area is scheduled as a related project. In this relation, the development of Cengkareng is surmised to be promoted further.

- Furthermore, Cengkareng is only 10 km apart from the urban center of Jakarta, being far closer to the urban center than the large-scale housing complex Depok developed by Perum Perumnas, being almost same as Klender in the relation of location. That is, demand also as a residential quarter oriented for urban center can be said to be very high. Actually, in and around Cengkareng, the development of housing complexes by private companies progresses considerably. Therefore, houses to meet various requirements are surmised to be able to be supplied.

2. LOCAL SETTING

The area mainly covering Kelurahan Kapuk, Kelurahan Kali Angke and Kelurahan Cengkareng as administrative divisions is called Cengkareng district in the following consideration. However, when deliberation on a wider area is required as in case of drainage, this framework will be ignored.

2-1 Physical Condition

2-1-1 Topography

o Cengkareng district is located between Java Sea and the Mookervaart River on the left bank side of the Angke River, and is classified into the following three topographical regions.

The first region covers the old coastal ridge and river levees, and this region is high in the height above the sea compared with the other regions, and has colonies located mostly in the respective portions. The height above the sea is almost 6.0 to 4.0 m, making the region relatively safe against inundations. Portions corresponding to this region lie like 200 to 500 m wide islands almost in parallel to the present coastline.

The second region is 4.0 to 2.0 m high above the sea and is used mostly for paddy fields, having the largest area in this district. This region generally inclines eastward and descends toward the coast since this district is located in the drainage basin of the Angke River.

The third region is less than 2.0 m in the height above the sea and is mostly swampy along the coast. This region is now used for fish ponds, and is not suitable for paddy fields, with a nature of land being left unused. Portions which are more than 2.0 m above the sea but remain swampy due to ill draining caused by higher land around them are dotted in the paddy field area. (Fig. 2-1- 1)

2-1-2 Geology and Soil Condition

The geology of this district is substantially based on volcanic sediment of end of Tertiary to Pleistocene and is generally covered with decades of meters thick alluvium deposit. The alluvium deposit comprises soft clay and silt, and partially organic matter. It holds partially a thin sand layer, and above the coastal ridge, a fine sand layer is dominant.

The soil of this district mainly comprises clay and silt as mentioned above and has only very poor bearing capacity. These soil layers are 40 to 60 % in moisture content, about 100 % in the degree of saturation, being large in cohesion, high in plasticity and low in permeability.

The clay layer or tuffaceous sand layer originating from volcanoes distributed below the alluvial deposit is relatively hard and high in bearing capacity. This layer is 9 to 10 m deep below the ground surface in Tangerang and as deep as 16 to 20 m below the ground surface in the coastal area in the northwest of DKI Jakarta. This layer becomes deeper from south to north or northeast like the trend of wide geological features.

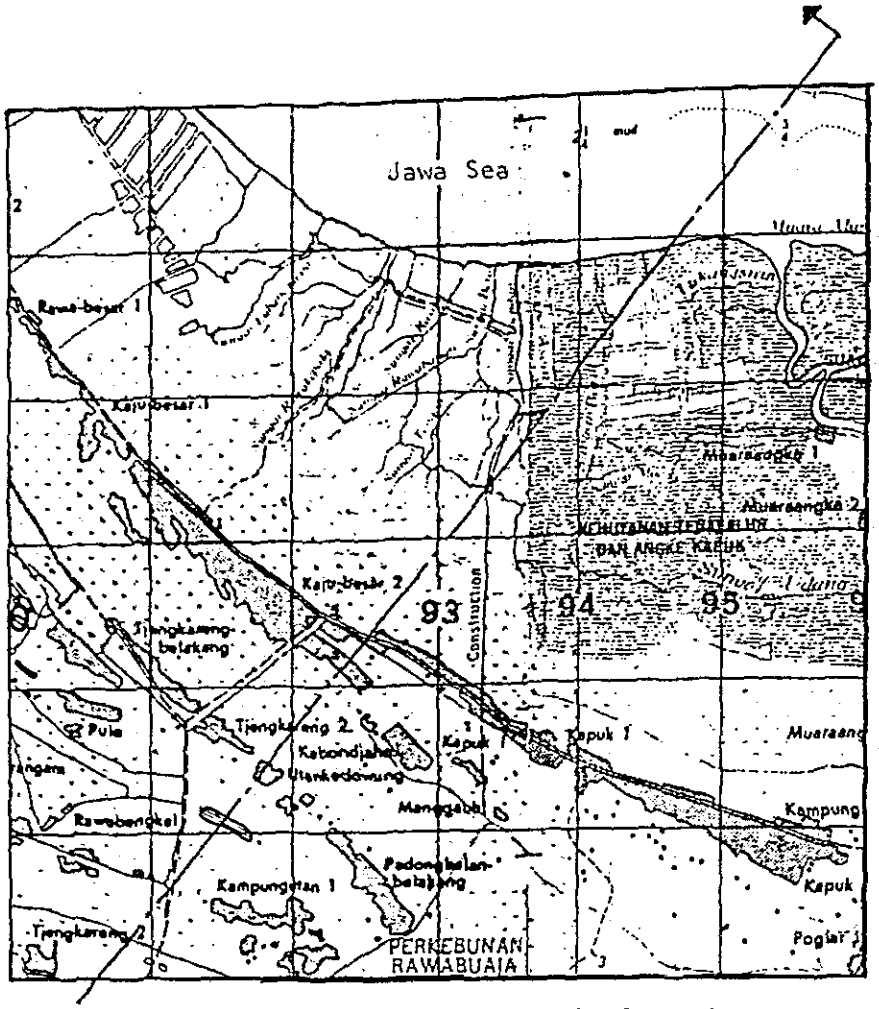
The ground-water level is generally very shallow, being at ground surface to 0.6 m below the surface in low flatland, and about 0.6 to 1.5 m below the surface at the coastal ridge. (Fig. 2-1-2)

2-1-3 Ecology

Characteristics of natural environment in this area can be divided roughly into two types from geographical features, that is, the area which is so to speak slightly high land or the area which is slightly higher than the rest of whole area, and low land area covered with water all the year round. Such difference in geographical features between these two areas has also produced the difference in the condition of surface soil. For instance, the slightly high land comprises the coastal ridge covered with fine sands containing crushed coral and the area covered with red weathered lava, while the low land is covered with either river drift or marine drift, though the latter covers mainly the are located near the coast. Conditions of surface soil by the area are as shown in the following:

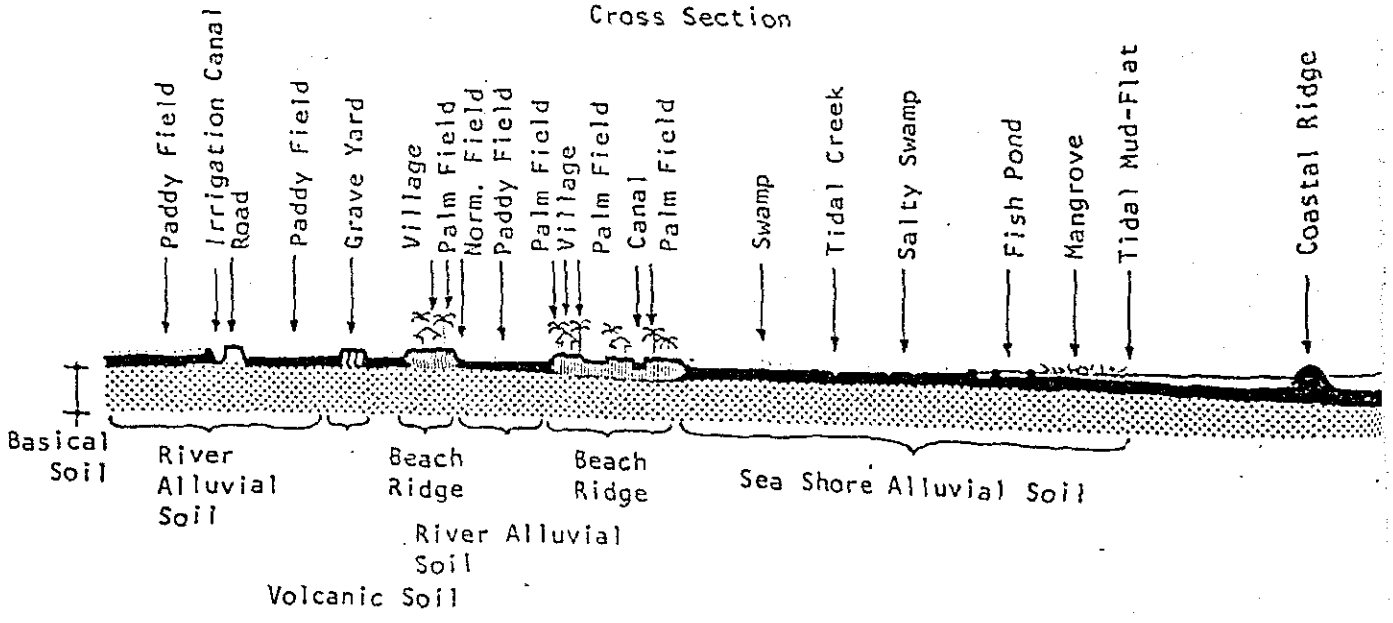
Characteristics of natural environment classified by type

	Sands	Alluvial soil		Red soil
		River	Coast	
Slightly high land	Type I	——	——	Type IV
Low land	——	Type II	Type III	——



Natural Environmental Model of Cengkareng Area

Cross Section Line



Features of each type are as follows:

Type I: Mainly consists of fine sand, but contains crushed coral too. There are villages, palm plantations and farmlands on the land. This type of land is surrounded by paddy fields and swamps, but the land has seldom been inundated even when the area has had heavy rainfalls. Also, there are a number of shallow wells here and there, and the level of underground water the quality of which is relatively good is 0.6 - 1.5 m. However, the salt content of water increases when the water is pumped in a large quantity, or when the depth of well is greater than a certain level.
These geographical features of the land are considered to be the main reasons for that villages are situated in this area.
Though the soil in this area is rather infertile, the land in this area is used as farmlands, for the geographical features of this area are suited for cultivation, and the salt content in the soil is not so significant despite of that the area is situated adjacent to saline swamps or near the coast. Bearing capacity of the soil in this area is relatively large compared with those of other areas.

Type II: Land falling under the category of this type mainly consists of the soil formed by the river drift, and the soil itself consists of mud, sand and pebbles. This type of land is mainly used for paddy fields, but the areas where the conditions for drainage are poor, and the use of land is difficult are left intact as swamps. This type of land is relatively fertile, and can be cultivated without much difficulty. However, this type of land is considered to present considerable acidity when dried up, and its bearing capacity is small. Thus, in order for this type of land to be used, it will be necessary to mix the soil brought from another place for plantations, and to improve the condition of soil for housing. Also, at present, the hydraulic mechanism predominant in the areas surrounding this area is helping

to reduce the outflow of the water at the time of rainfall. This area has been free from prolonged floods despite of the poor drainage, because the hydraulic mechanism in this area has been playing the role of the buffer against the flood in collaboration with the swamps in the coastal areas. Thus, if the land reclamation has to be promoted on the sacrifice of the function of the aforementioned natural hydraulic mechanism, it will be necessary for this area to construct the artificial hydraulic mechanism to replace the natural mechanism.

Type III: This type of land is mainly formed by marine drift, and the soil itself mainly consists of the muddy soil, which has almost similar characteristics to those of the land of Type II. The areas of good drainage and a relatively small salinity are used for paddy fields or fish ponds, but most of the areas are wasted as saline swamps.
Like the case of the land of Type II, this type of land is considered to present considerable acidity when dried up, so that it will be also necessary to improve the condition of the land when to be used for plantations, and the bearing capacity of the soil has to be improved when to be used for housing.

Type IV: This type of land consists of the red clay formed by the lava which has been weathered in the deep underground. This soil features its high viscosity, and tends to masses readily. Soil is rather fertile and presents acidity, though the drainage is poor. The land in this area is used for housing, farmlands and cemetaries, but is not necessarily suited for housing. Besides, this type of land is poor in water permeability, so that it is not easy to use underground water.

2-2 Land Use and Transportation System

2-2-1 Land Use and Facilities Distribution

- The most dominant land use in this area is shown by agricultural land used as paddy fields. At present, due to natural condition, two drops are raised a year, and management is well performed. However, about 25 % of paddy fields are not good in drainage, and rice planting is made there only once a year.

- The old coastal ridge is used by a colony of farmers. Since the land of the colony is a highly permeable fine sand layer, it is covered with palm and other trees.
  Most of the houses located there are farmers', but about 10 % of the houses are inhabited by other people than farmers. Along trunk roads, small factories, stores, warehouses, and other facilities are located, in gradual urbanization.
  Furthermore, on the east side of the low-coat housing project site, a residential quarter called Cengkareng Indah is newly developed, giving a high pressure of urbanization.

- In the east of the low-coat housing project site, swine's slaughter-houses and other large-scale business facilities are located, and many small and medium factories are located along trunk roads.
  In recent years, especially factory land is reclaimed from paddy fields. Types of business now featuring this district are chemical factories relating to chemicals and plastics, glass factories, electric machine factories, etc.
  On the other hand, as for commercial facilities, relatively large markets are located along Jakarta-Tangerang Road, for service in the neighborhood. In addition, shops like corner shops are dotted in colonies.

- With regard to mosques, relatively large ones are located in Kelurahan Kapuk and Kelurahan Cengkareng, as central existence for community activities in the respective kelurahans. In addition, many small mosques are dotted in colonies, to be nuclei of RWs and RTs.

- As for educational institutions, three kindergartens are located in Kelurahan Cengkareng, and one, in Kelurahan Kapuk; and 11 elementary schools are located in K. Cengkareng, 5, in K. Kapuk, and 2 in K. K. Angke. Furthermore in this district, 8 secondary schools and 3 high schools are located, and the number of schools is larger than in other districts in the suburbs.

- With regard to medical institutions, there are one maternity, one medical office and one drugstore in this district, and the preparedness is relatively high in light of the enriched educational facilities. (FIG. 2-2-1)

- Recreational facilities are few. There is only one movie theater in this district now, and there are no other outstanding recreational facilities.

- As for future land use, according to DKI Jakarta Master Plan, most of the land is planned as residential quarters, while business facilities are scheduled to be located along trunk roads. Furthermore, along radial roads running east to west, manufacturing industry quarters are arranged.
  In contact with the east side of the project site, a high voltage line running south to north is being constructed, and a green belt is planned along it. The green belt will lie from the inland coastal ridge through Cengkareng district to the recreation zone along the coast. The land along the Angke River and the area where slaughterhouses are now located are positioned as an industrial park. (Fig. 2-2-2)

2-2-2 Transportation System

- Major roads in the road network of this district are Jakarta-Tangerang Road running east to west in the south of this district and Cengkareng-Teluknaga Road positioned in the north. As trunk roads in the area, JL. Kamal Raya, road along the Angke River, etc. are redeveloped.
  However, most of narrow streets in the district are farm roads and village roads, and are not redeveloped well. For this reason, it is almost impossible for automobiles to go into those streets, while colonial spaces free from automobiles are formed.

- According to the road plan in DKI Jakarta Master Plan, a 100 m wide outer ring road runs through almost the center of this district south to north. This is an important road to mutually connect the suburbs of DKI Jakarta. Furthermore, the plan includes the widening of Jakarta-Tangerang Road and Cengkareng-Teluknaga Road, and the construction of a road in the swampy area in the north side of this district, to connect the central Jakarta with the New International Airport. It further contains the conception of laying a railway.

2-2-3 Population

- With regard to the trend of population in this district, consideration will be made on Kelurahan Cengkareng and Kelurahan Kapuk.
  As for the population of this district, the total population of these two kelurahans is 76,500. Since the area of this district is about 1,500 ha, the average population density of the district is 50/ha.
  The average age in this district is about 17 years old, showing that there are many infants and children. As regards households, the number of households is 13,800 for a population of 76,500, and therefore one household consists of 6.0 persons, being a value a little exceeding the mean value in the urban area.
  As for the annual mean rate of population growth, it was about 5 % upto 1974, but increased sharply since 1975, reaching 10 % . This shows that this district is affected by the urbanization in these years.

- As indicators to show the social structure of this district, the contents of RTs and RWs are examined below.
  This district has 308 RTs and 25 RWs. On the average, 250 person or almost 40 households form one RT. As for RW, 3,000 persons form one RW, and 12 RTs form one RW.

TABLE 2-2-1 POPULATION DATA

	Kelurahan Cengkareng	Kelurahan Kapuk	Total
1) Population Mobility			
1-1 Birth	112	46	158
1-2 From Inside of DKI	465	160	625
1-3 From Outside of DKI	62	12	74
(SEP. 1979)			
2) Total Population			
2-1 House Hold	7,689	5,334	13,023
2-2 Population	46,213	30,334	76,547
2-3 Area Size	851ha	643ha	1,494
2-4 Density (2-2 / 2-3)	54P/ha	47P/ha	50
(SEP. 1979)			
3) Planning Area's Household	576	1,135	1,711
4) Planning Area's Population	3,685	6,182	9,867

2-3 Infrastructure

2-3-1 Drainage

- Existing drainage canals of this district are as shown in Fig. 2-3-1-A. They can be classified into major three zones. The first is A1. zone of 1,260 ha directly connected to Java Sea. The second is A2. zone of 1,130 ha connected to the Angke River in Kali Kapuk Muara. The third is A3. zone of 300 ha connected to the Mookervaart River. These drainage facilities are not especially insufficient though they involve a certain problem of inundation in agricultural area. Water for irrigation is distributed from west to east in this district. The trunk canal is called Cisedane Timur Irrigation Canal.

- Since the low-cost housing project for this district was taken up, PBJR and NEDECO proposed a new drainage system in February, 1976, in their "Explanatory Note on the Design of the Cengkareng Drainage System - Annex VIII to Final Report Phase II, Jakarta Drainage and Flood Control Project". The proposal is based on the idea to discharge the drainage of A2. zone directly into Java Sea, instead of the Angke River. This proposal must have been made from the argument that the direct discharge into Java Sea allows easier disposal than the indirect discharge through the Angke River to Java Sea, in light of shorter distance and more advantageous slope.
  In this plan, the design water level was set as PP + 1.0 m at the river mouth. In accordance with it, the drainage canal profile of this district is designed as shown in the following figure.
  Thus, the design water level at BI point which relates the most to the development project in this district is PP + 2.258 m, and other levels are PP + 2.702 m at BK point, and PP + 3.092 m at BP point.

2-3-2 Water Supply

At present, 250 dia. piping is laid from Grogol to the east bank of the Angke River along Jakarta-Tanggerang Road. From there, 200 dia. piping is scheduled to be laid to a point about 1 km in the north along the east bank. On the west bank side of the river, there are no PAM facilities.

According to the Master Plan, 800 dia. piping is scheduled to be laid along Jakarta-Tanggerang Road by 1990 as 1st. stage of future project.

The present water sources in this district are shallow wells, while some deep wells (motor pump or wind mill) are used.

According to water quality data, the water of shallow wells contains salt, but that of 150 m or deeper wells is good. However, due to the large consumption by factories in the neighborhood, the capacity is surmised to be small.

2-3-3 Sewerage

In the district, there is no sewerage piping, and sewerage is directly discharged into drainage canals or treated by a septic tank or cesspool, to percolate through the soil. Especially in Kampung, there are many houses without toilet, insanitarily.

2-3-4 Solid Waste

Public depot spaces are provided in various places, to collect solid waste by garbage trucks of DKI Jakarta. Accumulated land is located in Pluit, along the road on the east bank of the Angke River, etc, but is said to be temporary.

The collection of solid waste from the respective houses is not complete, and dumping in vacant land, river, etc is observed.

2-3-5 Electricity

At present, a 20 KV line is laid along Jakarta-Tanggerang Road, but is used only in some limited regions. A 20 KV line is now being constructed from the Angke River to Cengkareng district, and is scheduled to be completed in 1980 or 1981. According to PLN, after the line is completed, the supply to the project site is said to be sufficient.

The 150 KV line along the boundary on the east side of the project site will connect Pluit power plant with a substation in Tanggerang, and is scheduled to be completed in 1979 or 1980.

2-4 Setting of Local Structure

- The structure of future urban activities of Cengkareng district is determined by DKI Jakarta Master Plan. Therefore, in the low-cost housing development, it is considered as a basic condition of Drainage and Flood Control Plan. That is, the structural contents as shown in Fig.2-4-1are set, and the low-cost housing project is promoted according to the policy.

- However, it is necessary to formulate a plan for social and economic phase, in correspondence to the physical plan. Especially, counter-measures must be worked out urgently for farmers who will lose the field of economic activities by the coming development in this district. Furthermore, considerable development of business facilities is planned for this district, and it is necessary to clarify the relation between them and dwelling houses and to bring the places of work and the residence of the workers close together as far as possible.

- Furthermore, as a greenbelt system, it is proposed here to enrich the contents of DKI Master Plan more positively.
  Especially, existing trees should be incorporated in urban space for preservation, and a greenbelt system based on it should be formed. Since the green belts are not artificially made parks located like scattered points, but are laid like belts, it has many advantages of ecological stability and easy maintenance.
  In this project, they will be further connected with the recreation zone in the coast according to the DKI Master Plan.

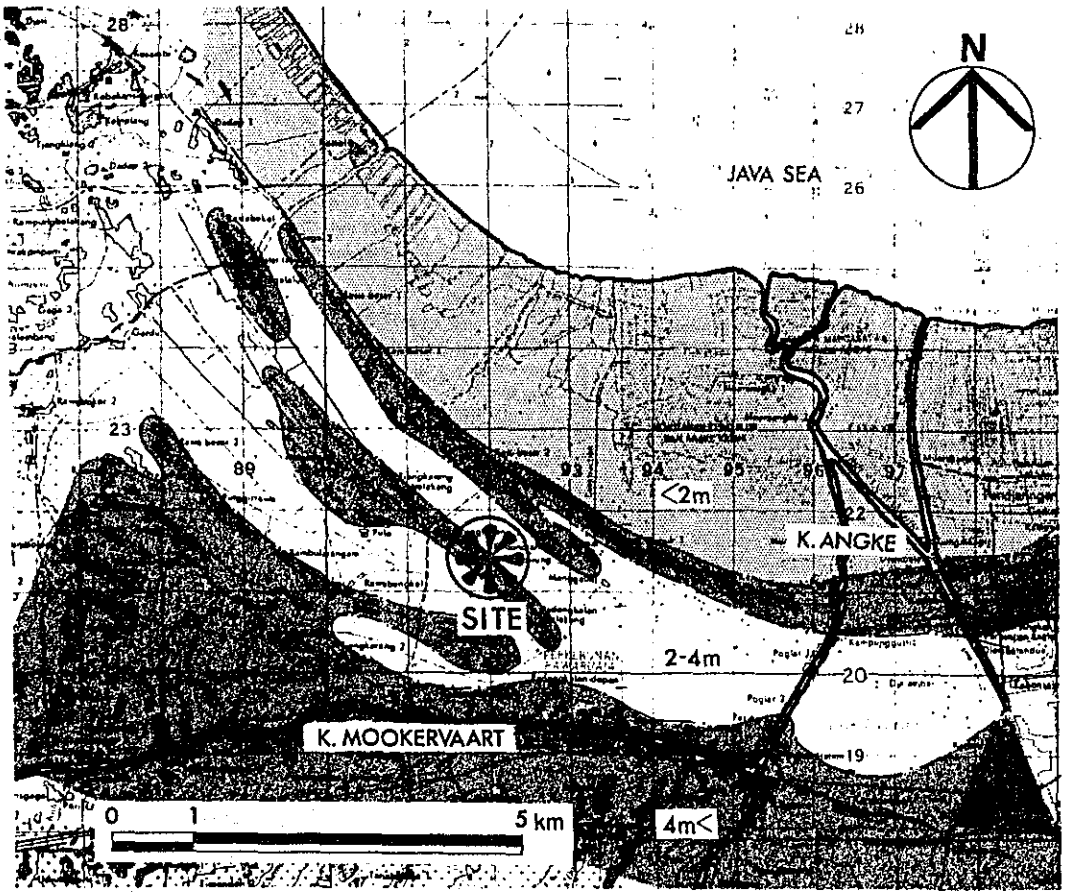


FIG. 2-1-1
TOPOGRAPHY

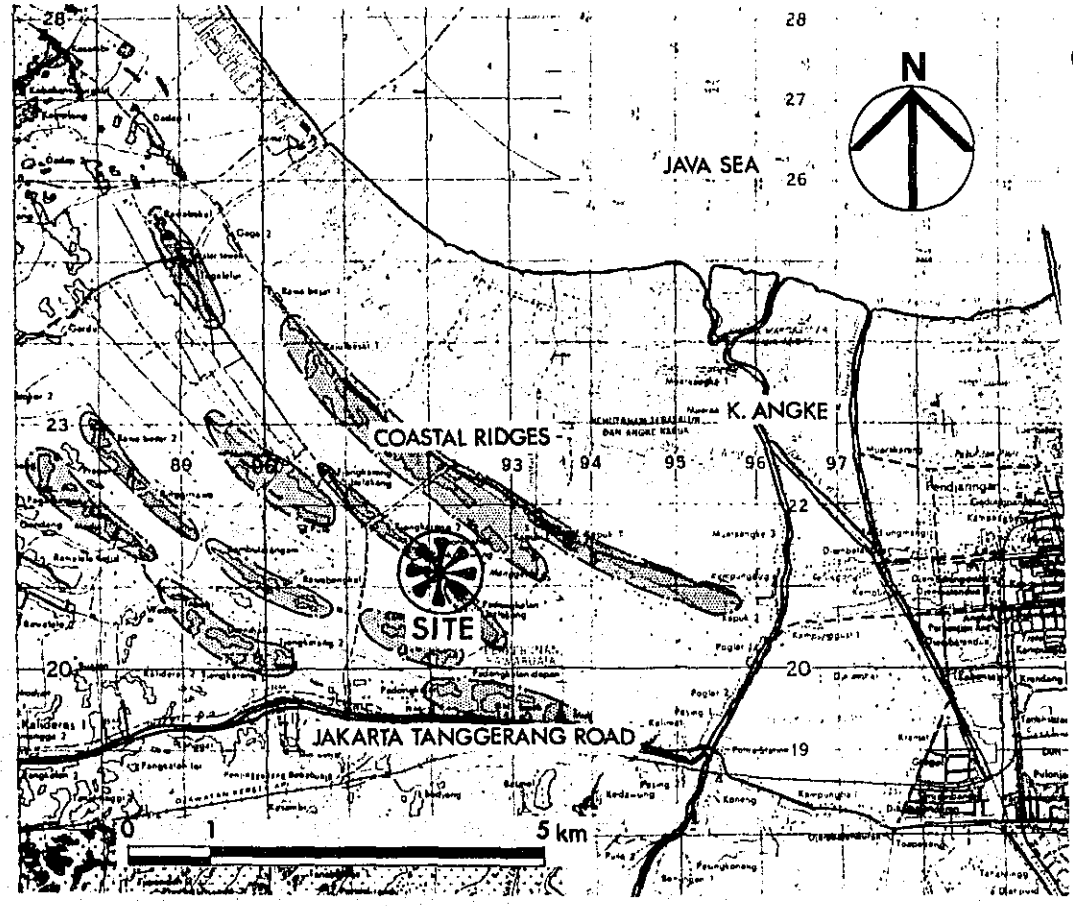


FIG. 2-1-2
GEOLOGICAL MAP

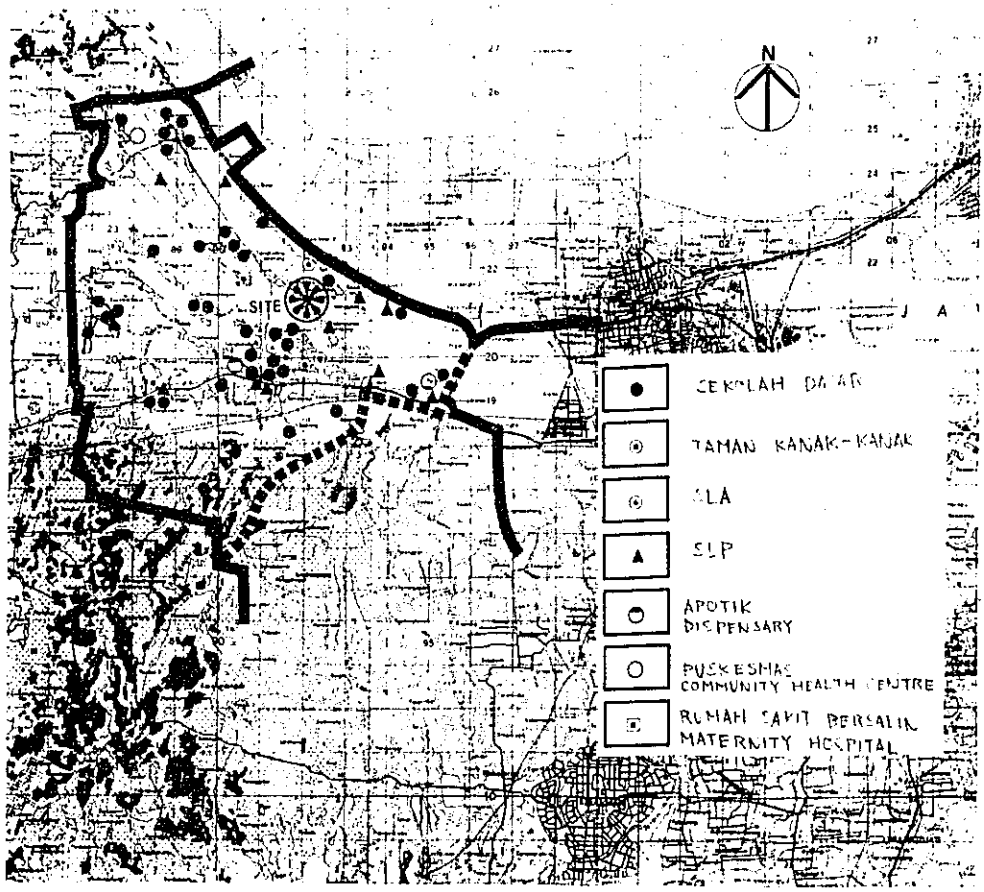


FIG. 2-2-1
FACILITIES
DISTRIBUTION

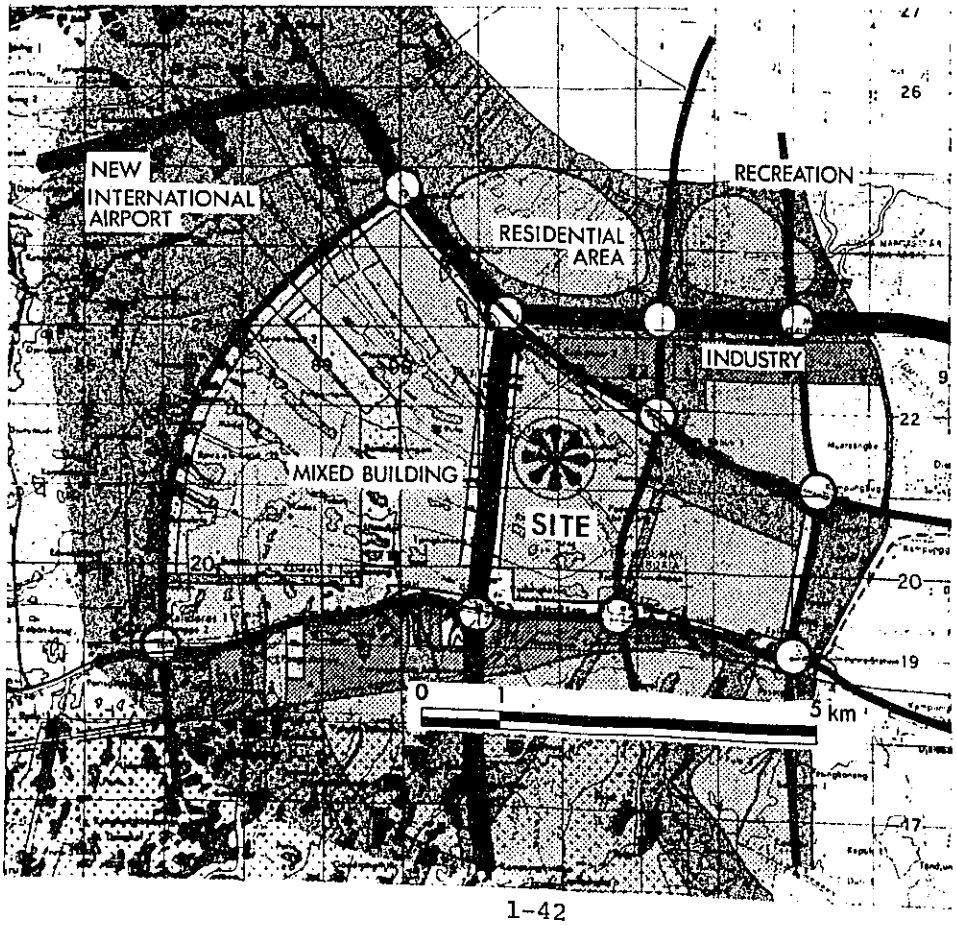


FIG. 2-2-2
DKI MASTER PLAN

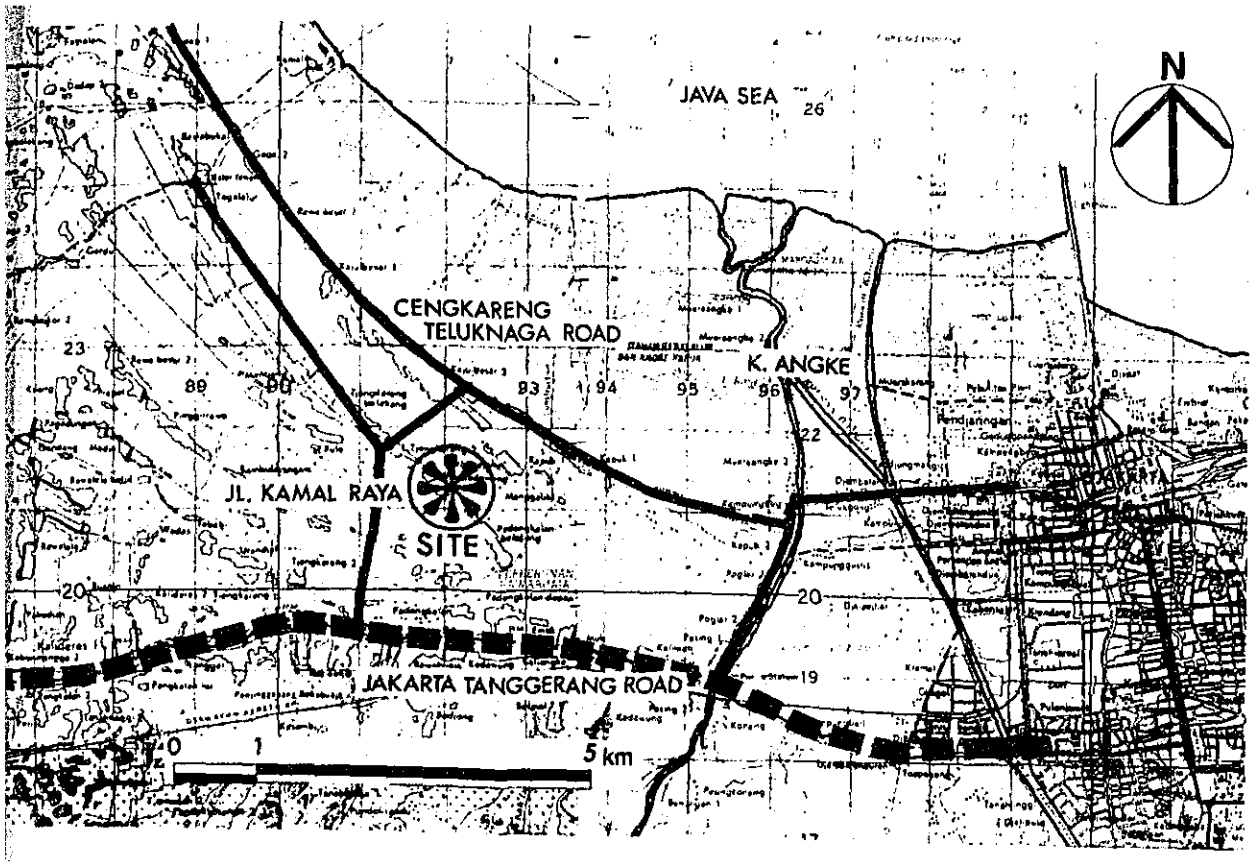


FIG. 2-2-3
EXISTING
ROADS.

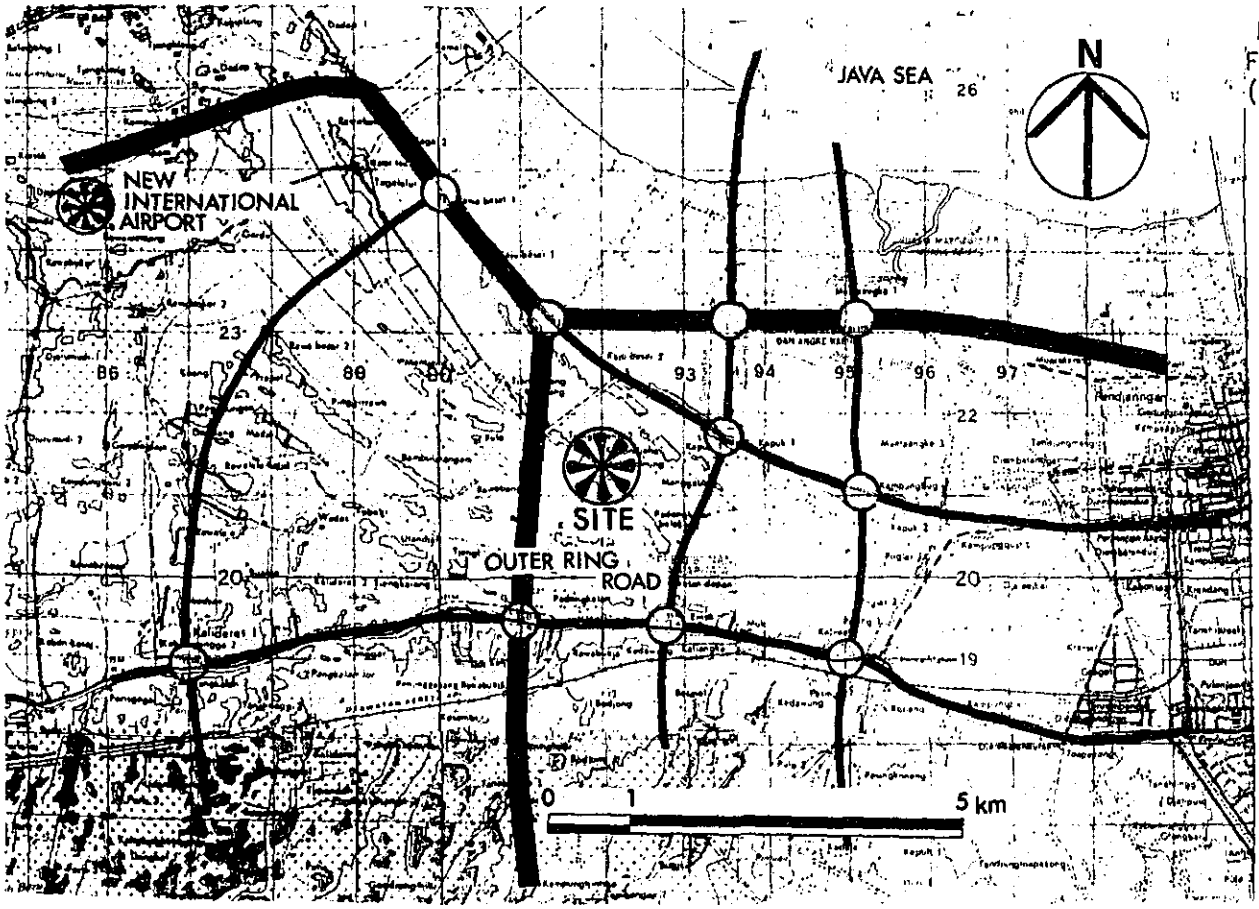


FIG. 2-2-4
FUTURE ROAD
(DKI MASTER
PLAN)

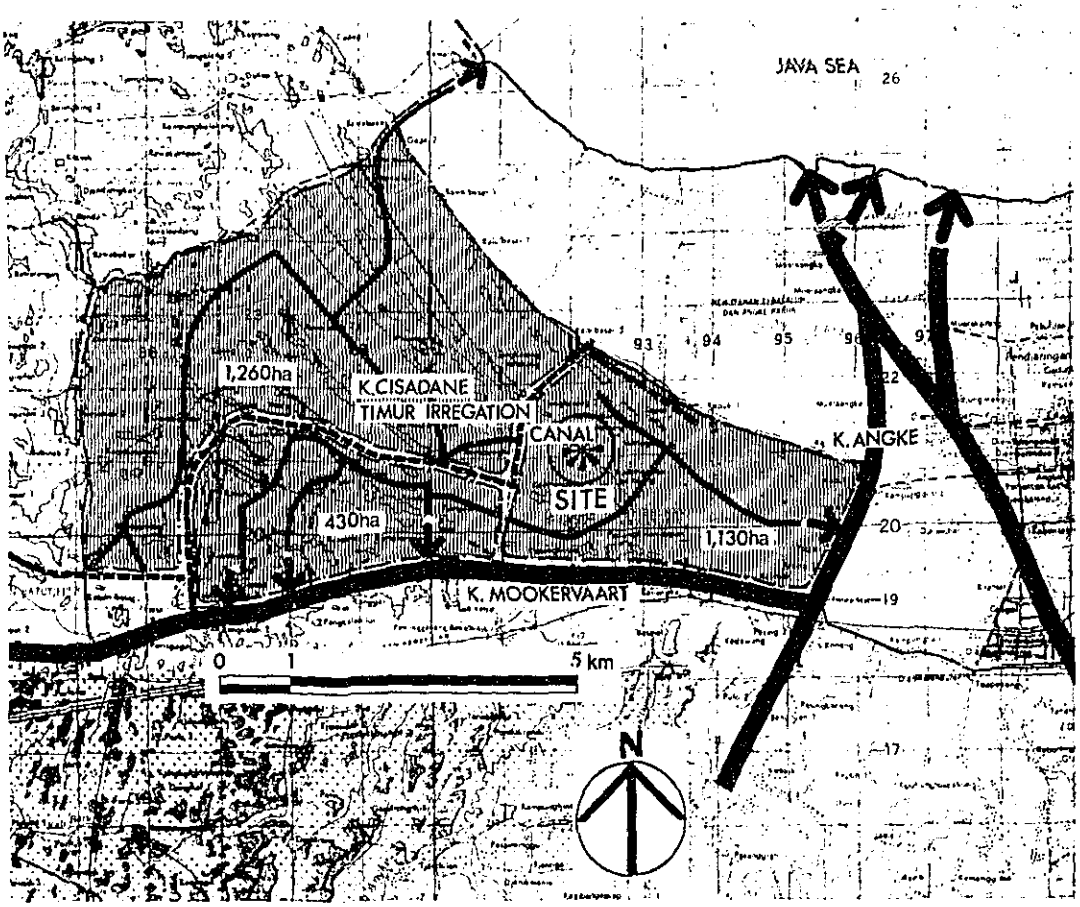


FIG. 2-3-1
EXISTING
DRAINAGE

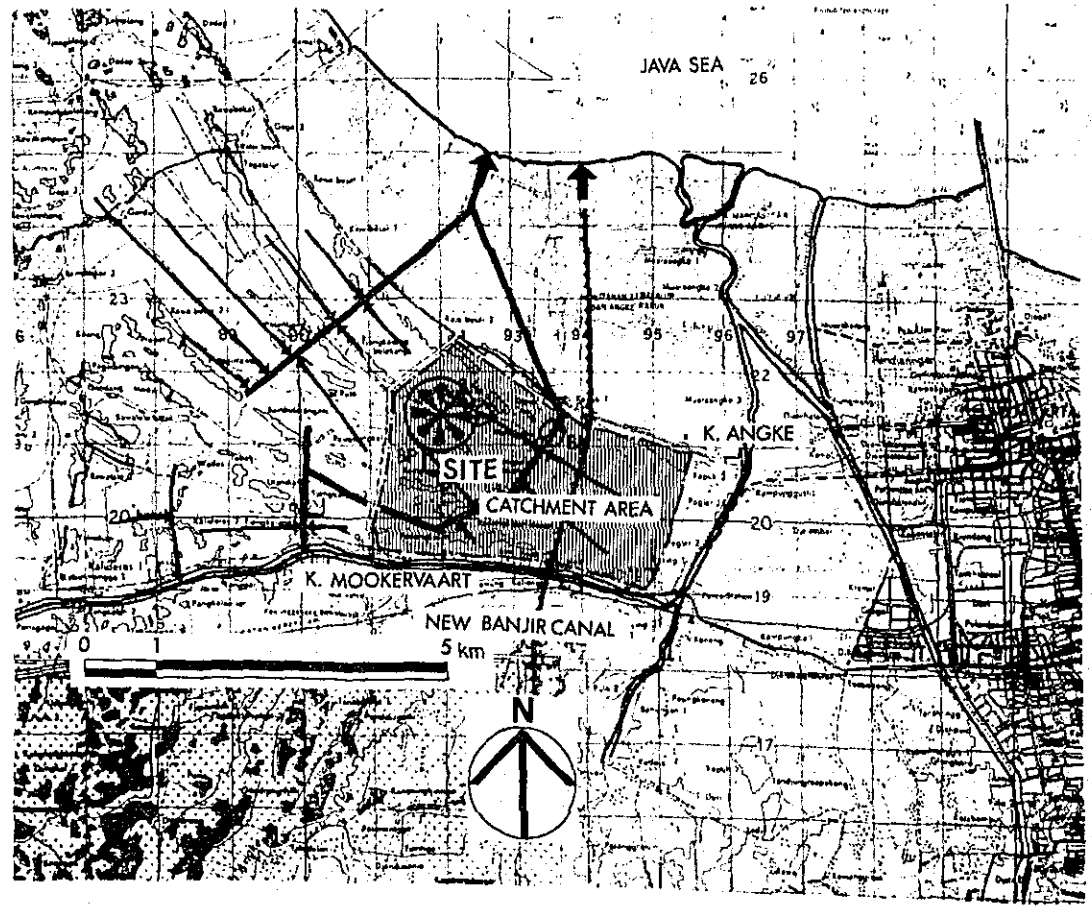


FIG. 2-3-2
FUTURE
DRAINAGE
SYSTEM

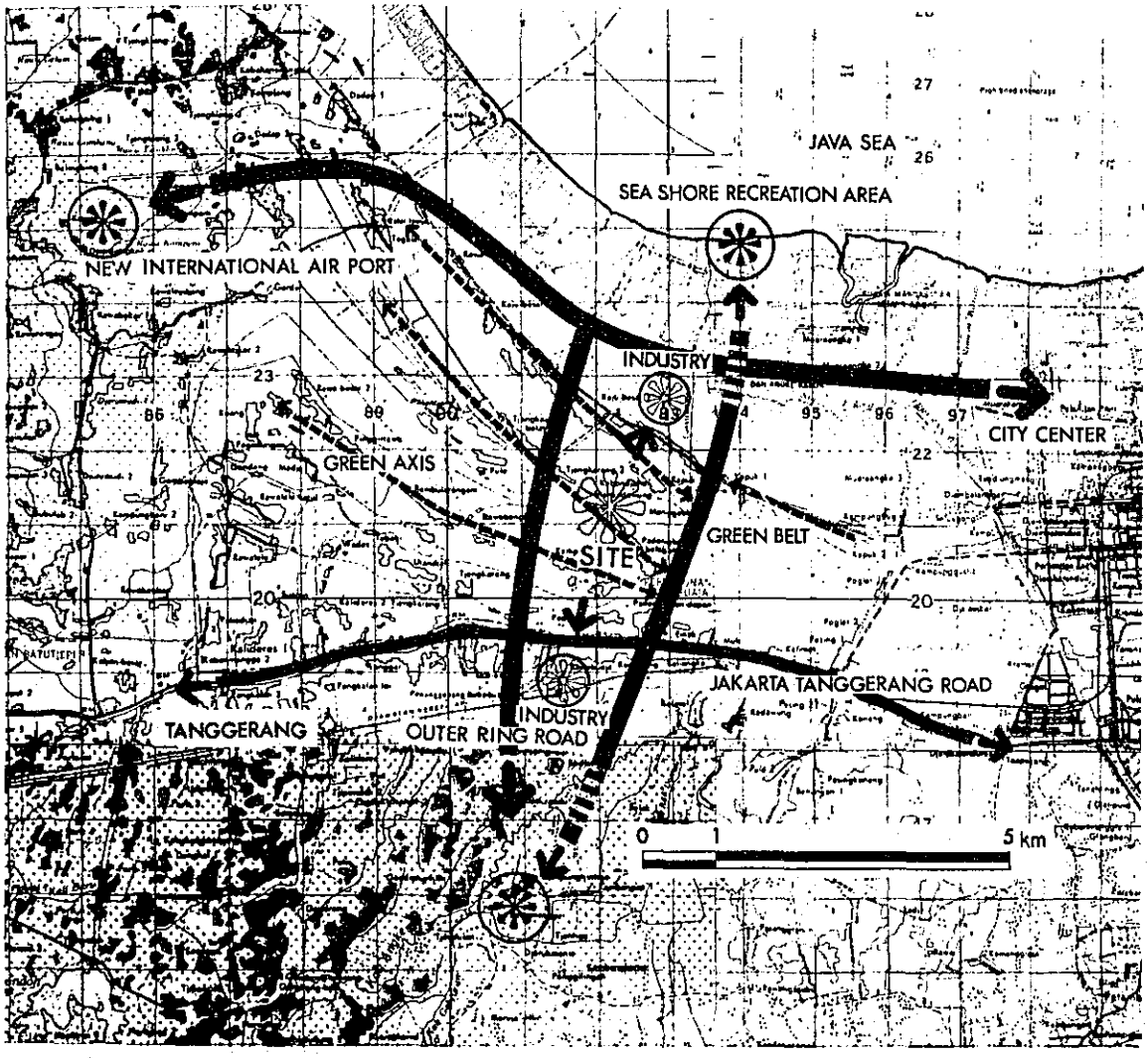


FIG. 2-4-1
STRUCTURAL
CONCEPT

3. STUDY AREA

This study area is bigger than the planning area. The actual planning area will be fixed, based on study and examination within this area. Therefore, the study and examination in this chapter is to be carried out in the area roughly bounded by Kamal Raya, the Cengkareng - Teluk Naga Road, and Kali Kapuk Muara. (FIG. 3)

3-1 Natural, Ecological and Topographyical Condition

3-1-1 Ecology

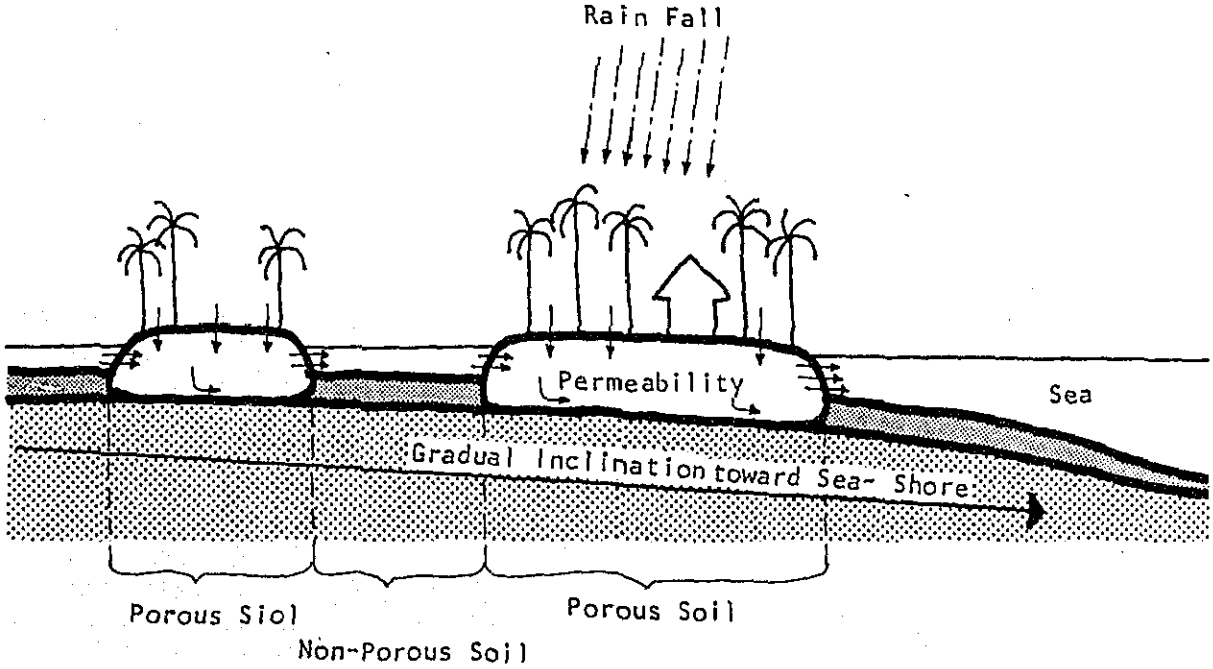
In conjunction with the characteristics of natural environment classified by types in 2-1-3, it is necessary for us to consider the following problems in promoting the land use project.

(1) Drainage conditions, especially the inundation mechanism of inner drainage at the time of heavy rainfall.

At present, in Cengkareng district, communities are situated mainly in the area of Type I. Geographical features of Type I area coupled with those of the surrounding areas constitutes the hydraulic mechanism that has prevented the inundation of inner drainage which is one the most serious to be solved in promoting the use of land for housing in such lowland as Cengkareng district.

Soil of Type I area mainly consists of sand, and thus it is prous, and has a high water permeability. Thus, where the surface of the soil is not covered with artificial objects, almost all rainwater permeate the soil easily even at the time of heavy rainfall. When the rise of river water level has occurred at its upstream, Type II area has been playing an important role in mitigating the effect of sudden increase in the flow rate of the river, and increase river water enters Type III area as it flows on mildly sloped to the coast, then empties itself into the sea. In the course of the flow of such increased river water, however, the soil of Type I area is almost no barrier to the flow of water because of its high water permeability, and thus helps to prevent the inundation of inner drainage.

Thus, in view of the effects of the existing hydraulic mechanism in this area, it seems not wise to cover the surface of Type I area with artificial structures leading to the loss of water permeability of the soil in this area, and to construct underground structures which also disturb the flow of underground water existing relatively close to the ground surface, because these things are considered to aggravate the danger of inner drainage inundation. Similarly, the land reclamation in Type II area, if realized, can be considered to increase the peak flow rate. As for Type III area, since it is playing the role of the passage of water flowing into the sea, the function of this area also deserves adequate consideration.



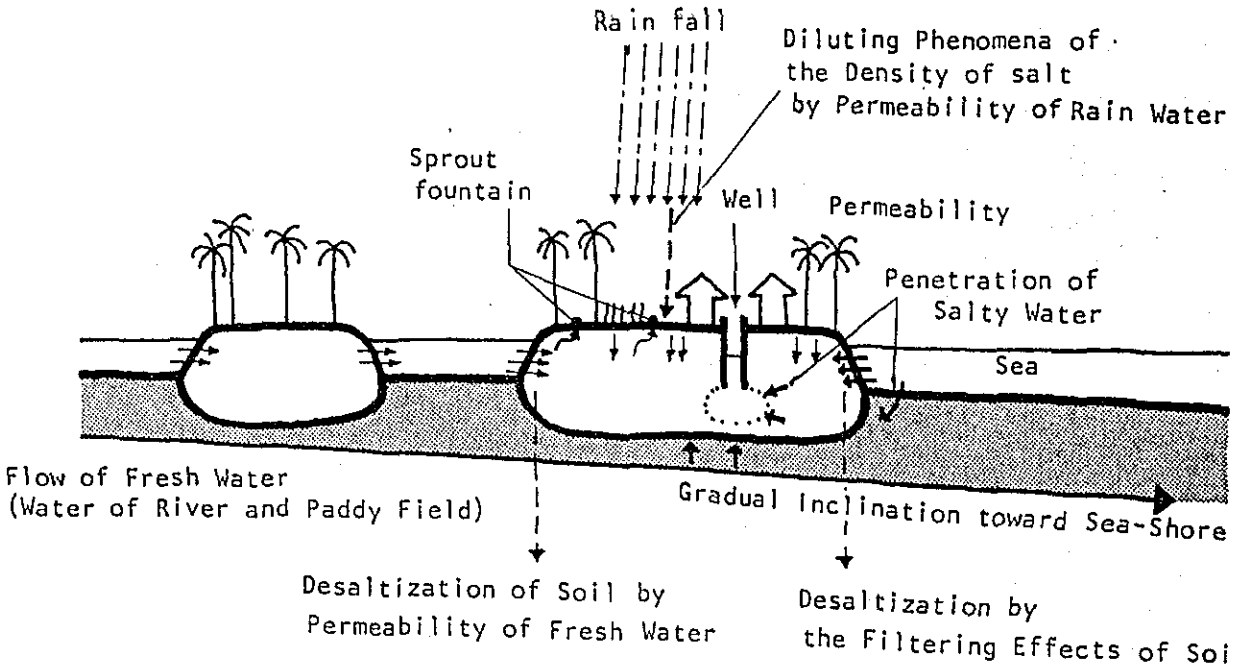
High Water Level Condition of Torrential Rain

(2) Mechanism permitting the salt to enter into soil and underground water

The area in question is situated extremely close to the coast, and adjacent to saline swamp, so that the salinity in well water or soil is relatively high. And, such condition is not desirable not only to the living of people but also to the agriculture. However, as far as the well water and soil in

slightly high land area are concerned, the hydraulic mechanism in this area is also working as the desalting mechanism.

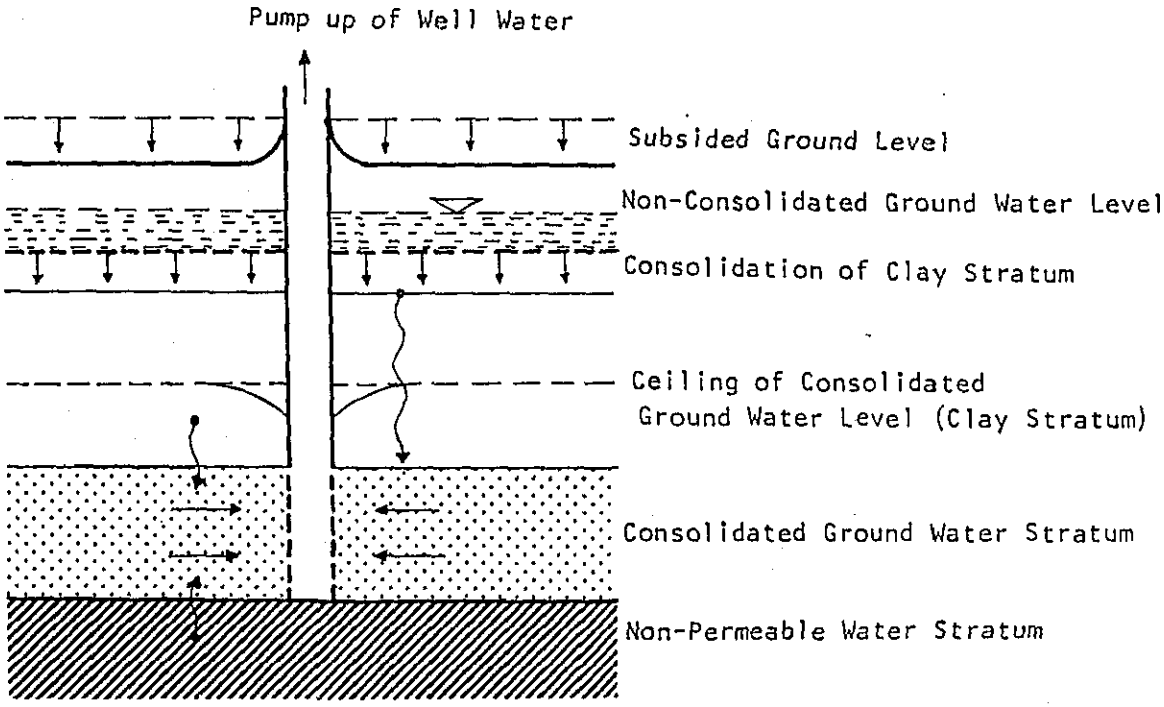
As discussed previously, the slightly high land area consists of porous soil with very high water permeability, which greatly facilitates the dilution of the salinity in water and soil in this area. Also, it must be noted that the salt entering slightly high land area from the adjacent saline swamp is not only diluted by the filtering function of the soil and sand but also desalted by the fresh water from its upstream as it empties itself into the sea after passing the mildly sloped land.
Almost the same hydraulic mechanism is working on the well water in this area. Thus, in promoting the local development projects in this area, adequate care should be taken so as not to damage the existing hydraulic mechanism as the destruction of this mechanism can lead to the increase in the salinity of soil and water in this area.



Desaltization Effects of Slightly High Land

(3) Mechanism of land subsidence

As discussed before, the soil in Cengkareng district is covered with the soft surface soil consisting of the deposit on the alluvial lowland, silt and sand. According to the results of the geological survey by borings and soundings, the proposed site of development, especially the area consisting of the paddy fields, consists of soft ground whose G.L. is under 5.5 ~ 9 m. Problems in preparing the development plan for soft ground are as follows:



Concept of Subsidence of Ground

a) Consolidation land subsidence by the load of banking:

It will be necessary to provide banking on the present paddy fields and swamps, but since the proposed site of development consists of soft ground, the land subsidence due to the load of banking is anticipated to occur, and such subsidence called the consolidation land subsidence progresses gradually with time. Such consolidation land subsidence can cause the cracks in the pavements of roads, concrete flooring and uneven settlement of land that affects the underground facilities such as underground pipings. Since the composition

of slightly high land is considered to differ from that of paddy field area, the difference in subsidence characteristics between these two areas causes the uneven settlement along the border of these areas.

b) Outflow of underground water into neighboring areas due to the load of banking on the site of development:

When the banking is providend on the proposed site of development, there is the possibility that the underground water in the site is forced to flow out of the site due to the load of banking, thereby causing the constant inundation of the neighboring swampy lowland.

c) Destruction of neighboring ground condition caused by the accidents such as the sliding of heaping on the slopes around the banking in the site:

Where the formation level of the banking in the site is made higher than the levels of neighboring grounds, the collaps of heaping on the marginal slopes of banking may occur thereby giving adverse effects such as the turnover of the surface soil on the neighboring grounds.

d) Subsidence of ground caused by excessive pumping of underground water:

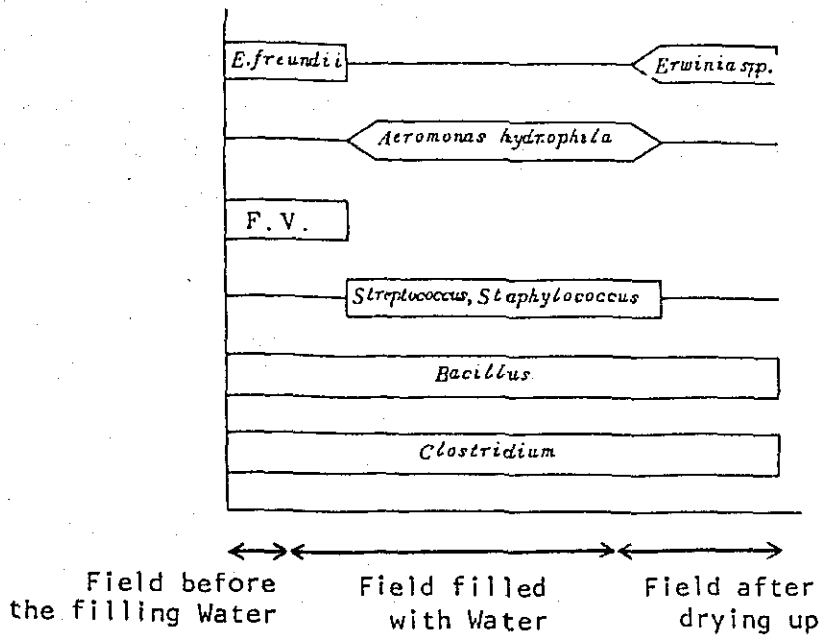
As it has already been observed in the central district of DKI Jakarta, the subsidence of ground can be caused by the excessive pumping of underground water, and there is a close relationship between the change in the level of underground water and subsidence of ground. Thus, supposing that this land development project for housing is planned expecting the intensive use of underground water for the living of the people, this project will have to face the problems arising from the fall of underground water level and resultant increase in the effective load on the ground and subsequent subsidence of the ground in view of the ground composition of the site, and further this can lead to the inundation at

the time of heavy rainfall or permanent submergence of the ground.

(4) Other mechanisms

a) Change in the condition of anerobic bacteria resulting from the change in the hydraulic condition of the soil in paddy field area:

Conditions for the growth of vegetation are largely dependent on the condition of surface soil, especially the condition of the microbes in it. Normally, it takes at least 4 to 5 years for the soil not suited for the growth of vegetation to acquire the conditions suited for the growth of vegetation. Especially, as far as the soil in the paddy field area in the site is concerned, the change in the condition of anerobic bacteria is considerably large as shown in next fig.so that it is impossible to use the soil as it is for the growth of vegetation.



Transition of Anaerobic Bacteria in Paddy Field

b) Temperature control mechanism by the evaporation of water from paddy field:

Those villages situated at present in the slightly high land area in Cengkareng district have relatively cool weather despite of being in the tropical environment, for not only they have relatively large spaces where trees grow but also the heat of vaporization resulting from the evaporation of the water from the paddy fields controls the temperature in this area. Therefore, when this paddy field area is dried as the result of land reclamation, rise of temperature by 2° - 3°C should be expected.

3-1-2 Geology

A. Geology and soil conditions

During October and November 1979, a geological survey was carried out, consisting of two borings and 18 Dutch cone soundings, in the planning area. The findings showed soil conditions in this area, up to 10 - 14 m below the surface, to be very soft ($N < 3$) clay accumulated with rather hard clay/clayey silt ($N = 3 \sim 10$), and among this some medium sand strata consisting or partly compacted sand/sandy silt, and clayey sand. Below this, diluvium, consisting of quite hard sandy clay, clayey silt and sandy silt, etc., is distributed.

The aluvium consists mainly of clay and clayey silt which have high plasticity and high water content, and almost all the soil strata have saturation levels of nearly 100 %. The soil characteristics are almost the same as general aluvium deposited clay, but in parts a remarkable compression index is obtained, being over 1.1. Because of the grain size distribution, except in the partial sand strata, extremely small water permeability coefficients are measured. This coefficient, roughly calculated from the results of pressure and density experiments, is less than 1×10^{-7} cm/sec.

The diluvium (or deposits of volcanic origin) is generally a brown sandy clay or clayey silt, and fairly hard ($N \fallingdotseq 20 \sim N > 50$) but an undisturbed sample was unobtainable.

The distribution of the upper surface of this hard soil strata is such that, on the south west ridge (south of S14) of this area, it forms islands of deposits close to the surface. In the rest of the area the strata deepen from west (the Y point) to east. This strata has quite strong basic load bearing capacity, and estimated from various data, the water permeability conditions show better results than the upper part of the aluvium.

B. Bearing capacity

From the results of the studies and various data, the bearing capacity of each soil strata of the area was examined, the following can be ascertained:

To estimate the bearing capacity, normally the standard penetration test result (N value) is the most easy and reliable means, but this time only two borings were made and, on the whole, in this area, soundings by Dutch cone penetrometer were carried out. Therefore, not only from this results, but also from data on the nearby area (Muara Karang and Tanggerang), a relationship between N value, and qc value from soundings, was assumed and the bearing capacity distribution for the whole area was estimated.

The relation between the N and qc values, as shown in the FIG. 3-1-2 correlates only with the low qc values ($qc < 40\ kg/cm^2$) and the overall correlation has a totally different trend. On this occasion, to be on the safe side, the correlation, obtained from all the data, of $N = 0.437\ qc$ was used, and the bearing capacity distribution graph was obtained. As a result, up to 2 - 3 m below the ground it can be seen that there is extremely soft strata ($N < 3$), and underneath there are one or two layers of soft clay strata $N = 3 \sim 10$, and then below that a further soft strata $N < 3$. The thickness of the soft strata, including the above mentioned strata, is between 5.5 m and 9 m relation between N - qc.

This is estimated that the long term bearing capacity is only $3\ t/m^2$ for slab-on-grade foundation. Furthermore, because subsidence is expected, it is not suitable for building foundations.

If strata are considered as practical building supporting strata N ≥30, the shallowest strata must be about 7 m, and the deepest about 13 m. When shown in map form as in the Isobath map of bearing layer, it can be seen that the coastal ridge, spread from the Y - point toward the inland area, is shallow, and it deepens dramatically between the Y - point and the northern edge of the area. As shown in the same map the middle sand strata which exist in the lower part of the marine strata provides a strong enough bearing layer, but there are discontinuities, so that there are gaps in the bearing strata distribution.

C. Ground water level

In this study, a systematic ground water level survey was not carried out, but the study period was during the rainy season, so generally ground water levels were high. Except on the coastal ridge, the levels were almost at ground level, or 0.2 ~ 0.4 m below the surface. On the ridge the ground water level is about the same as in the surrounding marine strata surface (in fact, fields), 0.6 m - 1.5 m below the ground.

3-1-3 Topography

This area consists of mainly flat low land, except the community area which is relatively high above sea level. As this project area has very subtle topographic changes, an understanding of this area's topography is required for planning. There is a need for drainage, and land stabilization projects.

Up to the present time, for the Cengkareng Flood Control program, many topographical maps have been drawn up. But on comparison, the maps have many points of difference, so it is not possible to ascertain which map is the most accurate.

Therefore, Perum Permnas, in December 1979, has carried out the topographic survey, and finished in February 1980. After that, the data was sent to the Team, but is still in study. Therefore the study is being based on the 1/25000 map which is expected to be the most reliable one at present, having 0.5 m contours, from 'Jakarta Drainage and Flood Control Project - Explanatory Note on the Design of the Cengkareng Drainage System' - by P.B.J.R./NEDECO, February 1976. This topographic map is based on the 1/5000 survey drawings carried out in 1974 by P.T. Intechno Partamn Consultants and C.U. Kutamas.

According to the above mentioned topographic map, land over 3.0 m above sea level lies in a line running in a N.W.-S.E. direction. This matches the distribution of village communities. Surrounding the ridge is low land under 3 m above sea level. Over the low lands, many isolated contours can be seen, and these generally indicate lower land than the surrounding lowland. For example, along the north west border of the project area, a swampy area is distributed, which is unsuitable for rice growing. This is formed by poor drainage, caused by its lower elevation. This area was found to be about 1.0 m lower than the surrounding area, by field measurement using hand levels. On the other hand, on the west and north west borders of the area, there are comparatively well maintained roads, such as J.L. Kamal Raya road, which is elevated to about 2.0 m above the rice fields. (Figure 3-1-3)

3-2 Land Use and Facilities Distribution

3-2-1 Present Land Use

The land use of the study area can be divided into community use, being mainly housing, and rice fields.

The percentage of the area under paddy fields is about 60 %, and the community use is about 40 %. However, in this community area, quite a lot of ordinary fields are included, and furthermore, in the paddy field area, swampy areas unsuitable for agricultural use are scattered, it is estimated that farming use represents 65 %, village 25 % and swampy area about 10 %.

The land use within the village areas is mainly for housing. Along the main roads are a few shops, factories and warehouses, but in terms of land use percentage these represent a tiny amount. (Fig. 3-2-1)

3-2-2 Distribution of Major Facilities

With regard to the distribution of educational facilities in the area, there is only one kindergarten, in Kelurahan Cengkareng, and although there are seven elementary schools, there are none in the central villages of the area, and furthermore there is only one junior high school and two senior high schools in the area.

As for Mesjid, there is one in each of Kelurahan Kapuk and Kelurahan Cengkareng, but there are many small ones scattered in the villages of the area.

Medical facilities are available, one being in Kelurahan Kapuk and one in Kelurahan Cengkareng.

As for administrative facilities, there is one in Kelurahan Kapuk and one in Kelurahan Cengkareng, but there is only one post office, which is in Kelurahan Cengkareng. (Figure 3-2-2)

3-3 Socio-economical Condition

The population of the area is about 10,000, and the number of households is estimated to be about 1,700. As is obvious from the land use, over 90 % of workers are engaged in farming and less than 10 % are non-skilled labors in industry other than farming.

With regard to the earnings of farm workers, these vary a great deal according to the year, but in 1979, for example, the average annual earnings were estimated to be 250,000 RP. Compared with other types of workers, an ordinary labourer earns about 150,000 - 180,000 RP per year, which means that farmers are earning about 1.7 times as much.

With regard to farming activities, the following information was obtained by enquiries in the Kampung office in December 1979.

With regard to farm production, in the case of rice fields which are irrigated and drained, nice cropping is biannual, and the amount of produce from each crop is about 4 tons/ha and annually it is estimated at 8 tons/ha.

On the other hand, in the case of rice fields which are not irrigated or drained, the productivity is low and the cropping is possible only once a year. It is estimated to produce about half of the former productivity, being about 2 tons/ha.

With regard to the distribution of agricultural land, the amount of agricultural land within the project area, owned by people living within the Kelurahan Cengkareng project area, is about 40 % of the total land, i.e. about 40 % of the cultivated land per farmer is located near the housing areas, while the remainder is relatively far away.

With regard to farming activities here, three-quarters is involved in rice growing, and the rest in growing vegetables. This indicates a comparatively greater emphasis on the latter.

	Population	Household	Farmers earnings	Other earnings
K. Cengkareng	3,685	576	200,000 RP/yr	150,000 RP/yr
K. Kapuk	6,182	1,135	300,000 RP/yr	180,000 RP/yr
Total	9,867	1,711	—	—

3-4 Infrastructure

A. Drainage

A-1 Existing drainage channel

This study area lies within the Kali Kapuk Muara Catchment area of 1,130 ha. This Kali Kapuk Muara is a tributary of the Angke River and is small compared with other tributaries of the Angke River.

The Kali Kapuk Muara, which forms the existing main drainage channel, has a 3 m by 1 m outlet, but in the middle of its length it has a width of 5 m and a depth of 1.5 m. From the Angke River to a point 500 m upstream it is concrete-lined and has a width of 10 m and a depth of 3 m.

The branch lines of the drainage channel in this area are, naturally, located at the lowest elevations, and along these branch lines swampy areas are scattered which are impossible to drain.

The Cisedane Timur Irrigation Canal runs beside the road on the west and north-west borders of the area.

However, the canal has partially cut off the natural drainage channels in this area, and rainfall run off has difficulty in escaping. At the moment, this area has low undrained, swampy areas scattered along the irrigation canal.

A field survey of flood and inundation conditions was carried out in the said area through the Cengkareng branch of DKI Jakarta. According to this study the general conditions are as follows:

The said area has no record of flooding or ununddation. However, every time it rains, the rice paddy fields become inundated even within a short period of time. On the other hand, the village areas and highroads do not become inundated under the same circumstances. In the swampy areas long periods

of inundation are observed, but as the areas are not used for cultivation, this is not considered a particular problem.
In rice paddy fields, a maximum of 0.5 m inundation occurs once every three to four years, which is to a certain extent a problem, but no definite damage has been recorded.

From the above, it can be seen that there is no special drainage problem in the agricultural areas, except within the swampy areas. Further, from the flood and inundation conditions there is at least a 0.5 m difference in elevation above sea level between village areas and the rice paddy fields. Also, the short period of inundation of rice paddy fields in the agricultural area is in fact beneficial. (Figure 3-4-1)

A-2 Drainage Plan

Drainage plan for this area have been suggested in 'Explanatory Note on the Design of the Cengkareng Drainage System - Annex VIII to Final Report Phase II, Jakarta Drainage and Flood Control Project' by the P.B.J.R. and the Nececo, February 1976. (Figure 3-4-2)

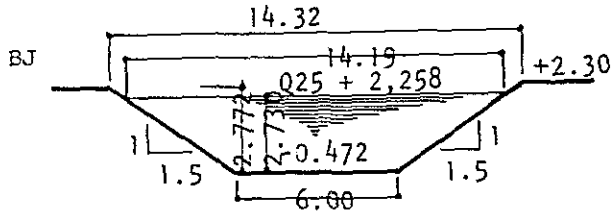
Finalization or semi-finalization of the main drainage and branch line plan shown in the above project is required. Therefore, extending from this project, branch line projects for low cost housing will be carried out. In this case, water levels in the branch lines are arranged 0.4 - 1.0 m above the project arterial and branch lines, and established every 500 m. In addition, in this branch line project, from the two year rainfall, 1/1000 - 1/3000 gradient, and the structural land loss, gives figures of 0.25 - 0.5 m.

This area's drainage plan by Nedeco is shown as in Figure 3-4-2. The design value relates to design water level, water channel width, and gradient at AX, BJ, BK, BO, (Figures 3-4-3). According to this, the low-cost housing area requires a fairly large amount of ground infilling.

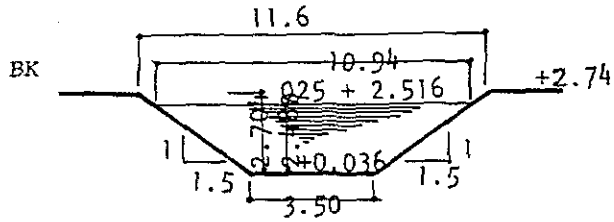
With regard to Hedeco proposals, these were reviewed by the Japanese Study Team who made tentative suggestions.

In the Nedeco plans, with regard to the relationship between points BI and AX, the distance is 4,600 m, the design water level of Q-25 at BI is pp + 2.258 m, and the average gradient is 1/3,657. If the average gradient is made to be 1/5000 the design water level at point BI becomes 1.920 m, 0.338 m lower than the Nedeco plan. By lowering point BI branch line 2 - 3 is affected. Furthermore, only branch line 2 - 3 was set with gradient 1/4000, 1/5000. Accordingly each maximum water level is reduced by 0.338 m or 0.434 m. Therefore, by this means, quite a substantial difference in the required soil infilling is made.

After changing the gradient as above, the profiles of points BJ and BK were examined. As a result, as shown in Fig. 3-4-1, Revised (1) Alternative (2), the profile of branch line 2 - 3 was approved.



Q25 = 28 cu.m/sec
V = 1.02 m/sec
A = 27.55 sq.m, P = 15.82 m
R = 1.74 m
I = 1/4,000, n = 0.0225
$R^{\frac{2}{3}} \times I^{\frac{1}{2}} \times A = 0.6305$



Q25 = 16 cu.m/sec
V = 0.90 m/sec
A = 17.91 sq.m, P = 12.42 m
R = 1.44 m
I = 1/4,000, n = 0.0225
$R^{\frac{2}{3}} \times I^{\frac{1}{2}} \times A = 0.3615$

Bed Slope = (0.036 + 0.472)/1,000
= 1/1.969

FIG. 3-4-4 Revised (1) Alternative (2)

B. Water supply

The drinking water supply is mainly from shallow wells, and, for washing, irrigation water is used. There is a lack of quantity and quality.

C. Sewerage

There are no sewerage facilities, and almost all the houses have no toilet facilities, using outside the house, or the river, instead.

D. Solid Waste

There is a lack of public storage space and refuse collection service.

E. Electricity

No electricity facility is supplied from PLN and kerosene lamps are used. A 20 KV line is under construction along the road on the study area's border, and this is expected to be complete in 1980 - 81.

3-5 Progress of Land Acquisition

Since 1972, the land acquisition of the Cengkareng for low-cost housing development has been encouraged by DKI Jakarta. At the end of 1979, 127.25 ha had already been purchased.

However, this is way below the original planning area's 330 ha, and furthermore the purchased land is widely scattered.

Under the conditions of purchase, in the village areas purchasing has not progressed well, and the larger part has yet to be purchased. The units of purchased land are also very small.

On the other hand, the purchase of rice paddy land has progressed well, but along the highway purchasing has not been very successful.

For the development of the housing area, it is important to acquire minimum land for functioning roads, infrastructure, so, even if it is only tentative, land purchase must achieve a certain scale.

FIG.3
STUDY AREA

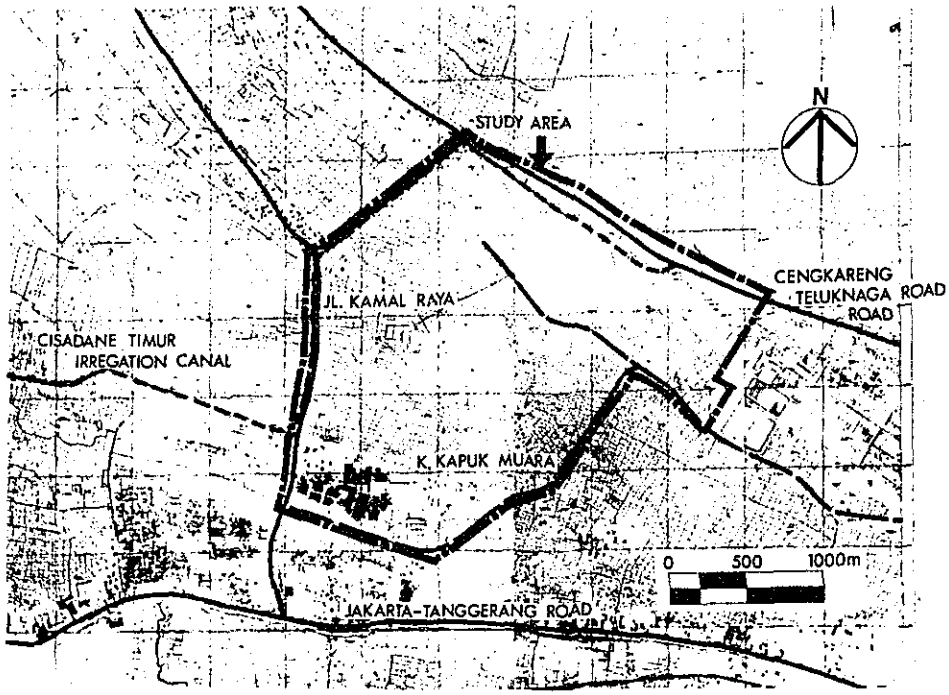
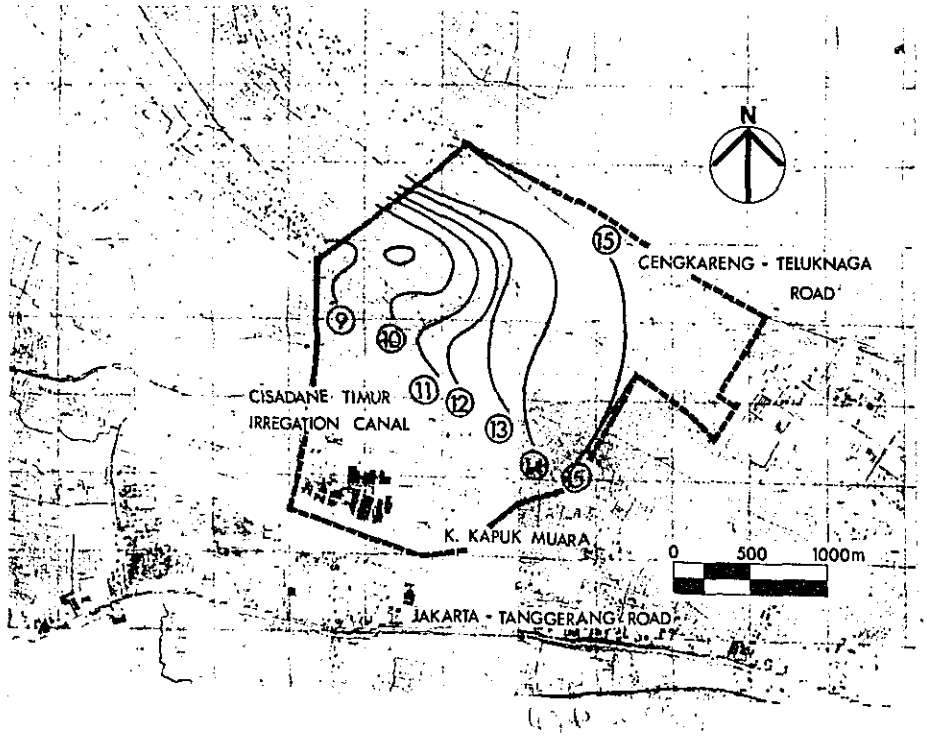


FIG. 3-1-1
SOIL CONDITION



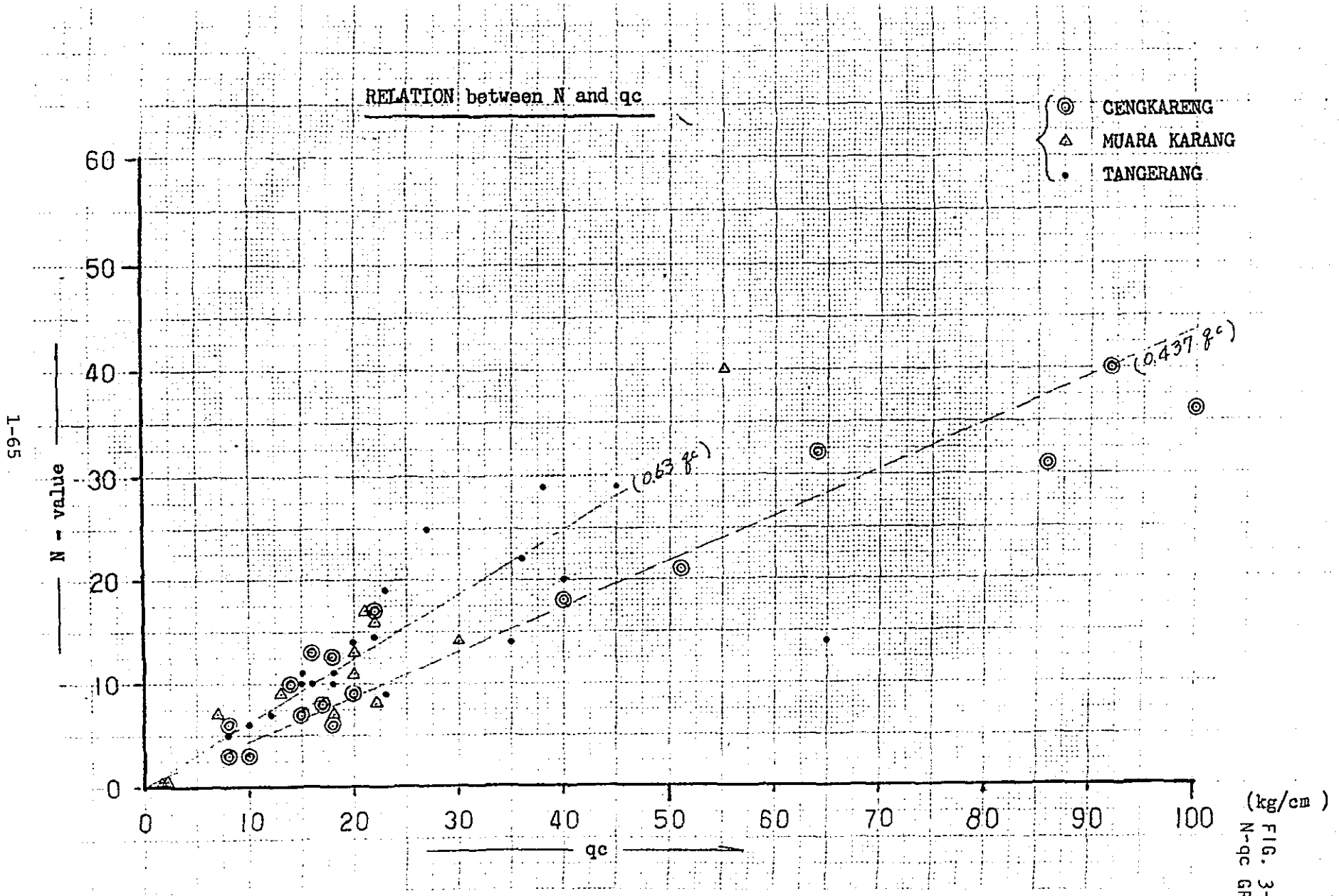


FIG. 3-1-2
N-qc GRAPH

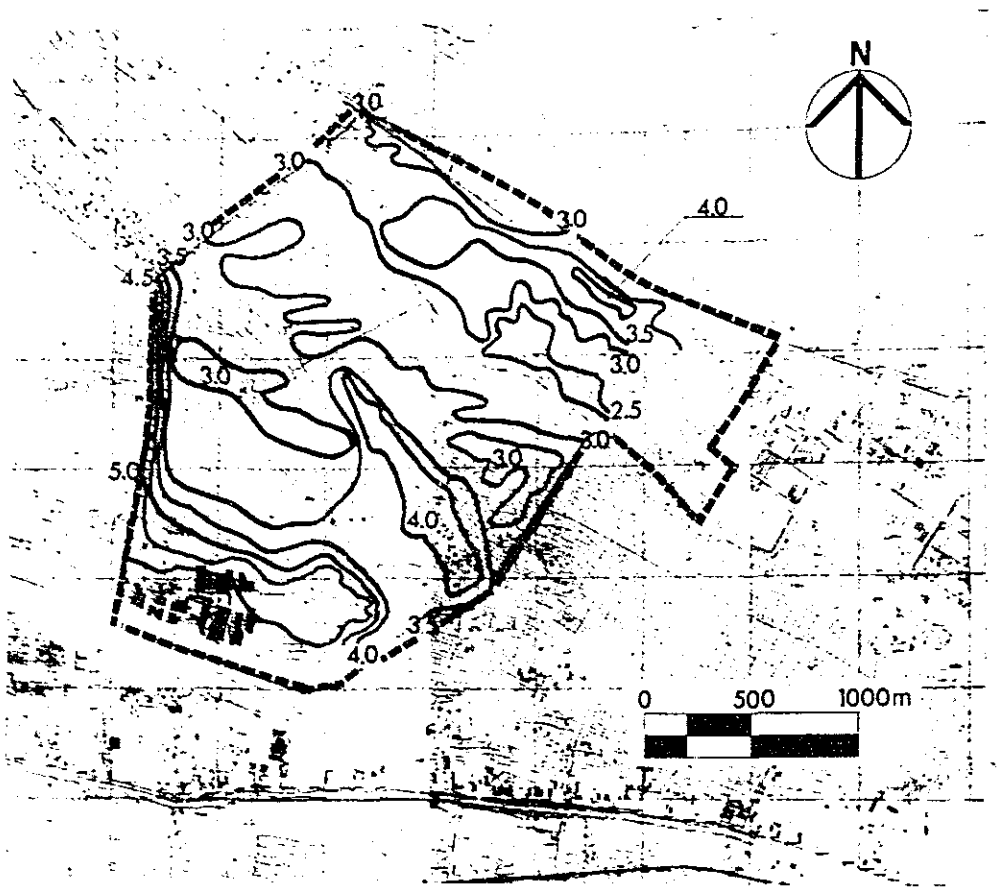


FIG. 3-1-3
EXISTING
TOPOGRAPHY

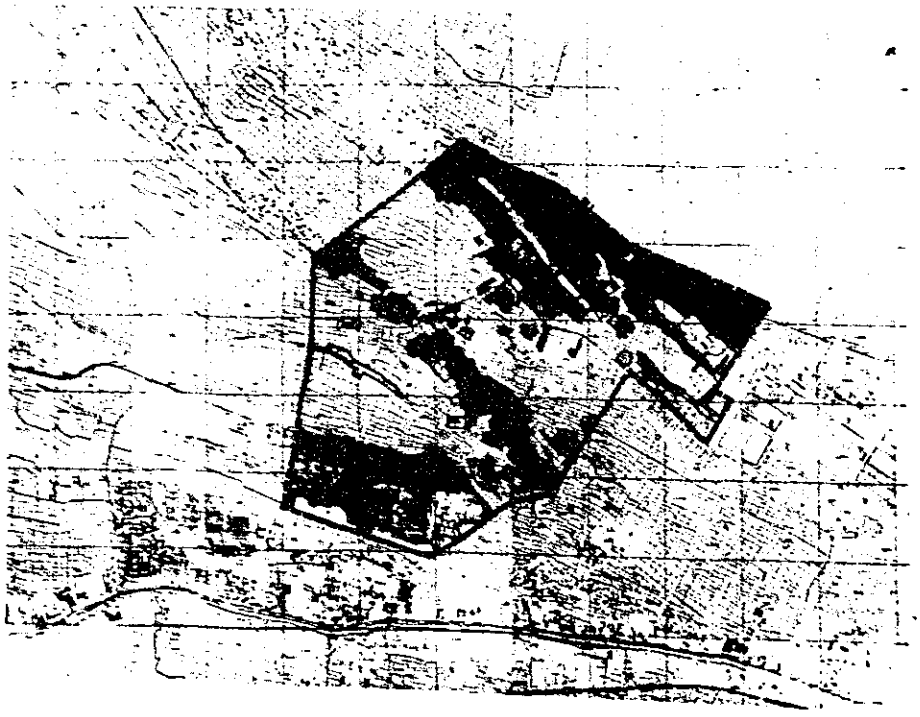


FIG. 3-2-1
EXISTING
LAND USE

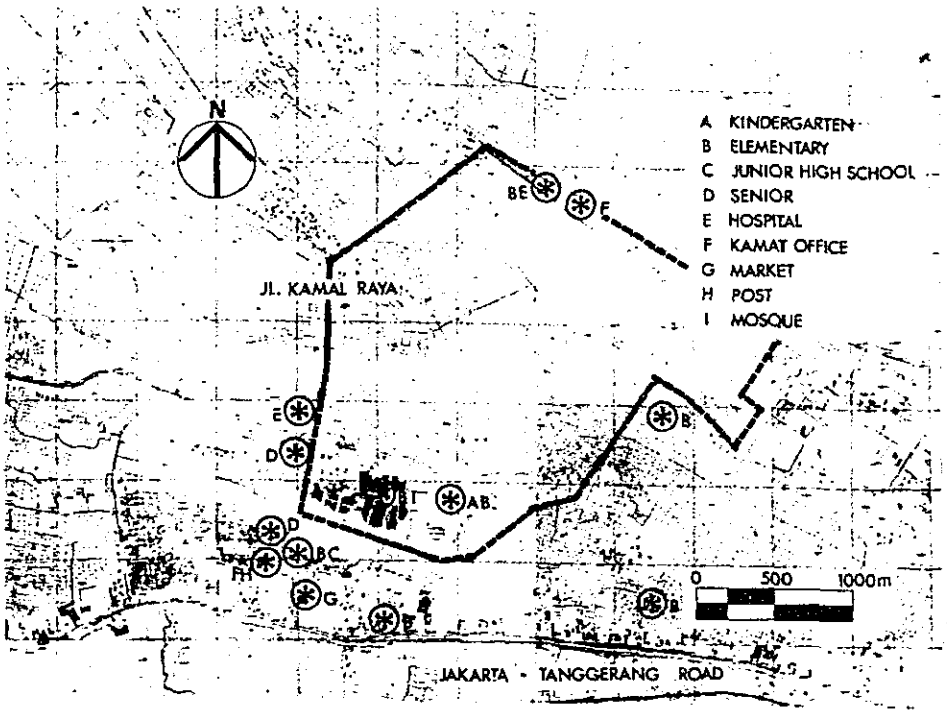


FIG. 3-2-2
FACILITIES
DISTRIBUTION

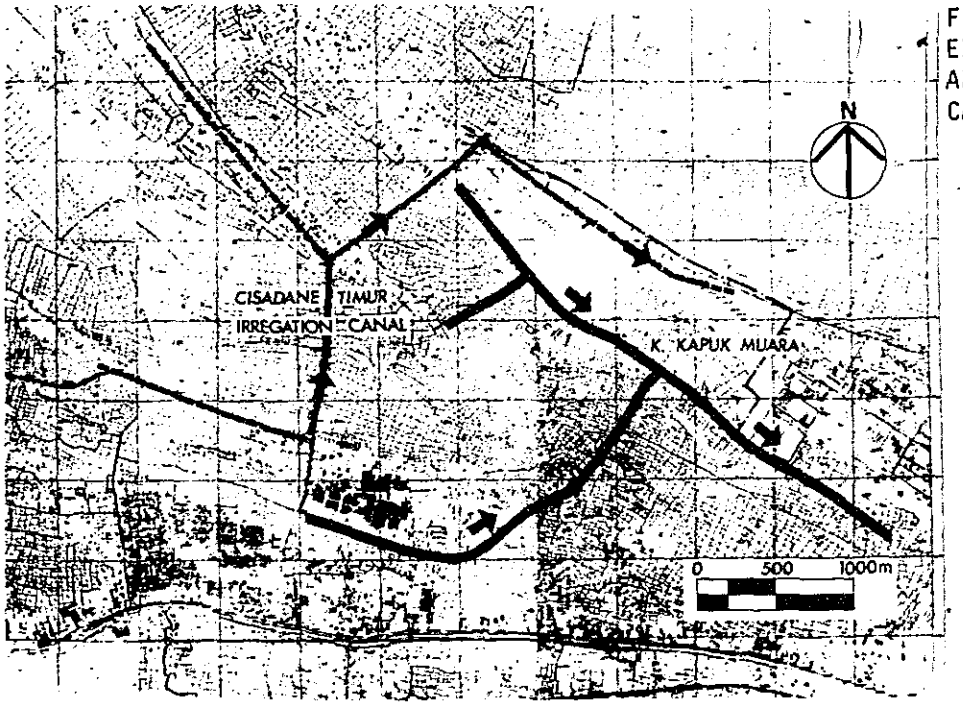


FIG. 3-4-1
EXISTING DRAINAGE
AND IRRIGATION
CANAL

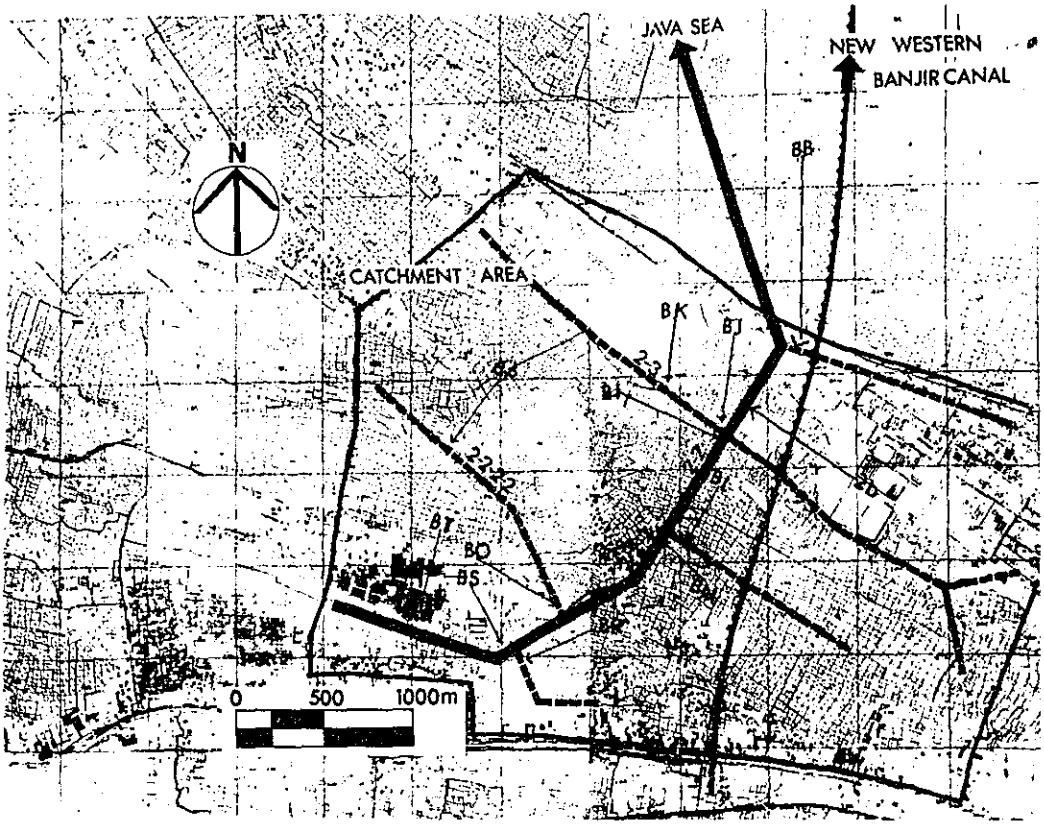
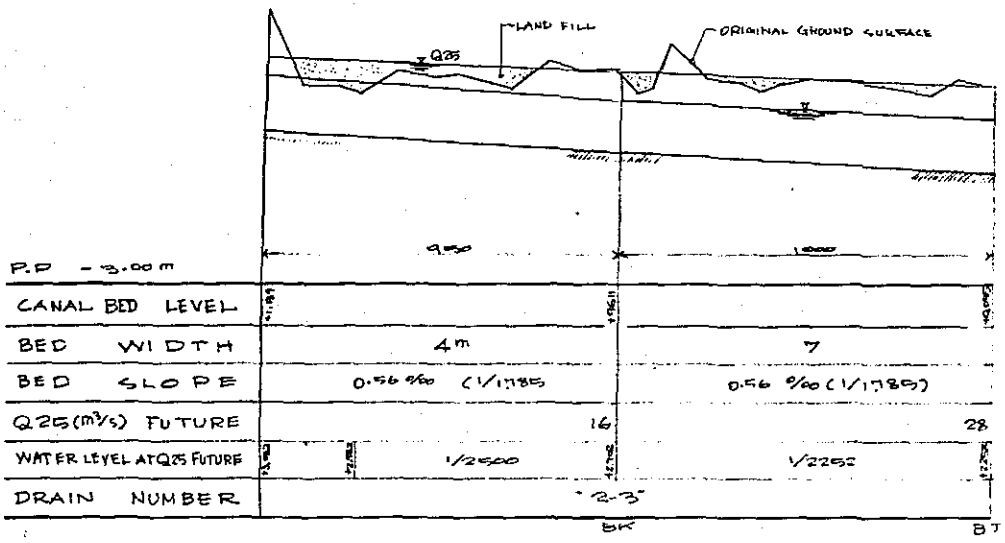
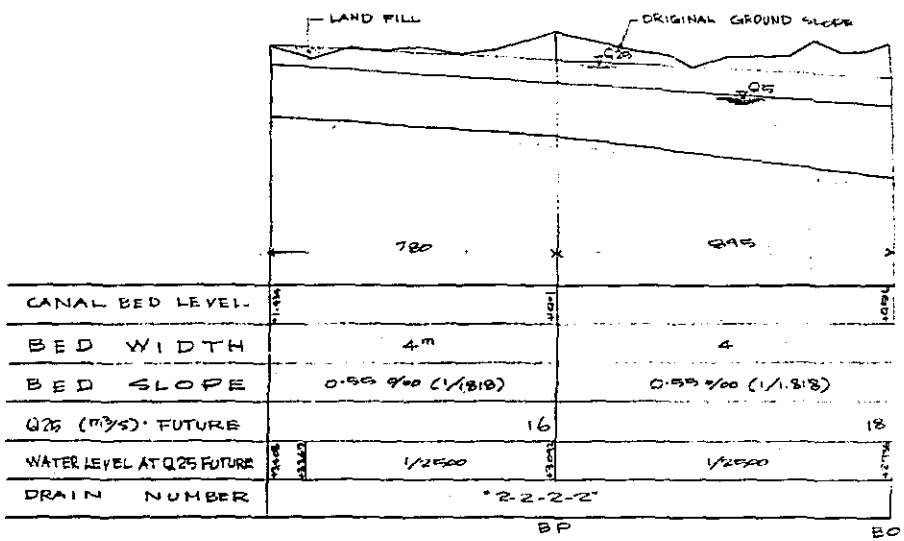


FIG. 3-4-2
DRAINAGE PLAN
BY PBJR/NEDECO





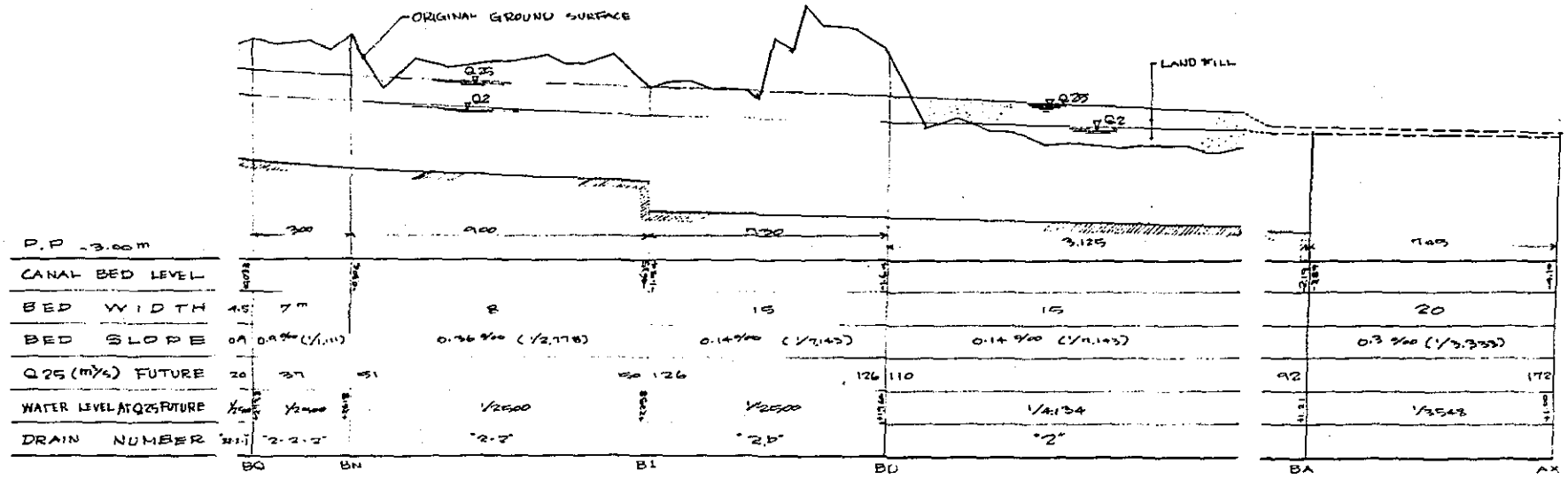


FIG. 3-4-3
MAIN SECTIONS
OF DRAIN

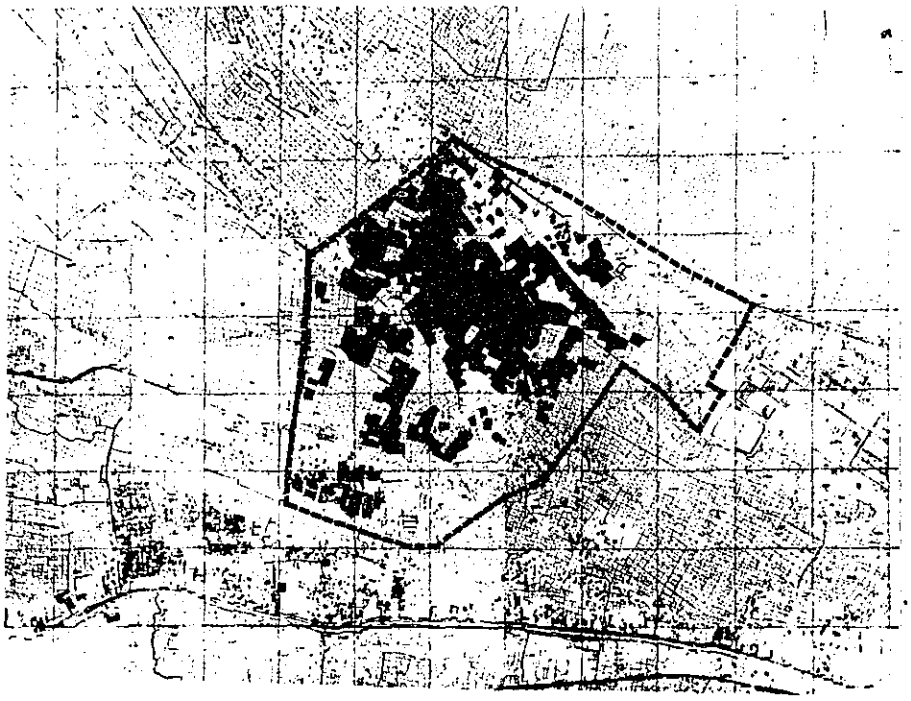


FIG. 3-5
LAND
ACQUISITION

4. STRUCTURAL PLAN

4-1. Development Policy

4-1-1 Precondition-1 (Ecological planning)

(1) Assessment of the aptitude of land for use

In view of the ecological planning, it is necessary to assess the aptitude for use of the land in the proposed site before setting up the land use planning.

It is desirable for us to conduct the surveys on the local vegetation, soil and living things, but this time we have substituted the following method for such surveys. That is, we have classified the characteristics of the local natural spaces by combining the characteristics of the surface soil which are considered to have been affecting largely "the types of natural environment in Cengkareng district", "mechanism of natural environment in Cengkareng district to be considered in conjunction with the land development planning" and "the conditions of local land use which are closely related with the local geographical features including those in the proposed site". In other words, we have prepared the matrix consisting of the combination of the geological analysis of the surface soil and the present conditions of the local land use, which is shown in next Table.

Evaluation Matrix of Land Use Aptitude of Cengkareng Area

Land Use / Surface Soil	Housing Lot	Field , Weeds Field	Paddy Field , Swamp
Sand	Public Facility Road, Green Zone, Park	Green Zone, Park	Semi-Public Facility (After land fill and dry-up)
Alluvial Soil	Housing Lot	Green Zone, Park	Housing Lot (after land fill and dry-up)
Volcanic Soil	Public Facility, Road, Green Zone, Park.		Housing Lot (after land fill and dry-up)

Here, the explanations about the effects and mechanisms of various natural phenomena viewed in terms of the matrix of the natural spaces (see above Table) are omitted, but the results of the assessment of the aptitude of the land for this land development project are discussed here. Our main concerns at this stage are the feasibility of afforestation, possibility of inner drainage inundation in conjunction with drainage mechanism, problem of ground subsidence, and bearing capacity of the soil. Fig. 11 shows the result of the assessment of the aptitude of the land for this development project based on the matrix for the assessment of the aptitude of the land. The basic policy for the use of the land in Cengkareng district has been determined based on the result of the assessment of the aptitude of the land for this land development project.

Geological Classification

ap Sands

al Alluvial Soil

V Volcanic Red Soil

Land Use Classification

H: Housing Lot

RF: Paddy Field

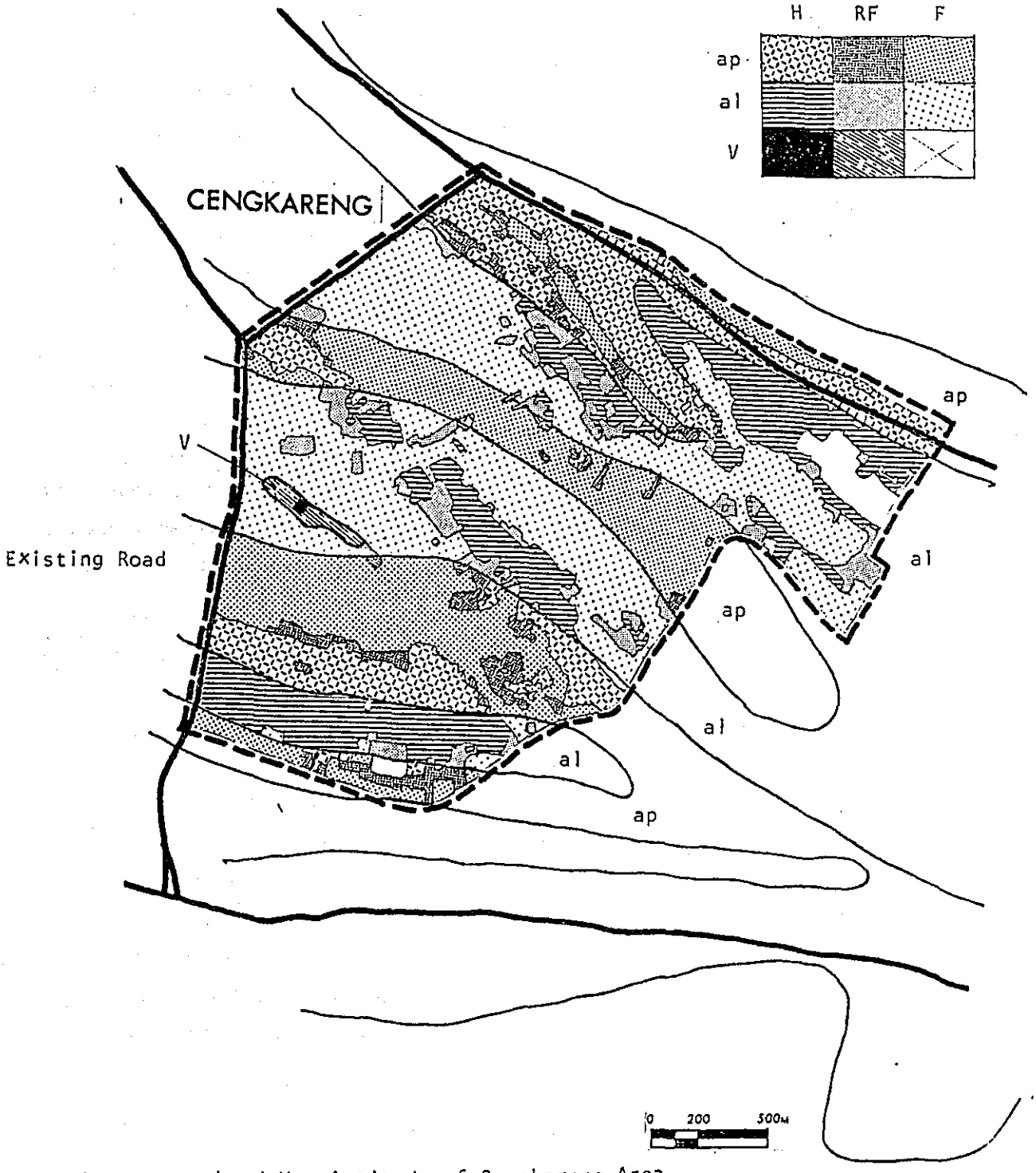
F: Field (Incl Palm. Field)

Natural Calacteristies and Function of aH~VH

Permissible Land Use of aH~VH

Permissible Land Use of aH~VH

Mon-permissible Land Use of aH~VH



Land Use Aptitude of Cengkareng Area

(2) Proposal for green axis

We would like to propose concerning the concept of the green axis as the proposal to which the first priority should be given in promoting the land development project for the proposed site. In view of the mechanism governing the natural environment in Cengkareng district, we can realize that the creation of the green area based on the concept of green axis will play quite an important role not only as the buffer against the effects of the land development project on the drainage system and seawater but also for the conservation of underground water and the natural control of temperature. Rather, it is not too much to say that the existence of such green areas is indispensable for this area to function as an ideal residential area.
Development consists of the soil containing considerable amount of salt, and moreover it is obvious that the soil developed through the land reclamation of paddy fields will present a considerable acidity in combination with the salt contained the soil. Therefore, it is difficult to create green areas in the site unless the soil is improved through appropriate investment, and the improved soil will require maintenance services.

As seen from the chart of the aptitude of land for development shown in above figure, the creation of green axis or green areas introduced in this report and the land use plan is indispensable for the promotion of this development project.

4-1-2 Precondition - 2 (Site Planning)

Before proceeding to the structural plan itself, several primary assumptions will be described below.

First, the project will be undertaken on the basis of the various development plans set up so far in connection with it. We have reviewed the DKI Master Plan as well as various flood control programs and have judged that they provide appropriate premises for the project although they require several modifications and partial changes. Therefore, the housing plan will be worked out within the framework of more general, high-ranking plans.

- This project will cover the site shown in Fig. 4-1-1.
  Neither the area of 400ha planned as the site for Perum Perumhas by Dki Jakarta nor the area of 330ha once intended by Perum Perumhas. This has been decided for the following reasons. First, Perum Perumnas, which is mainly engaged in developing new housing sites, i.e. neither redeveloping existing housing sites nor repairing existing houses sites, is not required to develop existing village sites where wide areas of land are left unpurchased.
  Second, a sufficiently large site must be secured for efficient infrastructure preparation and large-scale combined development.
  Third, the project site must be located near main roads and infrastructures for facilitating them, and should include districts whose development potential is great. However, the planning area will be finally determined by a re-examination of the progress on the infrastructure construction program and land acquisition.
- Land acquisition and readjustment are necessary for securing the required planning area. In this report, it is supposed that the required planning area will be secured by land purchase, including the spots not yet acquired for combined development. The land readjustment and arable land readjustment may be adopted as an effective measure for this purpose. It is not considered, however, that such measures can be accepted generally in Indonesia although equivalent land exchange may be made partially.
- The project will be considerably influenced by the program for constructing main infrastructures in Cengkareng district. Therein, a drainage ditch arrangement program will constitute one of the most

important factors. House construction is not possible at present because drainage ditches have not yet been prepared. Therefore, the project will be made presupposing that the development of planning area will be started after the preparation of trunk and branch drainages by DPU under the Master Plan described heretofore.

To emphasize the importance of these premises, we will mention the problems in developing housing sites before the complete preparation of a drainage system.

First, the preparation of drainages in housing sites would be relatively facilitated since it would be made in combination with the construction of housing sites themselves. Unless adjustment of Kali Kapuk Muana located downstream is made in time, however, downstream side expenses would increase and upstream drainages could not fulfill their functions.

The preparation of reservoir ponds for solving this problem would not be practical at all because its necessary area is roughly estimated at 43% of the total planning area. Further, existing waterways can be supposed to be repaired at Perum Perumnas' expenses. In this case, however, a huge investiment would be necessary and their performance would be lower than that of the drainage system to be constructed under the Master Plan.

Therefore, the preparation of a drainage system in the housing sites will follow the comprehensive development of Cengkareng district which will be made under the DKI Master Plan.

- Next, community facilities will be made by using as standards the medium density values adopted in "A Concept for Urban Planning Standard For Jakarta City" inserted in DKI Jakarta's "The Center for Planning Study".
- Policy for existing villages is required to be set up. However, the final conclusion thereon will be framed through careful surveys and examinations.

As stated above, the planning area has a population of about 10,000 with about 1,700 households. More than 90% of the households are farmers whose arable land outside the planning area accounts for 60% of the land under cultivation. Countermeasures to help farmers change their form of labour is expected to accompany the development

of arable land for housing. These will be prepared to take into account socio-economical aspects of the problem.

Our consideration will be given to the common pattern of such possible change. First, the farmers who have more than 60% of their land under cultivation outside the planning area could continue their occupat-on even after the completion of the project, provided the land remains arable. Those farmers, who must make up for the decrease in income due to the reduction of their farming, must be offset by income from other kinds of jobs. For those having sold their houses because of development it would be comparatively easy to aquire new houses with their gains from paddy field transfer and various compensations. If their land is valued at 3,000RP/m^2, their gains from the transfer of 1,000m^2 land will amount to 3 million RP, a sufficient amount for their aquiring low-cost houses. Therefore, what is described heretofore will be considered in formulating policy for existing villages.

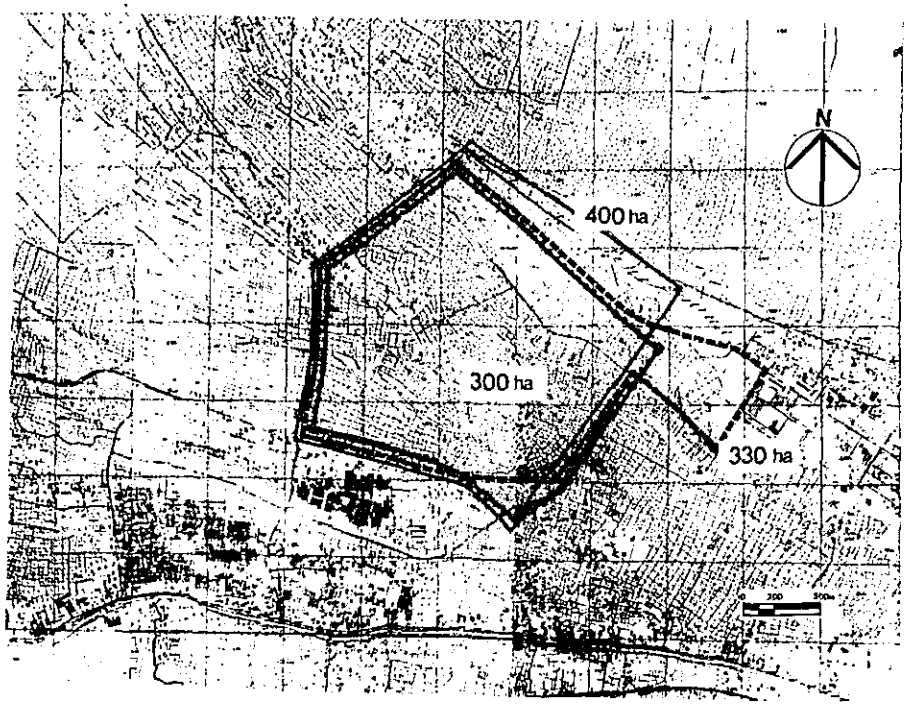


FIG. 4-1-1
PLANNING AREA

TABLE 4-1 THE MODEL OF COMMUNITY STRUCTURE

	HOUSE HOLD	RT	NEIGHBORHOOD UNIT	BNUx2	(BNUx4) x 2
GROSS AREA	200 m^2	1 ha	16 ha	32 ha	
HOUSE HOLD	1	50	800	1600	
PERSON	5	250	4000	8000	
PLAY LOT		1	16	32	
KINDER GARTEN			2	4	
SCHOOL			1x primary school	2x primary school 1x junior high school	SMP STN
		small mosque	sports ground mosque community center small shopping center (UTILITY CENTER) water supply center sewerage treatment plant rain water pumping unit extinguisher electric supply plant		passar and shops large sports ground big mosque community center etc.

URBAN PLANNING STANDARD FOR JAKARTA CITY
(FOR KELURAHAN)

	DKI Standard
Play Lot and Sports Space	2.1m^2/P
Kindergarten	0.7m^2/P
Shops	1.5m^2/P
Elementary School	2.0m^2/P
Junior High School	0.2m^2/P
Senior High School	0.2m^2/P
Mosque	0.3m^2/P
Other Community Facilities	0.4m^2/P
Total	7.4m^2/P

4-1-3 Basic Policy

- At present, the planning area includes about 60 ha total area of existing villages wholly covered with palm and other kinds of trees. Village districts differ from paddy fields in that the ground consists of highly water-permeable sandy strata which are suitable for the growth of trees. If existing paddy fields are developed into housing sites, it would be difficult to raise plentiful forests. Further, this would require very much time.

  Therefore, it will be of primary importance to the project to conserve the greens of existing villages to the utmost. The existing plants, well balanced ecologically, would be a great asset for the community if they can be conserved in view of their facility of maintenance. The main existing transport means for daily life are becas, bicycles and walking. Automobiles are increasing rapidly, keeping pace with economical development. However, the introduction of automobiles into residential districts affects residents' safety and health in many cases. In residential districts constructed so far by Perum Perumnas, a good living environment is maintained because automobile roads are considerably restricted. This Perum Perumnas' policy will be adopted for the project also, and efforts will be made for its further progress. To be concrete, pedestrian routes which are not restricted within residential districts will be set up over a wide area by linking the pedestrian roads in residential districts to a wide network of green ways. Namely, pedestrian routes in new residential districts will be connected to the green belts to be constructed over a wide range of existing villages, and further to the green belt extending between the inland and coastal districts along the high tention power line mentioned in DKI's master plan. As a result, residents will enjoy safety in cycling, for example, to Java sea, and a weekly recreation system could be established.
- The project is aimed at the formation of a mixed community consisting of a variety of social strata. It is an ideal to establish a well-balanced community of residents with a variety of occupations, ages and social strata. Residential districts for a specific social stratum generally form a closed community. This is not desirable.

Therefore, the project will be intended to form residential districts with rich diversity by constructing as many types of houses as possible. In the project, one neighborhood units comprises two units of one standard scale primary school (2,000 pupils), for securing such diversity and enriching school functions. They would serve as a unit of daily community activities as well as for infrastructure and implementation programs.

Facilities other than houses will be constructed to attain the planned diversity and in view of the projects' large scale, amounting to an area of 300 ha, and the high potential of the project area. Namely, "complex" land use will be made in establishing a residential area, not a "pure" residential area.

Under this policy, monotonous town construction could be avoided and the favourable principle of "the close proximity of residence and work place" would be carried out. This policy of construction would contravene Perum Perumnas' original principle but would serve as an important measure for smoothly carrying through the project since it could be effectively utilized as the material for cross-subsidy in developing housing area.

Roughly speaking, we specify four types of houses in our planning. The first type is a flat or maisonette type walk-up flat house ($45m^2$/house) newly developed for the project. The second and the third types are a two-story maisonette type (24, 36, 45 m^2/house) and a one-story row house type (24 m^2/house). The forth is empty loto for housing (200 m^2/house).

Most of the above-mentioned types of houses are improved versions of ones developed so far by Perum Perumnas. Such multi-story houses with elevators as are increasingly constructed in Southeast Asian countries of late will not be included in the project.

4-1-4 Setting of Alternatives

o The purposes of the setting of alternative plans are to determine the basic direction of the realization of the project as well as to clarify the problems and conditions for the drafting of the basic plan to be carried out in succession. Therefore, in the process of the drawing up of the basic plan, the optimum plan, a compromise plan or a third plan will be selected from among these alternative plans. The following factors will be taken into consideration when setting alternative plans.

1. Land use:	The dimensions of land area to be utilized for commercial buildings, its location and the combination with houses.
2. Facility arrangement:	Concentration or dispersion, location of the center.
3. Neighborhood unit:	The scale
4. Types of houses and density;	
5. Housing allocation:	Consideration given to flats.
6. Composition of neighborhood unit:	Consideration given to the existing village -- with respect to the aspects of the realization and planning.
7. Implementing plan:	Planning by stage, implementing bodies.
8. Infrastructure:	System
9. Land development:	Dry-up, filling, polder, etc.

o In this planning, it is necessary to select from a comprehensive viewpoint not individual factors but those factors combined as necessary for giving a major orientation in Cengkareng development. Therefore, we have drawn up two Alternative Plans centering on facility arrangement, the composition of neighborhood unit (including consideration given to the existing village) and the types of

implementing bodies.

In Alternative - I, the composition of neighborhood unit has been set seeking harmony with the existing village with community facilities to be located in green areas.

This plan will be referred to as the "unified development" hereinafter. Alternative - II seeks to create a new community through new development while preserving existing village. There will be two different kinds of neighborhood units ultimately in the planning area. For this reason, community facilities will be located near the centers of each of these neighborhood units with the contents and scales appropriate for respective zones. This plan will be referred to as the "composite development" hereinafter.

- As for the scope of works to be undertaken in the near future, development will be centered on the areas where land acquisition has already been made. When we take an area of approx. 100 ha where land acquisition has shown progress in order to find the status of land acquisition, we find that the acquisition of green area has made marked progress although it is less than that of paddy fields. Therefore both Alternative - I & II can be adopted in the initial stage of the project. As for the 300 ha of the planning area, both paddy fields and green areas are acquired in separate lots presenting a problem when deciding which of the two plans should be adopted. Moreover, it is expected that either of these plans once adopted will give rise to various problems. Careful consideration must be given, therefore, to these situations in advance and the project must be undertaken in a manner which can cope with these problems.

4-2 Site Planning

4-2-1 Alternative I - Unified development

(Land use plan)

- This alternative plan is to include a green belt with the community village in the PERUMNAS project area.
  Green belt is considered as public space of the new city in which parks, paths, and community facilities are to be arranged after the housing area has been developed.
  Therefore, it will become the center of residential area, and much of the residents' daily activities will depend on it. Its area amounts to 8 ha, about 30% of the planning area. Namely, it will be up to the ecological standards - 1/3 for development, 1/3 for conservation and 1/3 for medium zone.

- Commercial facilities other than those that are related to housing are to be arranged along the trunk roads and outer ring roads.
  By doing this, harmonization of housing area and trunk roads is accomplished and cross-subsidy and the house-close-to-work-place idea is satisfied.
  The categories of such commercial facilities will be determined through future facilities demand survey. Roughly speaking, however, they are expected to include the firms engaged in distribution and the manufacture of products with large added values and are concerned with the new air port.
  One unit is set as follows: (1 primary school area - 2,000 persons) x 2 = 4,000 persons. Assuming the average population density is 250/ha, the average size of one living area is 16ha, 400m x 400m. This would provide a appropriate space for preparing drainage and a bus route. Next, all of such neighborhood units will be directly connected to branch drainages and the green belts. Each neighborhood unit will serve as a unit in connection with the infrastructure system but will not be affected even though they dependent on each other, since they differ considerably in the timing of construction. On the other hand, the centers of the neighborhood units will be included in

TABLE 4-2 LAND USE (ALTERNATIVE I)

	AREA ha	PERCENTAGE %
HOUSING	130	44
Low Cost Housing	(100)	
Empty Lot	(30)	
COMMERCIAL	40	13
COMMUNITY FACILITIES		
mosque		
community center		
school	40	13
shop		
sports ground		
etc.		
ROAD	50	17
OTHERS		
utility facility		
park	40	13
etc.		
TOTAL	300 ha	100 %

the green zone planned as the center of community activities.

- Neighborhood units are required to have a substantially high housing density because existing greens cover a very large percentage of their area. Of the total houses, therefore, 10% is planned to be walk-up flat type houses, and another 10% for empty lots.

(Facility Arrangement Plan)

- As described above, the community facilities of neighborhood units will be included in the green belts to form a communal zone. Therefore, the district center is required to be located at a place with the highest potential in the communal zone. According to our planning, the district center will be located at the crossing point of a regional trunk road and the green belt. This will ensure highly efficient services and easy access for residents.

- Schools, kindergartens, an assembly hall, a mosque, and social and educational facilities are to be built in each living area but medical facilities and shopping facilities are mainly to be concentrated in the central area considering the efficiency of the facilities, etc.

(Road plan)

- Primary importance in road planning is the determination of the functional hierarchy of roads, and the formation of a road network suitable for land use planning, as well as for the layout of neighborhood units and infrastructure.

- District trunk roads, living area trunk roads, and automobile approach roads have been designed and pedestrain roads are to be arranged. Their widths and sectional constructions will be as shown in next figure

- The district trunk roads which will serve as main entrance ways from the trunk roads to be located at the periphery of the planning area will determine the major framework of the project. They will be provided along the branch drainages which will also serve as bounda-

ries between neighborhood units, one road will be laid out to interconnect them. On the other hand, district trunk roads will be built so as to section neighborhood units. Further, approach roads will be prepared for the houses in neighborhood units. The approach roads of which most will be arranged at 100 m x 100 m intervals are planned so that their interference with pedestrian roads may be minimized while their service and disaster prevention functions are maintained.

(Housing Allocation Plan)

- Target density is one of the most important factors in determining the layout of houses. We have examined what densities are obtained when walk-up flat two-story maisonette or one-story row type house are arranged in a given area (see Fig. 6). As a result, it has been learned that the approximate upper limit net densties of walk-up flat, two-story maisonette type, and one-story row type houses are 180 houses/ha (900 persons/ha), 120 houses/ha (600 persons/ha), and 80 houses/ha (400 persons/ha) respectively.
  The above-mentioned estimation results indicate that housing density will considerably depend on what kinds of houses will be constructed in residential districts. However, only a very small percentage of walk-up flats could be supplied only for pilots in view of their expense and because abandonment of the traditional mode of living is unavoidable at present. As to the other types of houses, their percentages will have no considerable effect on net housing density and will settle at 100 houses/ha (500 persons/ha) or so since the percentages will not be so significant and this significance is almost equal to those of housing site geography and facilities layout in this respect.
  In our planning, therefore, housing allocation has been made primarily with consideration to the geography, land development and drainage.

  The geography of the planning area remains such, even after land development, that the green belts having the highest altitude slopes down to the districts along drainages which have the lowest altitude. Planned to be arranged in the lowest area are walk-up flats which

comparatively facilitates countermeasures for inundation.

- On the other hand, most low-rise houses will be constructed at high altitude sections, and empty lots will be located along the highest altitude green belts because of the difficulty in providing countermeasures for submergence-resistance construction to all the houses to be built.

(Park and Greenery Plan)

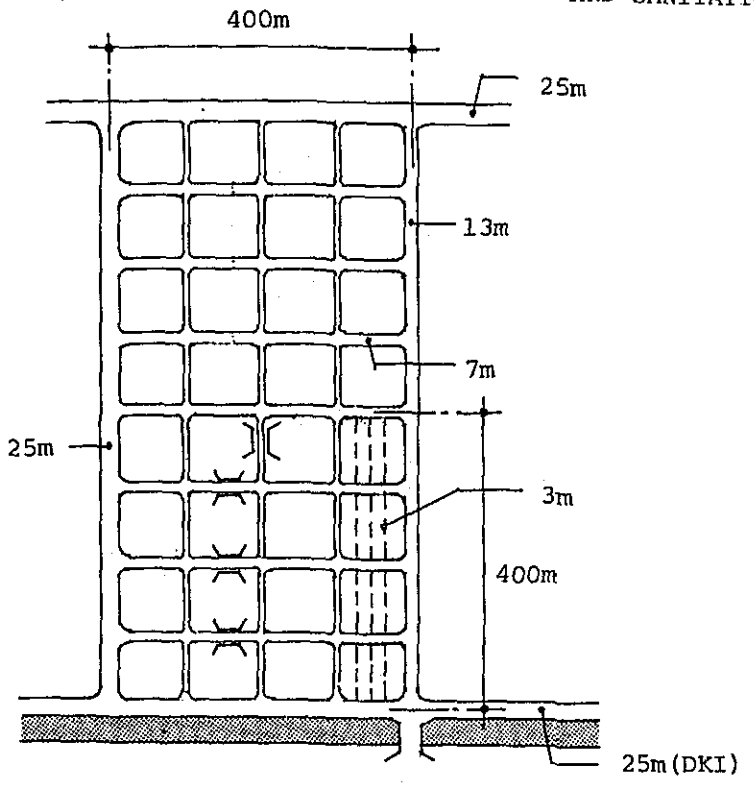
- For parks and green areas, firstly, existing greenery are to be preserved and it is intended to utilize the existing parks and vegetations as much as possible. Therefore, in neighborhood units only paths and some play lots are to be provided.

(Executing Body)

- The main proprietor of this plan is PERUMNAS, although DKI Jakarta, CIPTA KARYA, and DPU are partially involved. DKI Jakarta, DPU, etc. are involved in drainage trunk and branch lines, and trunk roads and community facility development, but the fundamental development of the project areas and housing construction are to be conducted by PERUMNAS. Further, infrastructural development of commercial areas and empty lots for houses are made ready and sold later. Thus the scope, division, and share of the cost, etc. of each organization must be adjusted between the parties concerned in the future.

Road construction costs were estimated based on the following set up.

(ref. BANDUNG URBAN DEVELOPMENT AND SANITATION PROJECT)



25m Road — 3,000m X 191,000Rp/m X 1/300ha=191Rp/m^2

13m Road — 1,200m X 33,800Rp/m X 1/16ha=254Rp/m^2

7m Road — 2,400m X 11,500Rp/m X 1/16ha=173Rp/m^2

3m Road — 4,800m X 2,800Rp/m X 1/16ha=84Rpm^2

Total 702Rp/m^2

↓

710Rp/m^2

- Cost estimation on bridge construction costs are as follows;

  width 7m X length 4.5m X 4 points = 126m^2

  width13m X length15.0m X 1 points = 195m^2

supposing the thickness of bridge slab 0.30m

V = 0.3m X 321m^2≒ 96.3m^3

30,000Rp/m^3X 1.5 X 96.3m^2X 2.0 X 1/16ha = 54Rp/m^2

↓

60Rp/m^2

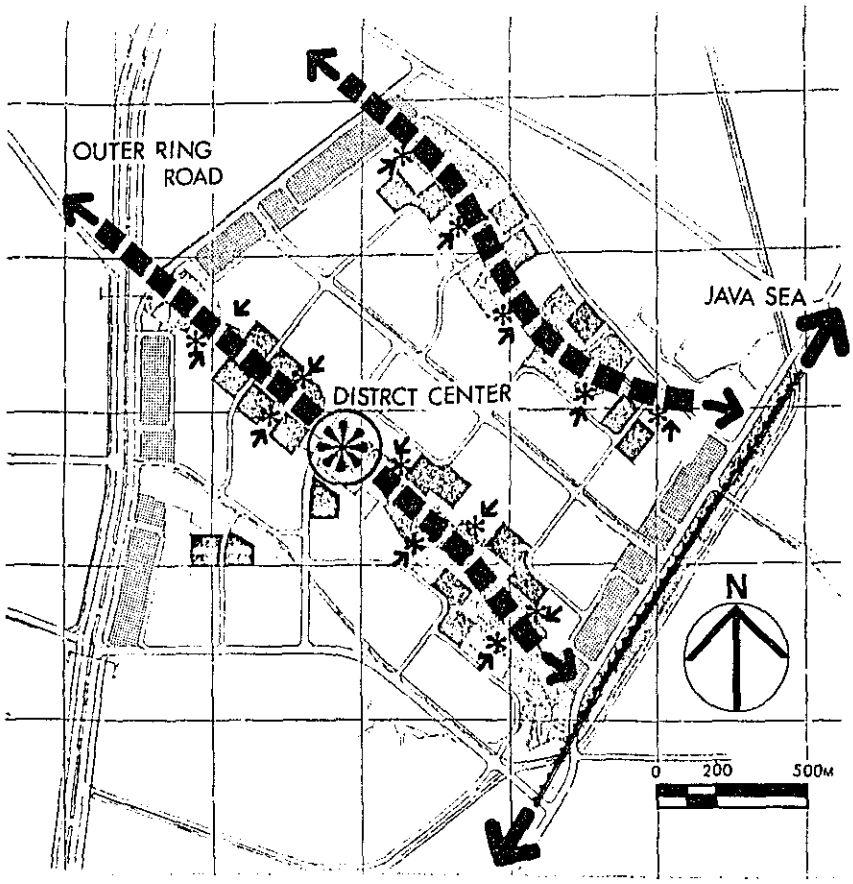


FIG. 4-2
URBAN AXIS
AND GREEN
NETWORKS

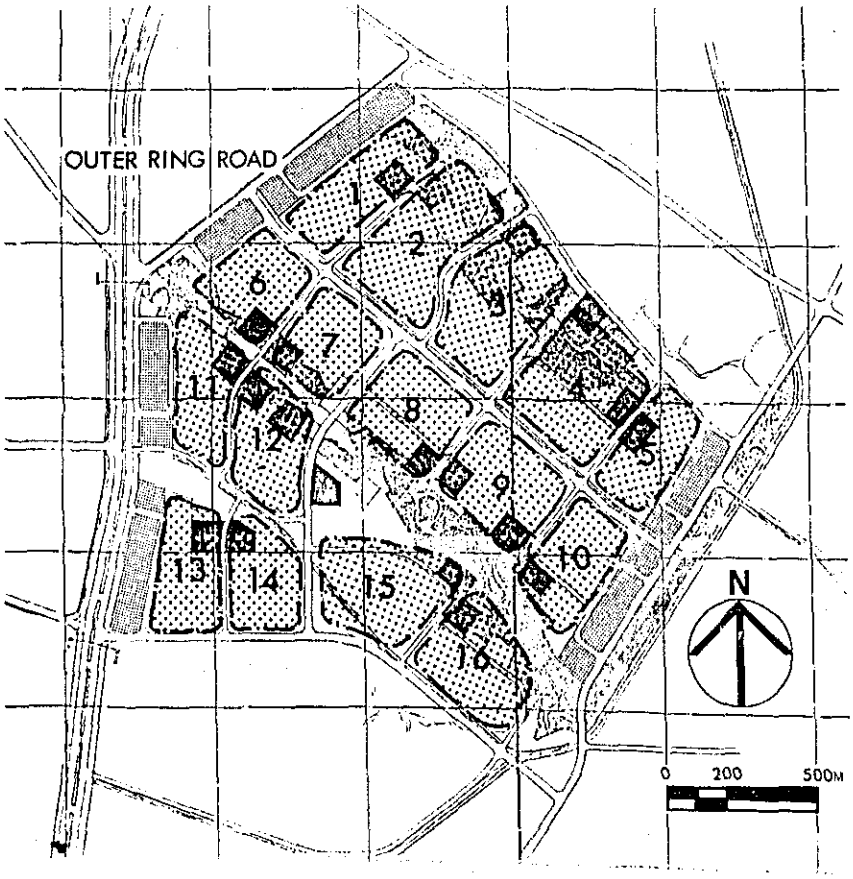
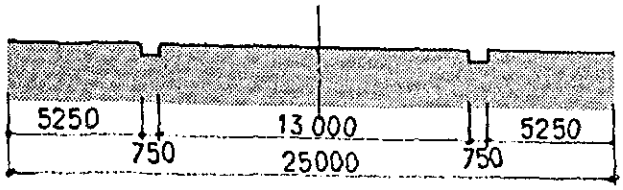
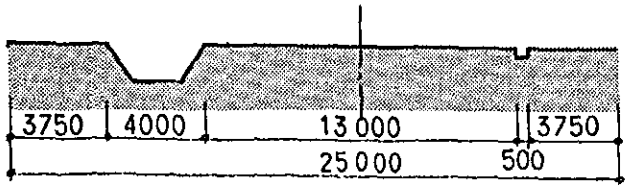


FIG. 4-3
STRUCTURE
OF
COMMUITY

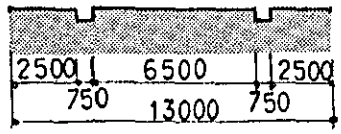
FIG. 4-4
ROAD SECTIONS

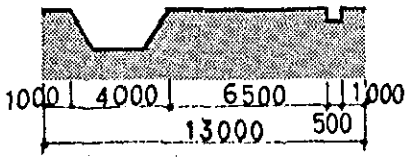
1 SECONDARY ROAD



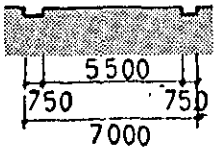


2 DISTRIBUTER





3 MINOR ROAD



4 FOOT PATH

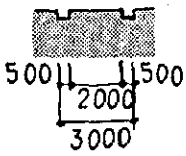
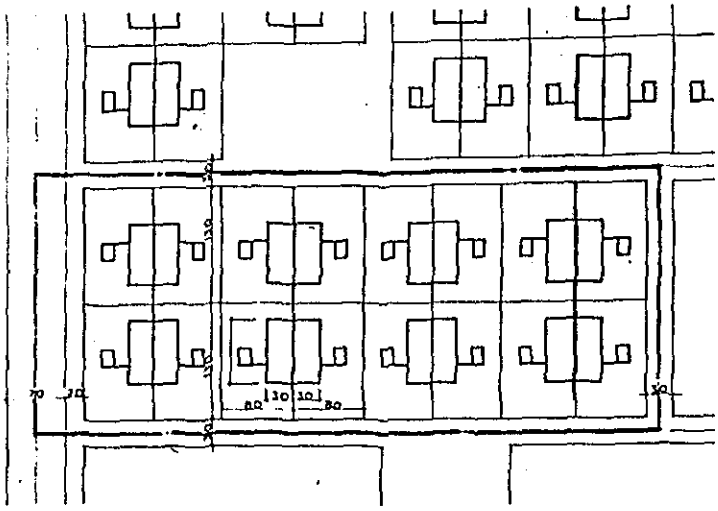
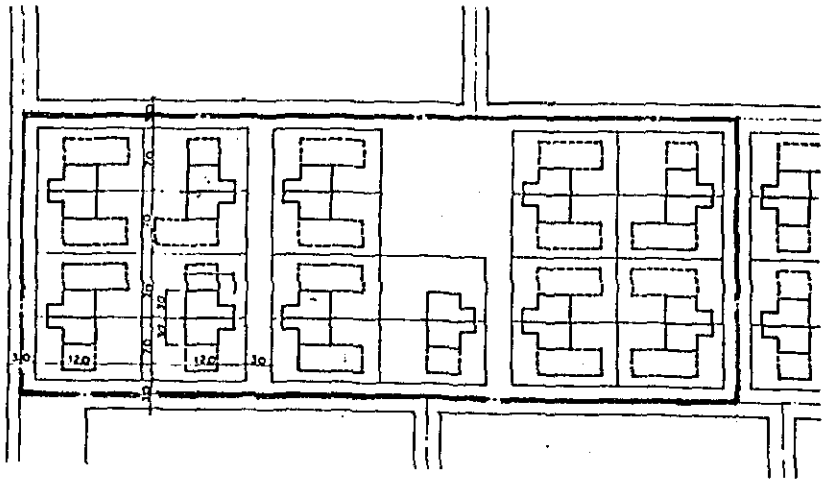


FIG. 4-6 (1)

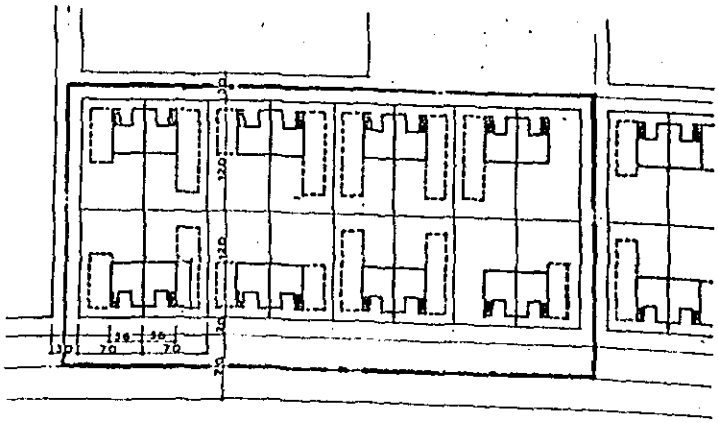
BLOCK PLAN BY HOUSING TYPE



TYPE D20			
SEMI-GROSS AREA		2059.0	M²
LOT SIZE		104.0	
FLOOR AREA		23.8	
TOTAL FLOOR AREA		23.8	
DENSITY	SEMI-GROSS	77.0	H.UNIT/ha
	NET	96.0	
COVERING RATIO		23.0	%
VOLUME RATIO		23.0	



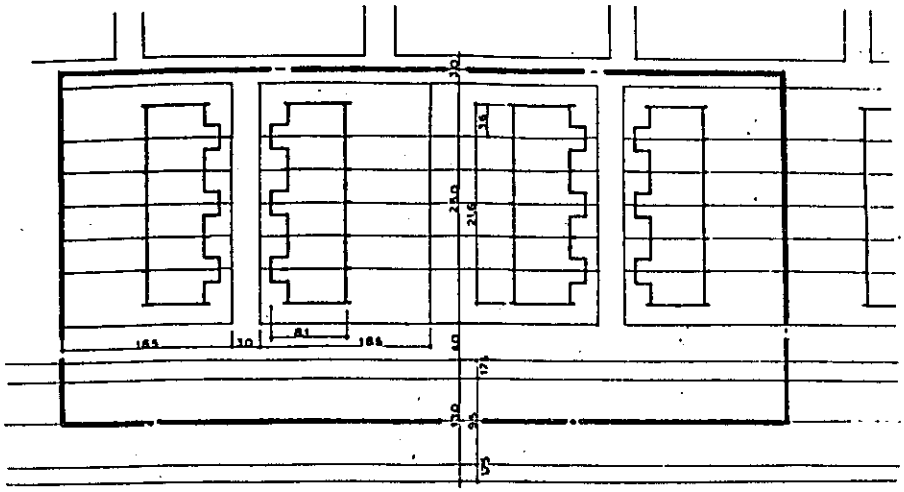
TYPE DM24			
SEMI-GROSS AREA		2511.0	M²
LOT SIZE		84.0	
FLOOR AREA		13.1	
TOTAL FLOOR AREA		23.9	
DENSITY	SEMI-GROSS	87.6	H.UNIT/ha
	NET	119.0	
COVERING RATIO		16.0	%
VOLUME RATIO		29.0	



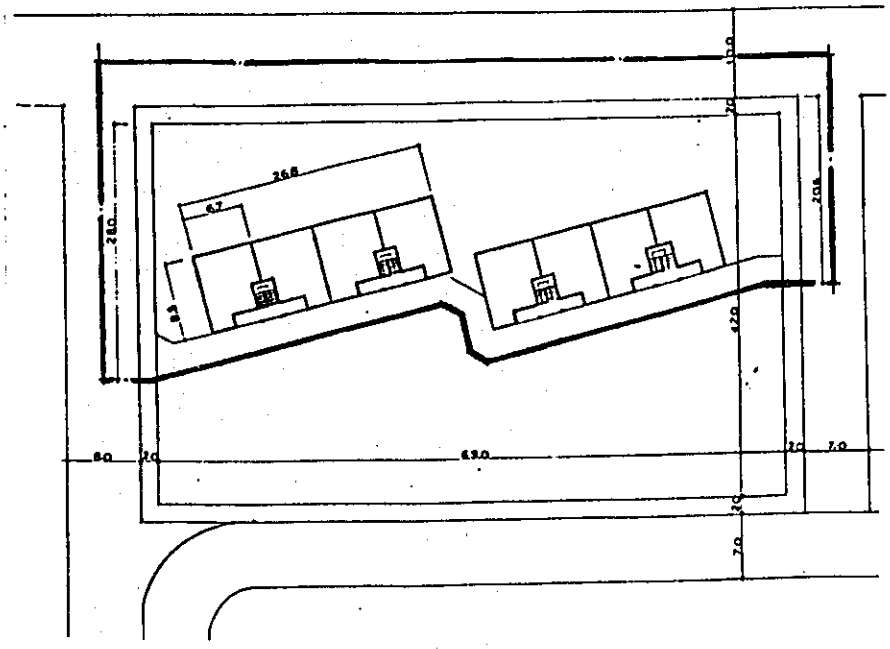
TYPE DM36			
SEMI-GROSS AREA		1829.0	M²
LOT SIZE		84.0	
FLOOR AREA		17.3	
TOTAL FLOOR AREA		34.6	
DENSITY	SEMI-GROSS	87.0	H.UNIT/ha
	NET	119.0	
COVERING RATIO		20.0	%
VOLUME RATIO		41.0	

FIG.4-6 (2)

BLOCK PLAN BY HOUSING TYPE



TYPE M45-A			
SEMI-GROSS AREA		3040.0	M²
LOT SIZE		80.2	M²
FLOOR AREA		25.0	M²
TOTAL FLOOR AREA		47.7	M²
DENSITY	SEMI-GROSS	78.9	H.UNIT/ha
	NET	124.7	H.UNIT/ha
COVERING RATIO		31.0	%
VOLUME RATIO		60.0	%



TYPE FS45-R.			
SEMI-GROSS AREA		2489.7	M²
LOT SIZE		54.0	M²
FLOOR AREA		11.4	M²
TOTAL FLOOR AREA		57.0	M²
DENSITY	SEMI-GROSS	160.7	H.UNIT/ha
	NET	185.2	H.UNIT/ha
COVERING RATIO		21.1	%
VOLUME RATIO		105.5	%

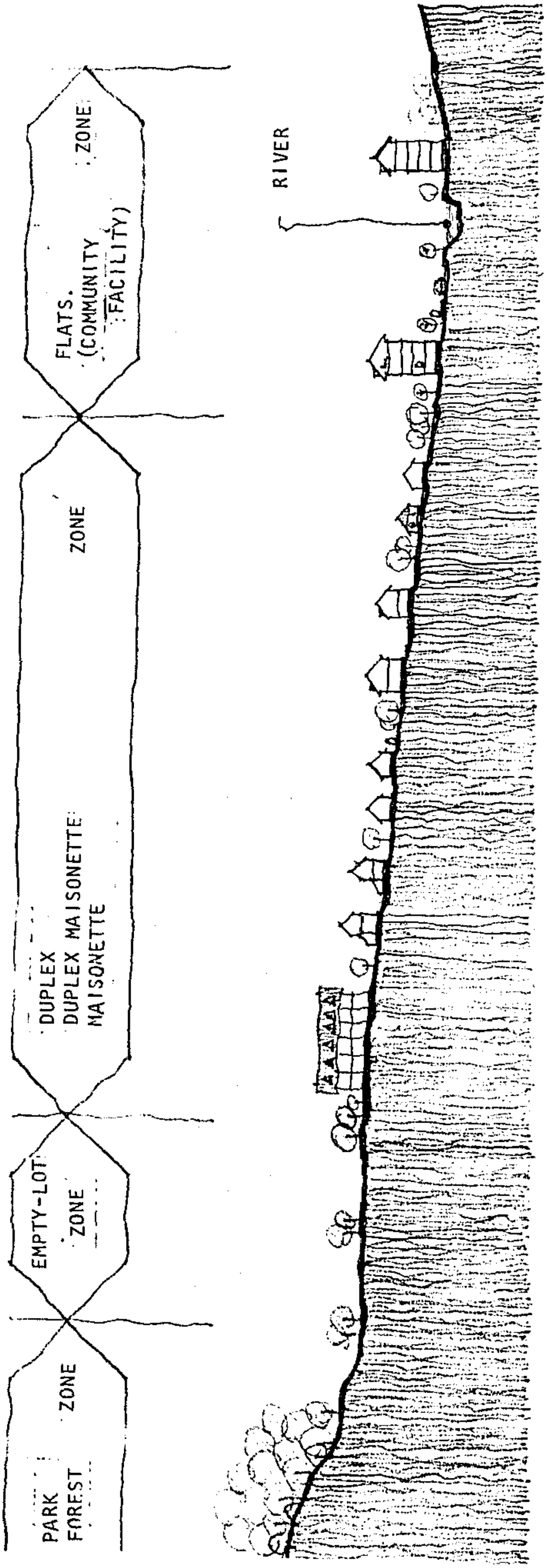


FIG. 4-7
BASIC IDEA OF
HOUSING TYPE
DISTRIBUTION

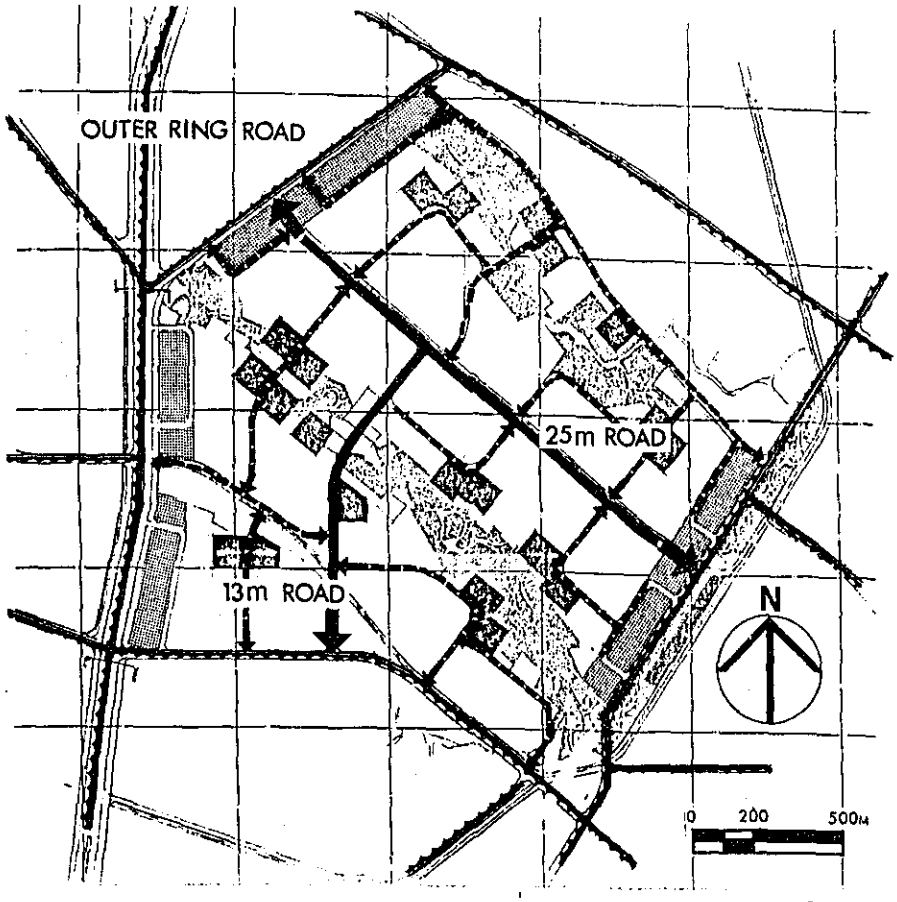


FIG. 4-8
ROAD NETWORKS
AND LAND USE

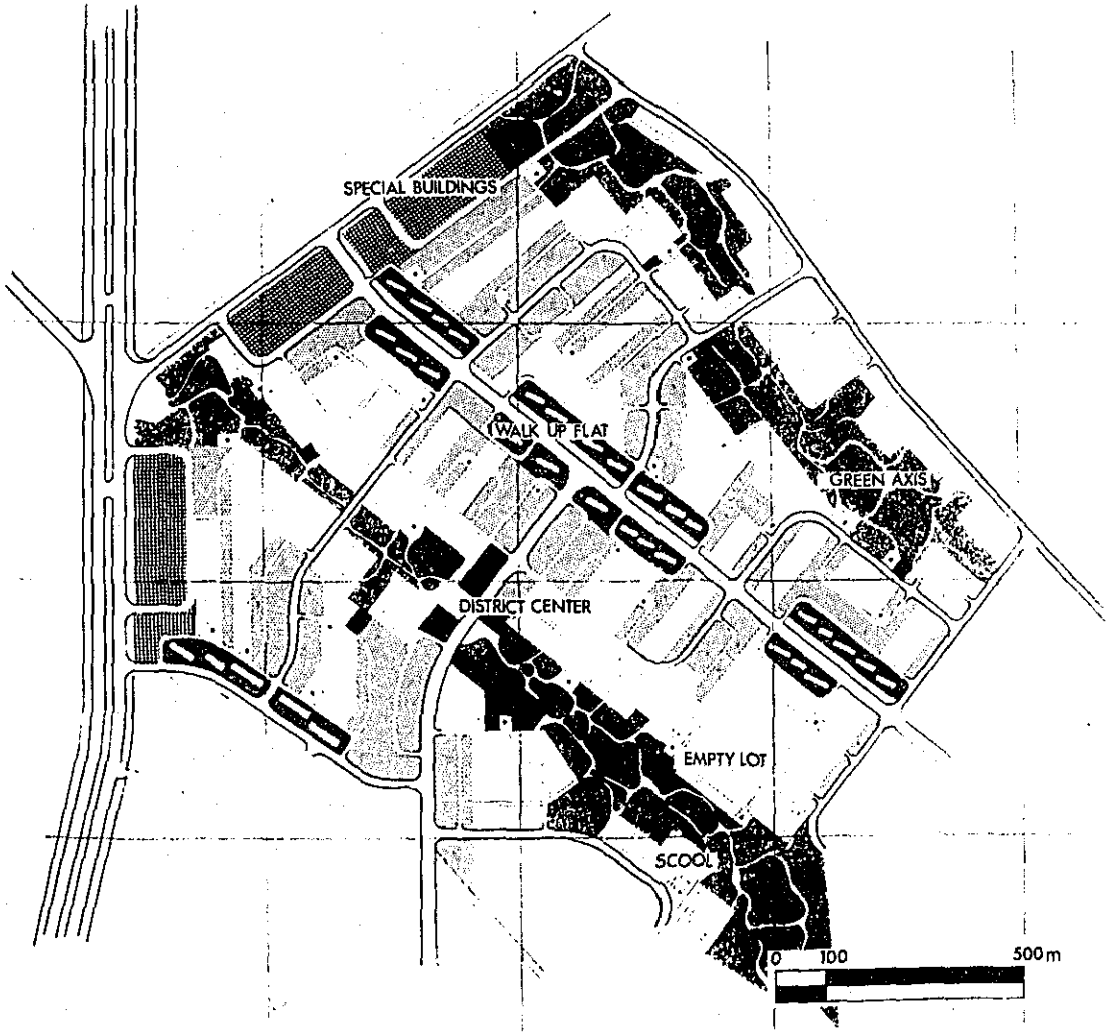
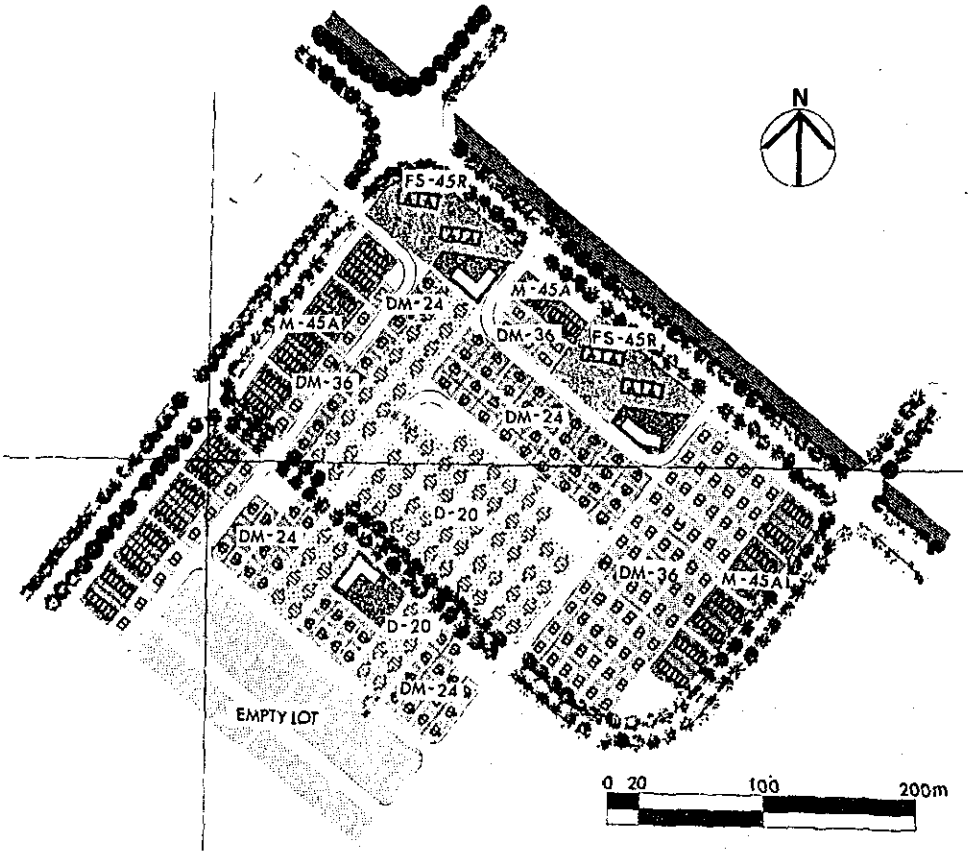


FIG. 4-9
LAND USE
PLANNING

FIG.4-10
TYPICAL NEIGHBOURHOOD UINT
POPULATION - 4,000p



4-2-2 Alternative - II - Composite development

(Land use and facilities arrangement Plan)

- This alternative plan is to divide the planning area into PERUMNAS project area and the area not covered by PERUMNAS, and more than 2 proprietors are to carry on the plan.
  That is to say, PERUMNAS will mainly develop the area not including existing villages and DKI Jakarta or CIPTA KARYA will develop existing villages.

- Green belts in which villages are located function within the total planned area as well as functioning as daily living space of existing communities.
  Community facilities such as house facilities, parks and green ways are included in the green zone as stated in Alternative I (unified development), their density will become too high to keep its greenery conservation. On the other hand, it may be possible to construct community facilities in the districts adjacent to the green belts for common use with existing villages. However, there are a number of existing farm lands. If they are left untouched, it will be difficult to prepare housing sites at the periphery of community facilities so that they will be isolated from residents. Further, existing villages' demand for developing their own sites will rise depending on the location of community facilities. If Perum Perumnas and other enterprises' development programs are not adjusted in this case, sprawl phenomenon will take place in existing villages.

  Under the subject plan, therefore, the green belts will be conserved to serve for residential districts by its original function and for greenery. Community facilities will be locatedat the center of newly developed site along drainage for concentrating daily activities. In this case, the green belts will serve for weekly recreation and contribute to an enriched town sight.

  As the result, two different types of communities will co-exist in the planning area. In order to promote mutual exchange and harmony of different communities, only one district center is to be built at the

TABLE 4-3 LAND USE (ALTERNATIVE II)

	AREA ha	PERCENTAGE %
HOUSING	80	40
Low Cost Housing	(60)	
Empty Lot	(20)	
COMMERCIAL	40	20
COMMUNITY FACILITIES mosque community center school shop sports ground etc.	30	15
ROAD	30	15
OTHERS utility facility park etc.	20	10
TOTAL	200 ha	100 %

crosspoint of the two communities.

There, medical and shopping facilities will be installed to serve for the whole planning area.

- On the other hand, the commercial facilities will have a similar location as those described in Alternative I (Unified development) through macroscopic studies. Namely, a 30 ha site will be prepared along the trunk road and sold in lots for this purpose.

- As to the layout of neighborhood units, the subject plan does not differ from Alternative I (Unified development), it will be suited for the construction program and infrastructure directly connecting main drainage and the green belts.

- The subject plan differs from the Alternative I in that the existing green belts is not included in neighborhood units. If the gross housing density is equalized to Alternative I, the net housing density of neighborhood units become lower than Alternative I. In view of this, the target percentages of walk-up flat construction and empty lots have been fixed at 5% and 15% respectively.

(Road plan)

o As for roads, it is arranged on the same basic policy as Alternative I. In this case, there are some differences between PERUMNAS project and this plan in timing and methods. Trunk roads or area trunk roads are designed on the border of these plans to draw a line between the two projects.

A site is required to be kept unused for this purpose for the time being. This is, because disorderly housing site development in existing villages will not be avoidable unless road building is made at the same time as the adjustment of existing villages. District trunk roads will be laid out to interconnect the a ove-mentioned roads, and district centers are prepared to open onto the district trunk roads.

- On the other hand, a comparatively wide green belts will be furnished along the drainage and comnal facilities. It will serve for the

maintenance and control of drainage and as main traffic line between community facilities.

(Housing Allocation Plan)

- According to this plan, one area of about 16 ha is set up as one living area but a large scale green belt is excluded like the one in Alternative I. Therefore, the net living area is about 65% of the total. In other words, if similar housing types are made as in Alternative I, the density will become about 15% higher. In these alternatives, the density is planned in the same way as Alternative I, and the rate of low-rise building and empty lots will be increased.

  . The layout of the various types of houses is similar to that of Alternative I. However, walk-up flats are considered as most suitable for minimizing the influence of the repair and redevelopment of existing villages of the districts concerned, i.e. for conserving the green belts. But existing village residents who have been mainly engaged in farming are expected to show considerable resistance to the abandonment of their traditional mode of living.

(Park and Greenery Plan)

- In the PERUMNAS project area, existing greens are included in the residential.area. Therefore, separate parks and green areas should be secured in it.
  For that purpose, small scale parks are planned along the drainage which will also serve as reserved land.

(Executing Body)

- The executing agencies of this plan are DKI Jakarta, CIPTA KARYA, and DPU. What is different from Alternative I is that the work can be divided into several parts. Namely, in arranging infrastructure and community facilities, they are intermingled. However, in large part PERUMNAS will carry on new developments while the preservation of existing villages will be carried out by agencies other than PERUMNAS.

The main problem with this alternative plan is that, two different executing agencies exist in the given area, so the development programs of two agencies must be adjusted. To conduct preparation of the existing village first is not practical, so the PERUMNAS project should go first. This plan naturally influences the development of the existing village, therefore, as well as promoting the PERUMNAS project. Development of the existing village must be regulated.

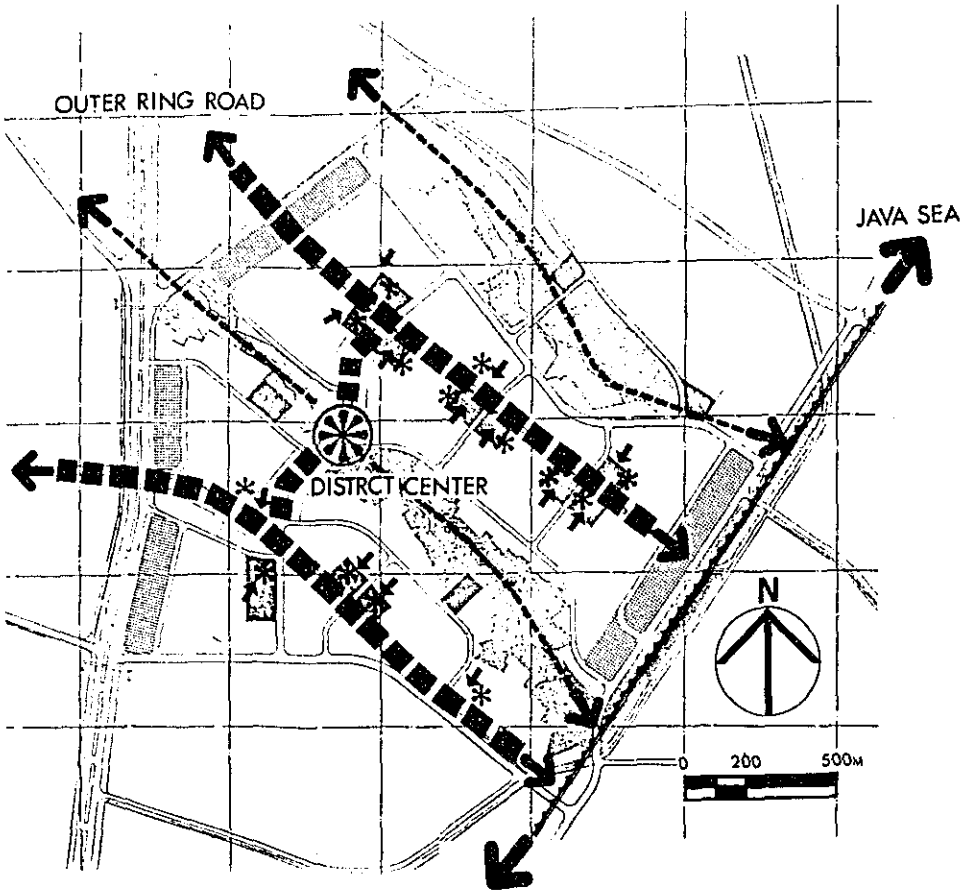


FIG.4-11
URBAN AXIS AND
GREEN NETWORKS

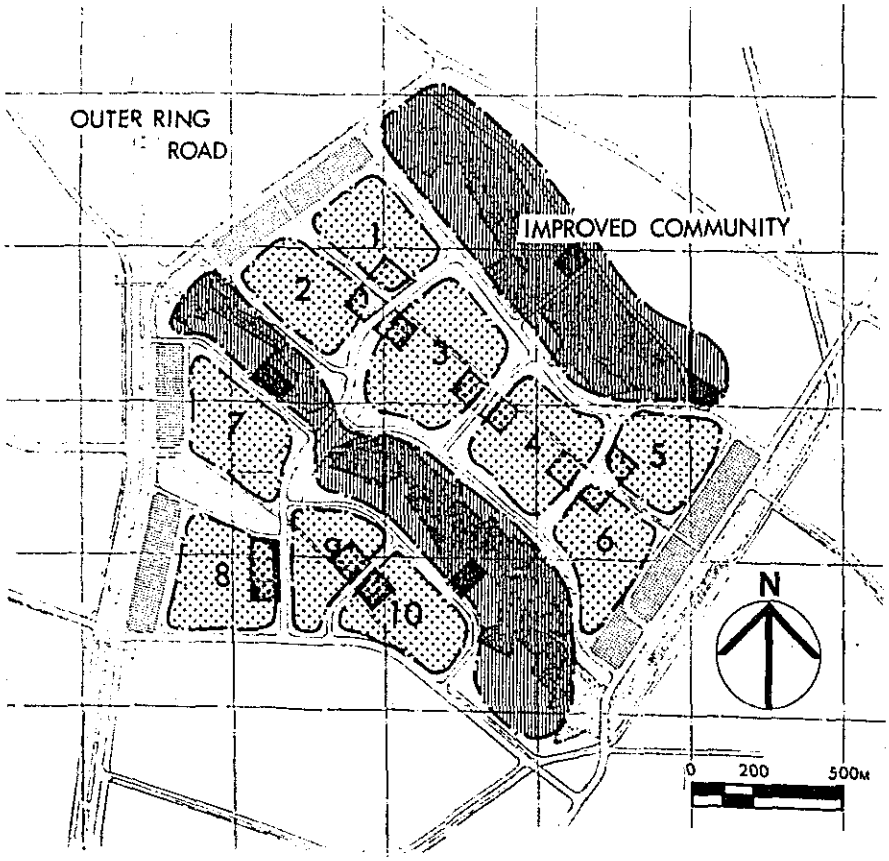


FIG. 4-12
STRUCTURE
OF
COMMUNITY

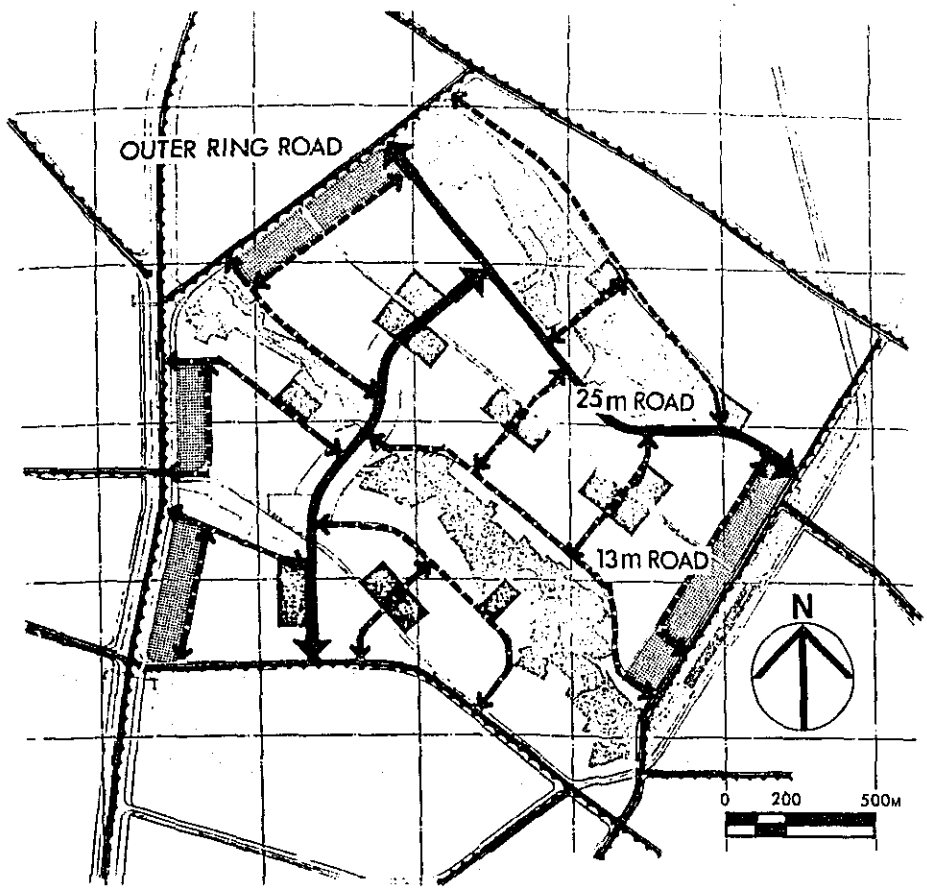


FIG. 4-13
ROAD NETWORKS
AND
LAND USE

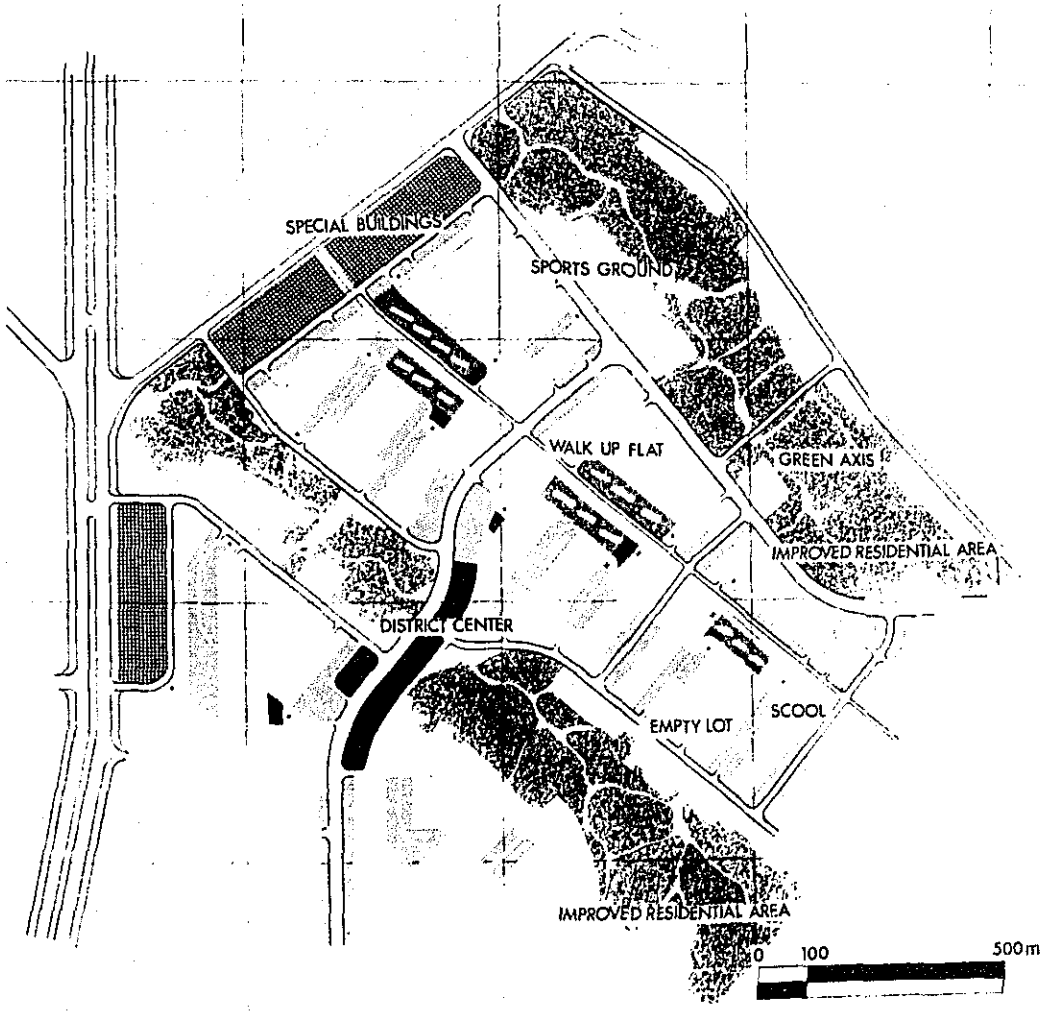
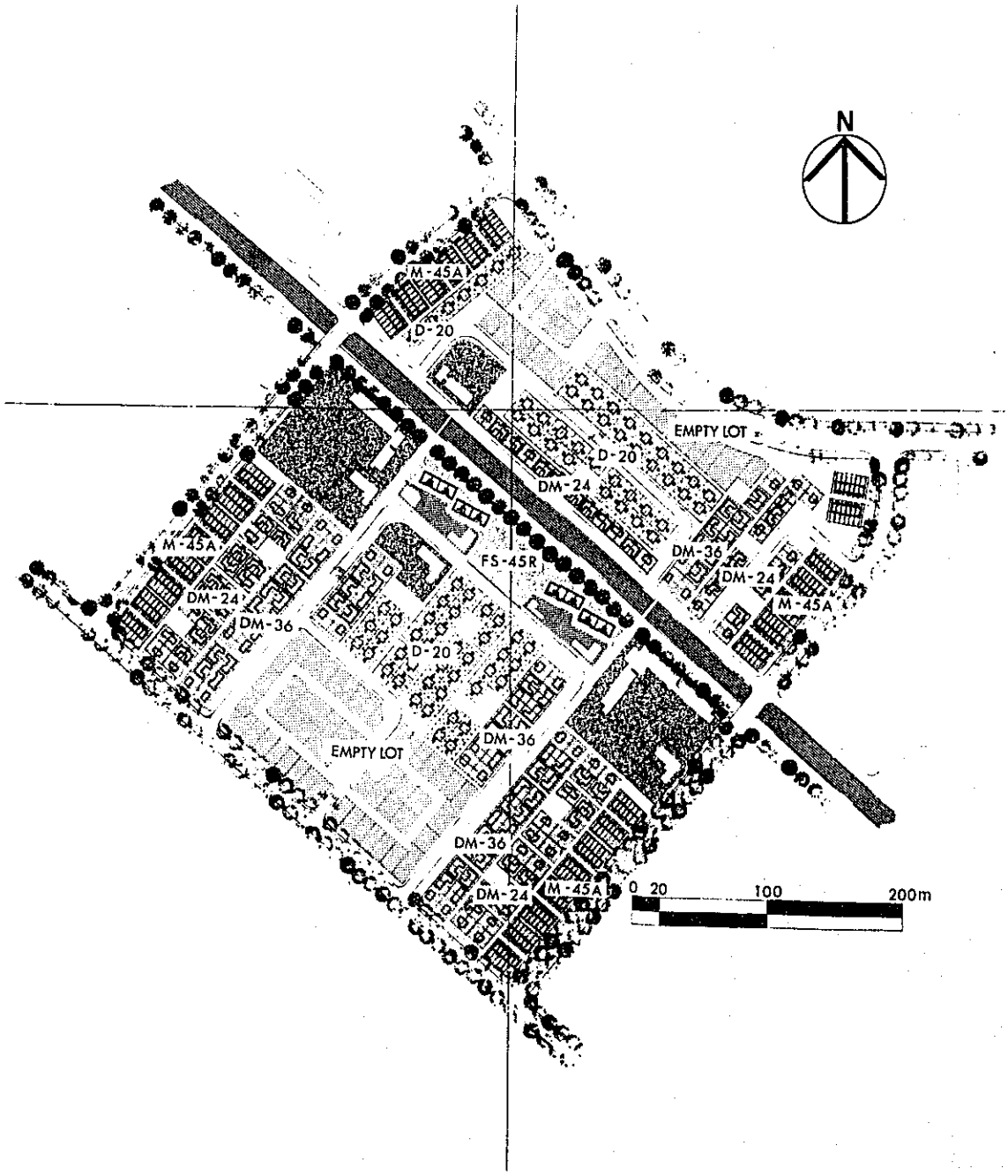


FIG. 4-14
LAND USE
PLANNING

FIG. 4-15
TYPICAL NEIGHBOURHOOD UNIT
POPULATION-4,000p



4-2-3 Study for Implementation of the Project

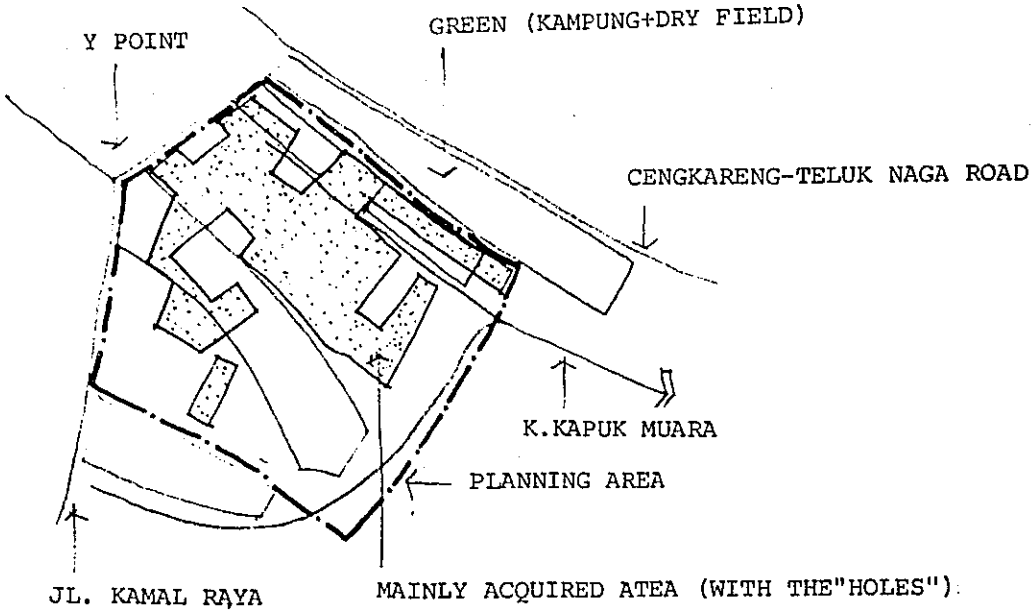
- The Alternative I & II mentioned earlier both show the basic direction of Cengkareng development in the constancy aspect. Here we would like to examine the project from the viewpoint of implementation while giving consideration to stage planning, housing density, etc.

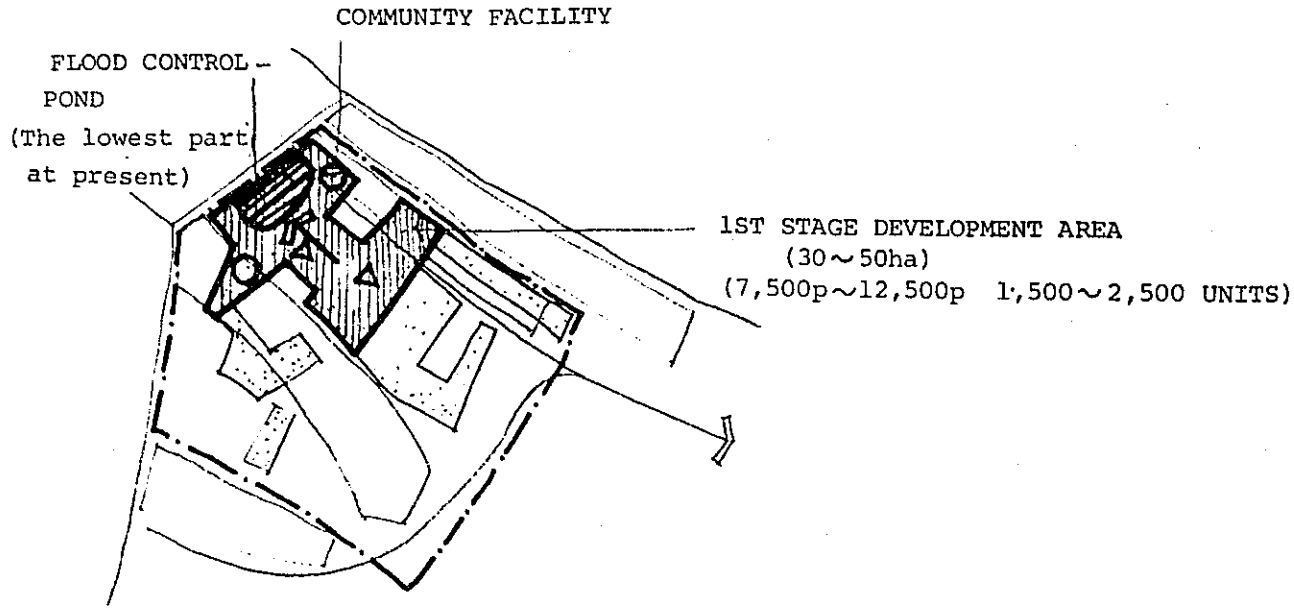
(Stage Planning)

- The purpose of this planning is to examine the problems existing in the process of the implementation of the Alternative Plans proposed. As a case study, we will set a number of implementing areas on the basis of the status of present land acquisition, future acquisition possibility, topography and drain provision program and clarify the characteristics and problems.

- Although this case study aims at the greater efficiency of the utilization of already acquired areas, we will divide it into "Alternative-Y" where drain provision can be made with already acquired areas and "Alternative-X" where such provision is not possible.

- Up to the second stage, the contents of works to be undertaken in Alternative - I and II are not greatly different.
  The only difference is that in Alternative - I emphasis is being placed on the movement of existing houses to the greatest extent possible to new residential areas. But, from the second stage, development will be conducted in the areas where acquisition has not been made almost entirely. Therefore, decision will be needed regarding which of these Alternative Plans should be introduced.

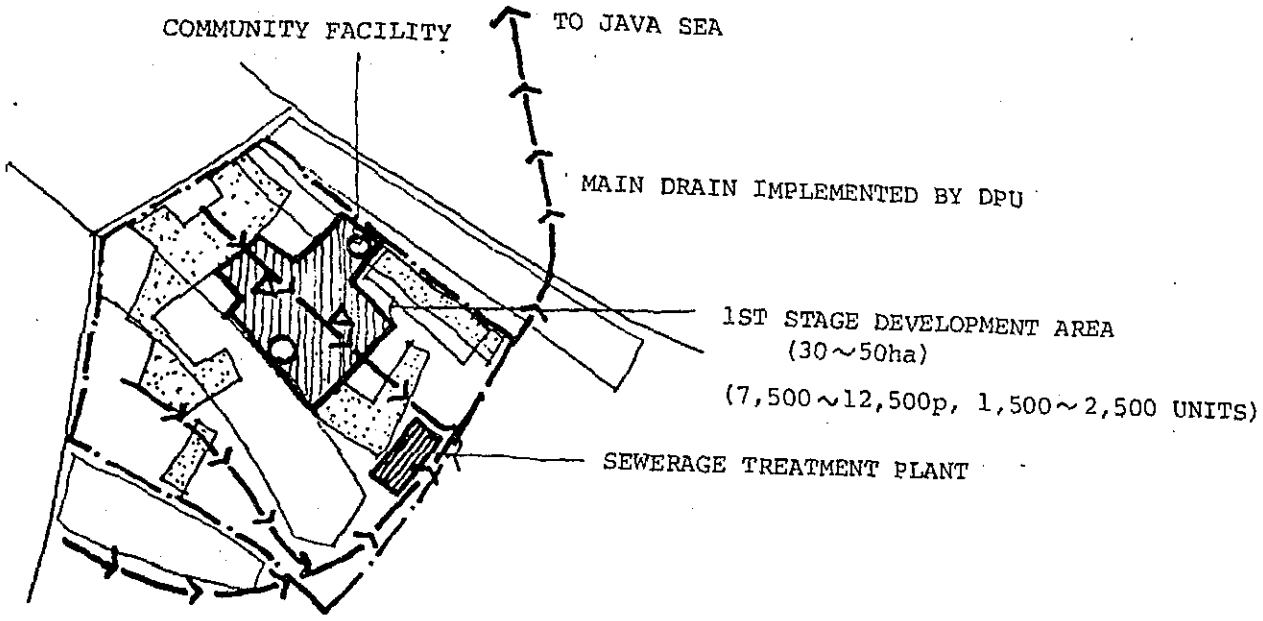




(1st Stage) -- Alternative-X -- No Provision of Drains

Implementation will be conducted centering on the areas already acquired. In this case, drainage trunk is likely not to be constructed and a swampy land will be acquired additionally for reservoir pond. Thus the development area will be set in accordance

with the size of this reservoir pond. Dry up is impossible and land filling must be conducted for land development. Moreover, provisional sewer treatment facility will be needed, ——→ leading to higher costs. Existing villages will be encouraged as strongly as possible to move to the new residential areas at the 1st stage when Alternative-I is adopted.



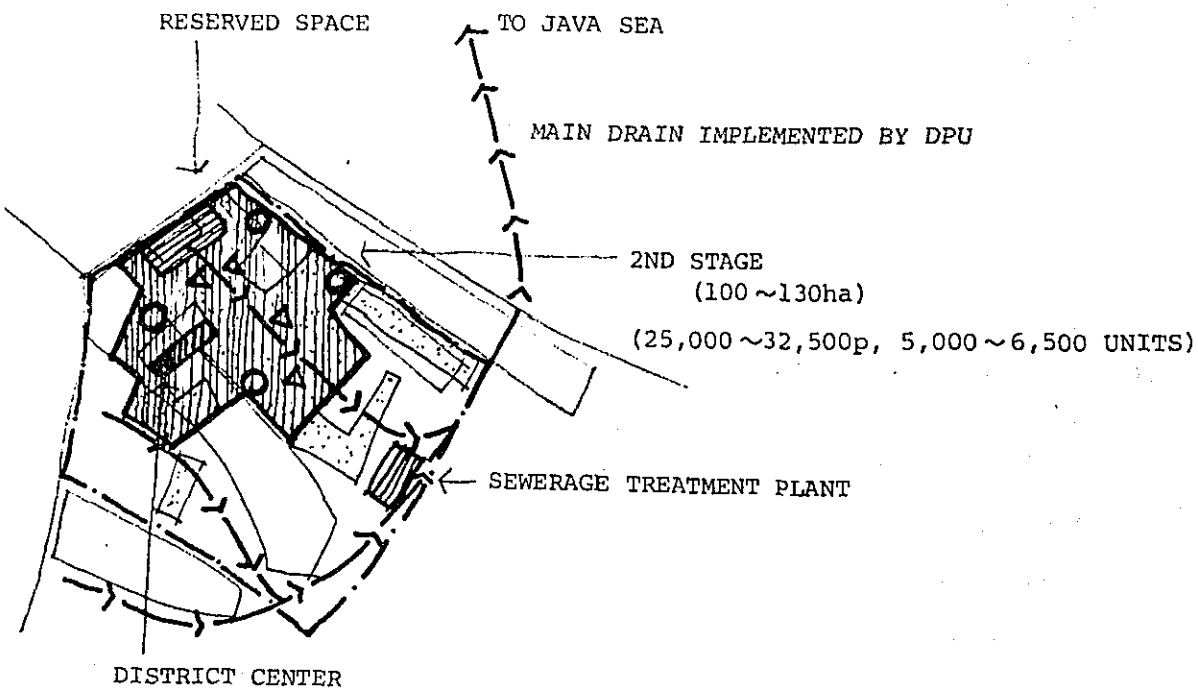
(1st Stage) -- Alternative-Y -- Provision of Drains Completed

Implementation will be conducted centering on the areas already acquired. Since the provision of drain is completed, the sewage treatment plant can be constructed at the initial stage of devlopment. (However, since the land for this purpose is not acquired at present, acquisition must be accelerated when constructing drains.) As low swampyland continues along Cengkareng - Teluknaga Road, land filling will be needed. For the time being, however, land acquisition is to be made as progressively as possible and the land thus obtained will be maintained as reserve for future commercial lots. Housing construction will be possible starting from areas with relatively high altitude since drains are already completed. As for existing villages, these will be encouraged to move to new residential areas as strongly as possible at this stage

as in the case of "Alternative-X" is Alternative-I is to be introduced.

(1st Stage) Alternative X

Development will be conducted in the farmland and green areas with relatively high altitude so that the need for land filling can be reduced to the minimum. It is recommended to provide reservoir pond at the time of small scale improvement works of the existing drains. Since this area is set aside as reserve for the future commercial lots, its impact on the overall planning will not be great.



(2nd Stage)

At this stage, the plan is prepared on the premise that the provision of drains are existent. Part of the District Center is completed and the general outline of residential area is formed. Reserve area will be developed into commercial lots gradually in step with the provision of road network (in particular, Outer Ring Road).

Up to this stage, the difference between Alternative-I and II is not so great. However, from this stage onward, a major decision must be made for the advancement of the project.

(Housing Density)

- In preparing Alternative Plans, the density goal has been set at 50 units/ha (gross). Here we wish to clarify the relative significance of this 50 units/ha by drawing up alternative plans on the basis of net housing lot area and the allocation of the types of housing. This examination of density has a major bearing on the per housing unit cost when land relating cost is high and is an important condition for project implementation.

- Net housing scale is set as follows:

	1 storied	2 storied	flats	
CASE X	120 m^2/unit	100 m^2/unit	80 m^2/unit	Ex; Perumnas housing Complex in Bandung
CASE Y	100	80	60	Proposed density
CASE Z	80	60	40	Ex; Tanah Aban

- "Case X" is an actual example at Perumnas and these scales are adopted in the suburban districts of metropolitan areas and local cities. Case X is relatively wide, however, when the conditions of Cengkareng are taken into consideration, higher density appears to be required. When the coverage ratio after the expansion of housing construction which is included as a premise of the planning, is set at approx. 50%, the net housing scale will be as given in "Case Z." In this planning, we adopted "Case Y" which represent midway between "Case X" and "Case Z" when drawing up the Alternative Plans.

- Moreover, gross density will depend in a large measure on the allocation of the types of housing. For instance, if only flat houses are to be allocated, two times higher density can be obtained when compared with the method of allocation where only 1-storied houses are constructed. Here, we have set three cases taking feasibility into account.

	1 storied	2 storied	Flats	Empty Lot for Housing	Total
CASE A	40 %	50 %	0 %	10 %	100 %
CASE B	20	60	10	10	100
CASE C	0	70	20	10	100

- In "Case A", flat houses are nonexistent while there are a considerable number of 2-storied houses and this situation is very close to the standard of Perumnas up to present.
  "Case C" is aimed at high density to the maximum of feasibility, and here we have adopted "Case B" which represents midway between these two when preparing the Alternative Plans.

- We have prepared 9 types of density alternative plans in combination mentioned above. At the same time, we have examined changes which occur according to housing land ratio.

MATRIX OF HOUSING DENSITY

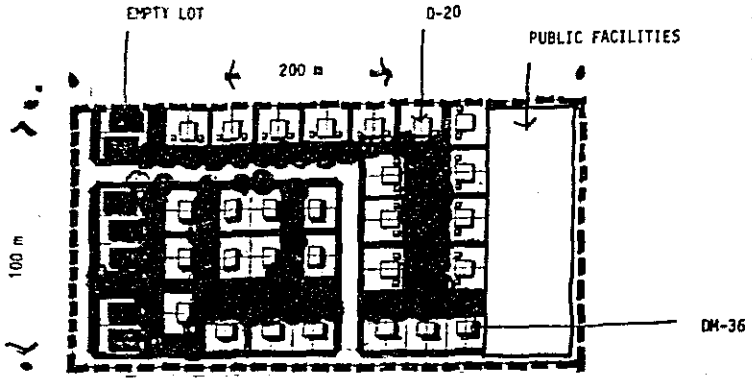
	CASE A			CASE B			CASE C			
	Net	Housing lot ratio	Gross	Net	Housing lot ratio	Gross	Net	Housing lot ratio	Gross	
	units/ha	%	units/ha	units/ha	%	units/ha	units/ha	%	units/ha	
CASE X	85	40	34.0	90	40	36.0	95	40	38.0	Minimum ratio: 34.0 units/ha
		50	42.5		50	45.0		50	47.5	Minimum ratio with flat: 38.0
		60	51.0		60	54.0		60	57.0	
CASE Y	100	40	40.0	105	40	42.0	115	40	46.0	Medium ratio: 52.5 units/ha (Proposed ratio)
		50	50.0		50	52.5		50	57.5	
		60	60.0		60	63.0		60	69.0	
CASE Z	120	40	48.0	130	40	52.0	145	40	58.0	Maximum ratio: 87.0 units/ha
		50	60.0		50	65.0		50	72.5	
		60	72.0		60	78.0		60	87.0	

- When the land relating cost is set at A RP/Ha at the housing density of 52.5 units/ha in the Alternative Plans, the per unit cost will be A/52.5 RP/unit. Thus, when density is raised to 87.0 units/ha, the per unit cost will be reduced by approx. 40% at A/87.0 RP/unit.

- At present, both Alternative-I and II are premised on the density of 52.5 units/ha. In the case of Alternative - II, however, there are no limitations arising from green area preservation and relatively higher density can be achieved. On the other hand, Alternative-I will be difficult to achieve such high density when compared with the Alternative-II, even though green areas are included in land utilization as for community facilities, because there are limitations to the effective utilization of housing land arising from topographical and distribution conditions.

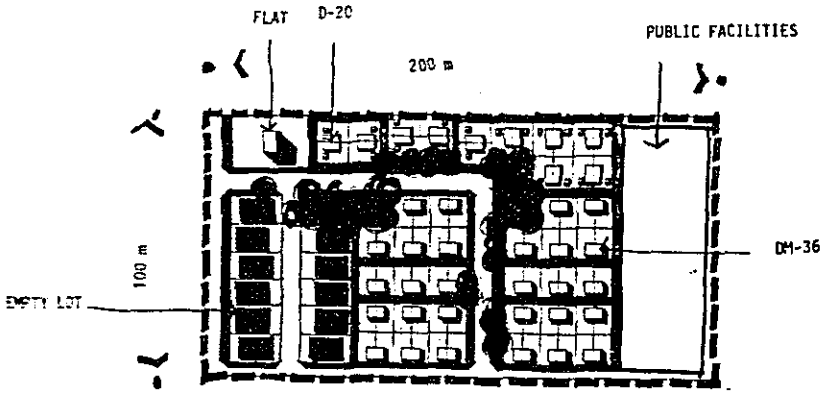
FIG. 4-17
DENSITY PATTERNS
OF HOUSING AREA

AX (34.0 units/ha)-gross density



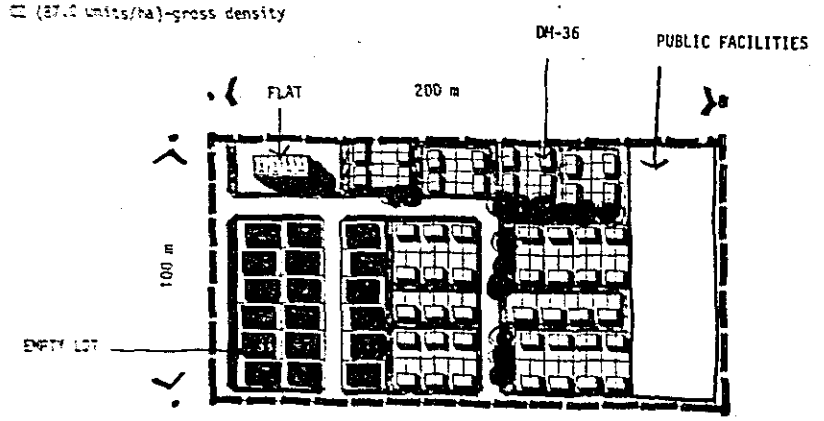
	1 story (D-20)	2 stories (DM-36)	5 stories (FS'-45R)	EMPTY LOT
PROPORTION	40%	50%	0%	10%
UNIT AREA	120 m^2	100 m^2	80 m^2	200 m^2

BY (52.5 units/ha)-gross density



	1 story (D-20)	2 stories (DM-36)	5 stories (FS'-45R)	EMPTY LOT
PROPORTION	20%	60%	10%	10%
UNIT AREA	100 m^2	80 m^2	60 m^2	200 m^2

CZ (87.0 units/ha)-gross density



	1 story (D-20)	2 stories (DM-36)	5 stories (FS'-45R)	EMPTY LOT
PROPORTION	0%	70%	20%	10%
UNIT AREA	80 m^2	60 m^2	40 m^2	200 m^2

TABLE 4-4 IMPLEMENTATION BODY

	MAINTENANCE	CONSTRUCTION	LAND	FINANCE
ROAD				
off site	BINA NARGA DKI	BINA MARGA DKI	BINA MARGA DKI	BINA MARGA DKI
in site	DKI	PERUMNAS	PERUMNAS	PERUMNAS
DRAINAGE				
off site	PBJR DKI	PBJR DKI	PBJR DKI	PBJR DKI
in site	DKI	PERUMNAS	PERUMNAS	PERUMNAS
WATER SUPPLY	PAM	PAM	PAM	PERUMNAS
ELECTRICITY	PERUMNAS in site from transformer			
KINDER GARTEN		Public	PERUMNAS 50 % subsidy for private	
PRIMARY SCHOOL		Public	PERUMNAS	
JUNIOR HIGH SCHOOL		Public	50 % subsidy	
HIGH SCHOOL		Public	50 % subsidy	
COMMERCIAL		Public	Sale with market price	
MOSQUE		People	PERUMNAS	
COMMUNITY FACILITIES		PERUMNAS	PERUMNAS treated as road, drainage	
PUBLIC HEALTH		Others	PERUMNAS	
HOSPITAL etc.		Others	Sale with basic price	

4-3 Infrastructure

4-3-1 Drainage

. Here we will refer only to the criteria for a drainage system because of the shortage of data on existing topography.

First, the annual rainfall of Cengkareng is about 1,900mm, of which 80% falls during the period of November through March. In the rainy season, 60 - 80% of the daily rainfall is obtained between 14.00 and 21.00.

. Figs. 4-17 and 4-18 show the rainfall mass-curves and rainfall intensity curves obtained from the above-mentioned data. The run-off coefficients are 0.7 in medium-density urban districts, 0.8 in high-density urban districts and 0.6 in vacancies.

. Trunk, branch and sub-branch drainages are planned to have minimum gradients of 1/5,000 - 1/3,000, 1/3,300 - 1/2,500, and 1/2,000 - 1/1,000.

. If a branch drainage is planned to have a gradient of 1/1,500 and the most distant point drained by it is supposed to be 1,000m, a head of 0.667m is necessary. If this value is applied to DRAIN 2-3 and DRAIN 2-2-2-3, ground levels are 2.746m + 0.667m = P.P. + 3.413m and 3.408m + 0.667m = 4.075m.

. The construction cost of the drainage system has been tentitively estimated on the basis of the following construction assumptions.

The area of one neighborhood unit is 16 ha. If branch drainages are supposed to have a total length of 750m, the length of the branch drainages per gross area is 750m/16ha ≒ 50m/ha.

Next, unit construction cost is estimated as follows:

1) Excavation

$$\left(\frac{4+3}{2}\right) \times 1.5 = 5.25\ m^2$$

$$\alpha = 0.3 \rightarrow 5.25\ m^2 \times 1.3 = 6.8\ m^3/m$$

$$6.8\ m^3/m \times 1{,}050\ RP/m^3 \fallingdotseq 6{,}800\ RP/m$$

2) Concrete

$(1.5 \times 2 + 3.0) \times 0.15 = 0.9\ m^2$

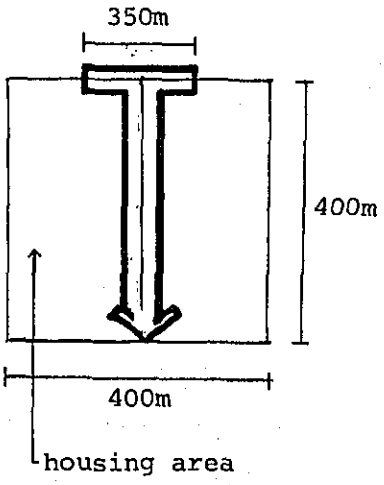
$\alpha = 0.3 \rightarrow 0.9\ m^2 \times 1.3 = 1.2\ m^3/m$

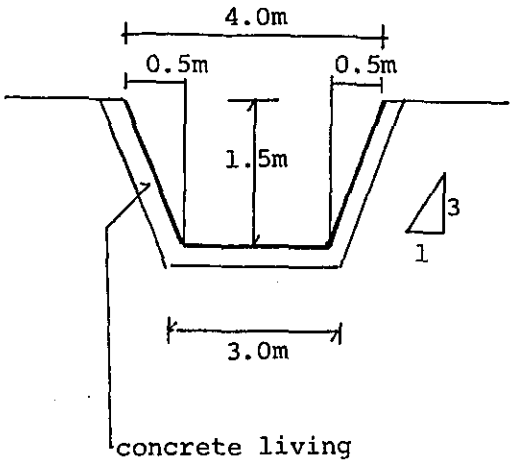
$1.2\ m^3 \times 30{,}000\ RP/m^3 = 36{,}000\ RP/m$

3) Construction Cost

$6{,}800 + 36{,}000 = 42{,}800\ RP/m$, or

$42{,}800\ RP/m \times 50\ m/ha \fallingdotseq 220\ RP/gross\ m^2$





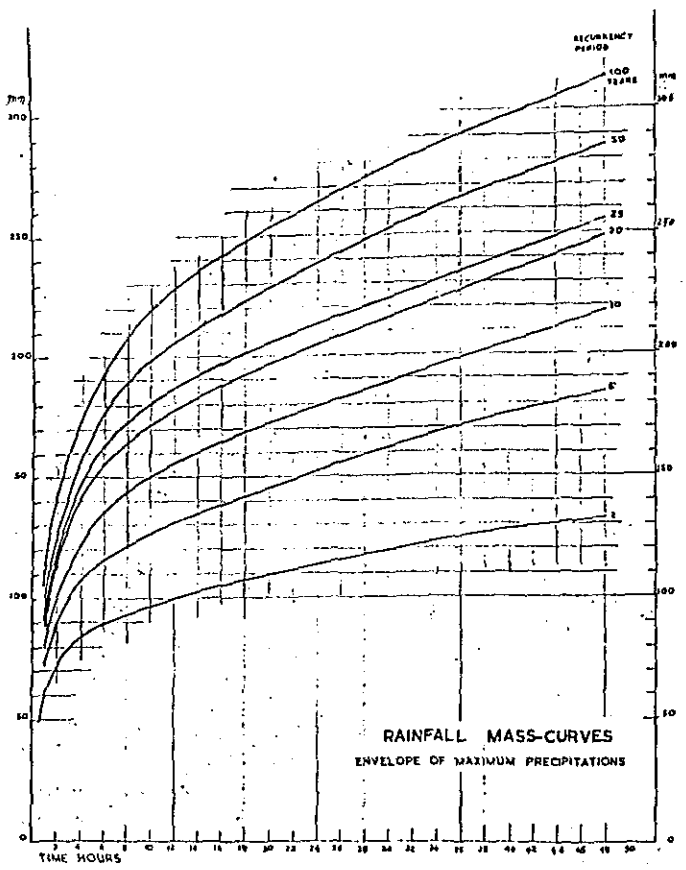


FIG. 4-17
RAIN FALL
MASS-CURVES

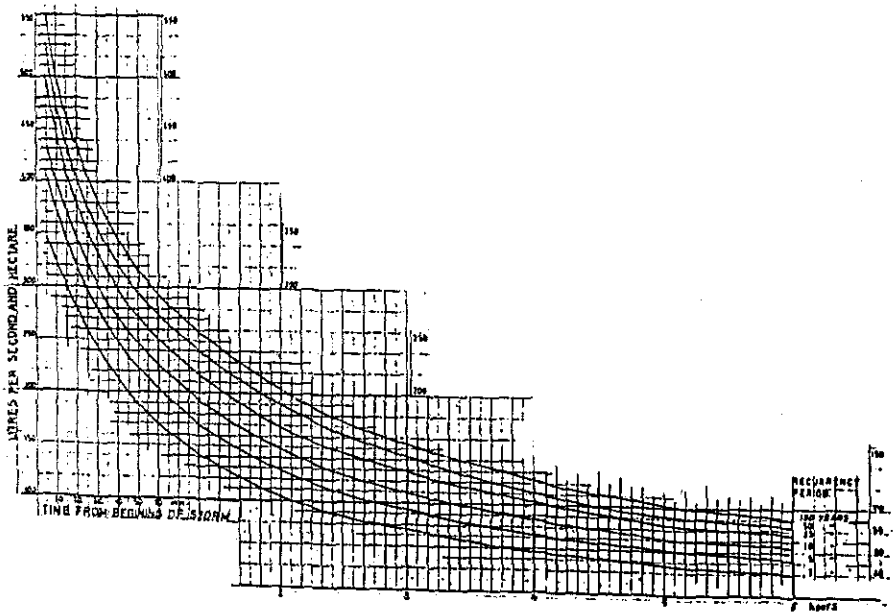


FIG.4-18
RAIN FALL
INTENSITY
CURVES

4-3-2 Water Supply

A. Outlines of Planning

- Water supply must be executed by PAM but in case PAM's water supply facilities are not functioning at the time water supply is needed by this plan, underground water (deep well) or surface water (river) must be used temporarily.

- As an emergency water supply source, a shallow well will be provided for each housing block and no generator set will be provided.

- A water distribution system should be selected so that its coverage may be kept within an allowable pressure range (1 - 4 kg/cm^2) and so that it can cope with fluctuations in water consumption.

- The basin in Mandi room can be used on the suspension of the main water supply and for decreasing peak flow.

- Distribution Main pipes will have a sufficient size (more than 100 mm) to connect to fire hydrants and will be buried under main roads for the convenience of fire fighting.

B. Calculation of Water Consumption

- In PEILITA III, the Indonesian Government has made the following policy for small cities.
  For 60% of the estimated population in 1985, average per capita water supply is set for 60 liter per person per day. The net equivalent for water supply facilities will be borne by the government and the expense in excess of this amount should be shared by the proprietor.
  At this stage, investigations have been made as to existing reports of PERUMNAS and other foreign countries' data, we set the daily water supply to one household for 400 liter/house/day (net). (5-6 capita/household)

  a. Average water supply to
     1 household/day (net) 400 lit/house/day

b.	For public facilities a x 0.1	40 lit/house/day
c.	Leakage from the pipe (a+b) x 0.15	60 lit/house/day
d.	Average daily water supply (gross) Qda	500 lit/house/day
e.	Max. daily water supply (gross) Qdm = Qda x 1.25	625 lit/house/day
f.	Ave. hourly water supply Qha = Qda ÷ 24 hr.	20 lit/house/hr.
g.	Peak hourly water supply Qhm = Qha x 2.5	50 lit/house/hr.

. From the above, average daily water supply for the project area will be:

	(50 units/ha) for housing area	for commercial area (30ha)	Total
Alternative I	6,400 M^3/day	1,000 M^3/day	7,400 M^3/day
Alternative II	4,000 M^3/day	1,000 M^3/day	5,000 M^3/day

* In Alternative II, when water will be supplied to the existing community, maximum water consumption of the total planning area will be as same as that of Alternative I.

C. Water Source

. Water supply source capacity should be more than the maximum daily water supply (Daily average x 1.25).

. The following three are considered as the water source.

a. PAM

. At present, there is a 600 mmø pipe up to Grogol from the center of Jakarta. A 800 mmø pipe will be added to it by 1982. According to CIPTA KARYA, the existing water supply capacity is sufficient, including that of Cengkareng district.

. A 250 mmø pipe has been already provided between Grogol and the eastern coast of Angke River. However, since water pressure at

Grogol is about 15m, water flow is too small (about 25 lit./sec.) for supplying the Cengkareng district.

- According to the Master Plan, a 800 mmø pipe is planned along the Jakarta Tanggerang Road to the north of Angke River by 1990 during the first stage of Future Project. However, it would not be completed in time for the subject project.
- Requirements for using PAM, therefore, include laying a pipe from Grogol and, if water pressure is low, to install a booster pump station.
- To enable utilization of PAM's water, it is necessary to install a new pipe line from Grogol. Therefore, the possibility and schedule must be discussed by PERUMNAS, CIPTA KRYA, and PAM not only as a problem of Cengkareng but also of the total water supply plans for West Jakarta as a whole.
- The feasibility of the use of the water source expected for the New International Air port under construction at a distance of about 5km northwest of Cengkareng has been considered. However, the construction plan for this purpose has not yet been established. Further, because it would be located at a considerable distance from Cengkareng district and outside DKI Jakarta boundary, its use is hardly considered feasible.

b. Rivers

- The following rivers flow in and around the Cengkareng district.
  a) Angke River (about 3km east)
  b) Mookervaart River (along the Jakarta-Tangerang Road)
  c) Irrigation canal (northern and western sides of project site)
  d) Cisadane River (about 10km west)
- According to water quality data at hand, only Cisadane River can be considered usable as a water source in view of its water flow and quality. The others cannot be so considered because of the shortage of wa ter flow during the dry season, bad water quality, and the possibilities of the inflow of water containing heavy-metal. As to Cisadane River, consultation would be necessary for water rights since it is already being used as a water supply source (for both

drinking and irrigation).

- The use of rivers requires the approval of the "Directorate General of Water Source Treatment".
- Intake installations, conveyance pipe and purification plants are necessary to use river water.

c. Deep wells

- We have no boring data for Cengkareng district. Reportedly, however, underground water has levelled down because a number of deep wells are used by factories arount the project site. Therefore, it would be difficult to secure the required quantity of water for a whole subject area.
- Reportedly, underground water up to 100m depth contains salt, but that more than 150m depth is a good condition.
- The use of deep wells is regulated by "the Geological Survey of Indonesia" as follows.

  Max. capacity per deep well: 200 lit./min.
  Min. depth of deep wells: 100m
  Min. distance between deep wells: 200m

- Before the use of deep wells, boring is necessary for investigating the quantity and quality of water. At Jakarta, water treatment is reportedly necessary in general for removing iron and manganese.

D. Water distribution System

The following are considered as water distribution system.

a. Direct PAM connection		
b. Central distribution	1. Direct pump connection	. One zone system . Two zone system . Combination with pressure reduce valve . Combination with pressure reduce tank
	2. Elevated tank	. One zone system . Combination with zone elevated tanks
c. Zone distribution	1. Direct pump connection	
	2. Elevated tank	

. A direct PAM connection system can be used only when the water supplied from PAM has sufficient pressure (about 30m at the district intake place). Only piping with sufficient size will be capable of coping with the hourly fluctuation of water supply. Its cost is most advantagenous of course.

. The various types are considered to belong to the category of central distribution systems.
In the case of such a large-scale development as the subject project, if the elevated tank system is adopted, the high frame is necessary and the construction cost is expensive particularly in bad ground conditions.
Among the direct pump connection systems, the one zone type is most advantageous if its whole coverage is within the allowable pressure range (1 - 4 kg/cm^2).
In the case of higher pressure than the allowable range, a 2-zone type etc. are considered suitable. In the case of the subject project, however, the 1-zone type is preferable because it covers the allowable pressure range.
It would be advantageous when the implementation is made over the whole project site in a short period of time and when the aquisition of the construction site of main installations has been completed. Maintenance and control are easy because of the concentration of installations.

. It is considered that a zone distribution system can be divided into various types also. In the case of small scale distribution, a direct pump connection system requires a considerable quantity of pumps and troublesome control to cope with the considerable hourly fluctuation of water consumption.
While an elevated tank system does not require as great a height in its frame (about 15-20m), and is easy to cope with hourly fluctuation of water consumption.
The latter, therefore, is preferable. This system is suitable when development is continued for a long period of time, if land acquisition is difficult or development is only made partially.
Therefore, studies will be made on the following three most feasible systems.

a. Direct PAM connection system
b. Central distribution system --- Direct pump connection system (1-zone)
c. Zone distribution system --- Elevated tank system

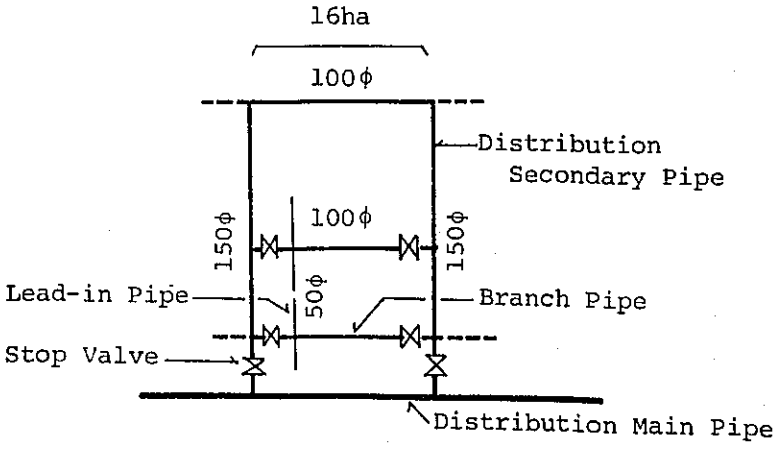
E. Criteria for Installation Capacities

1. Primary intake water capacity : Qdm ÷ 24^{hr} ÷ 3,600 (/sec)
2. Reservoir tank capacity : Qda x 0.4 (M^3) [Qda 800 M^3/day]
   Qda x 0.3 (M^3) [Qda 800 M^3/day]
3. Elevated tank system (in case of zone distribution system)
   . Lift pump : Qhm (M^3/hr) (divided into more than two pumps,) (one as stand-by)
   . Elevated tank : Qhm x 0.5 (M^3)
4. Direct pump system (in case of central distribution system)
   . Distributing pump : Qha x 2 (M^3/hr) (control of no. of pumps,one) (as stand-by
5. Water pressure at house
   . lead-in point : 1 - 4 kg/cm^2

F. Piping Network

The piping network should be that the influence on branch pipe will be small during accidents and maintenance is easy.

One zone will have an area of 16 ha. Two-directional inflow will be secured for branch pipes by loop piping. Secondary pipe and branch pipe will be 100 mmø at the minimum. Connection will be made to another adjacent zone for mutual supply.



Distribution Pipe System
(Central Distribution System)

G. Fire Extinguishing Installations

The following fire hydrants will be installed.

Fire hydrants: at 200m intervals along roads
(housing areas)
at 100m intervals along roads
(Public and commercial areas)

H. Pipe Materials

Materials and sizes of pipes manufactured and easy to obtain in Indonesia are as follows:

- o Asbestos Cement Pipe (ACP) 3 24"
- o Hard Poly Vinyl-chloride Pipe (PVC) 3/8 12"
- o Galvanized Iron Pipe (GIP) 1/2 8"

The imported large-diameter ductile cast-iron pipes frequently used besides the above-mentioned pipes for public water supply plants will be relatively expensive.

Of the pipes mentioned above, the ACP with high corrosion resistance and comparatively low cost will be used for piping over 100 mm , and the PVC will be used for piping less than 100mm on which no great pressure is applied.

I. Construction Cost

RP/GROSS M^2 (In case of Alternative I)

WATER SOURCE		DISTRIBUTION SYSTEM		TOTAL
PAM		PAM Direct	405(435)	405(435)
	—	Central	470(530)	470(530)
		Zone	535(565)	535(565)
RIVER WATER	525(785)	Central	470(530)]	995(1,315)
		Zone	535(565)	1,060(1,350)
DEEP WELL	150(240)	Central	555(630)	705(870)
	(150)	Zone	505(505)	655(655)

* No. in blanks shows the construction cost of the project area in case the existing community is covered, but not included the cost of inside facilities of them.

Note: A water source system for river water includes intake, lead pipe, and water purification facilities.

- A direct pump connection system is mentioned to represent the central distribution system.
- An elevated tank system is mentioned to represent a zone distribution system.
- No shallow well used on the suspension of main water supply is included since its cost will be borne by the users themselves.

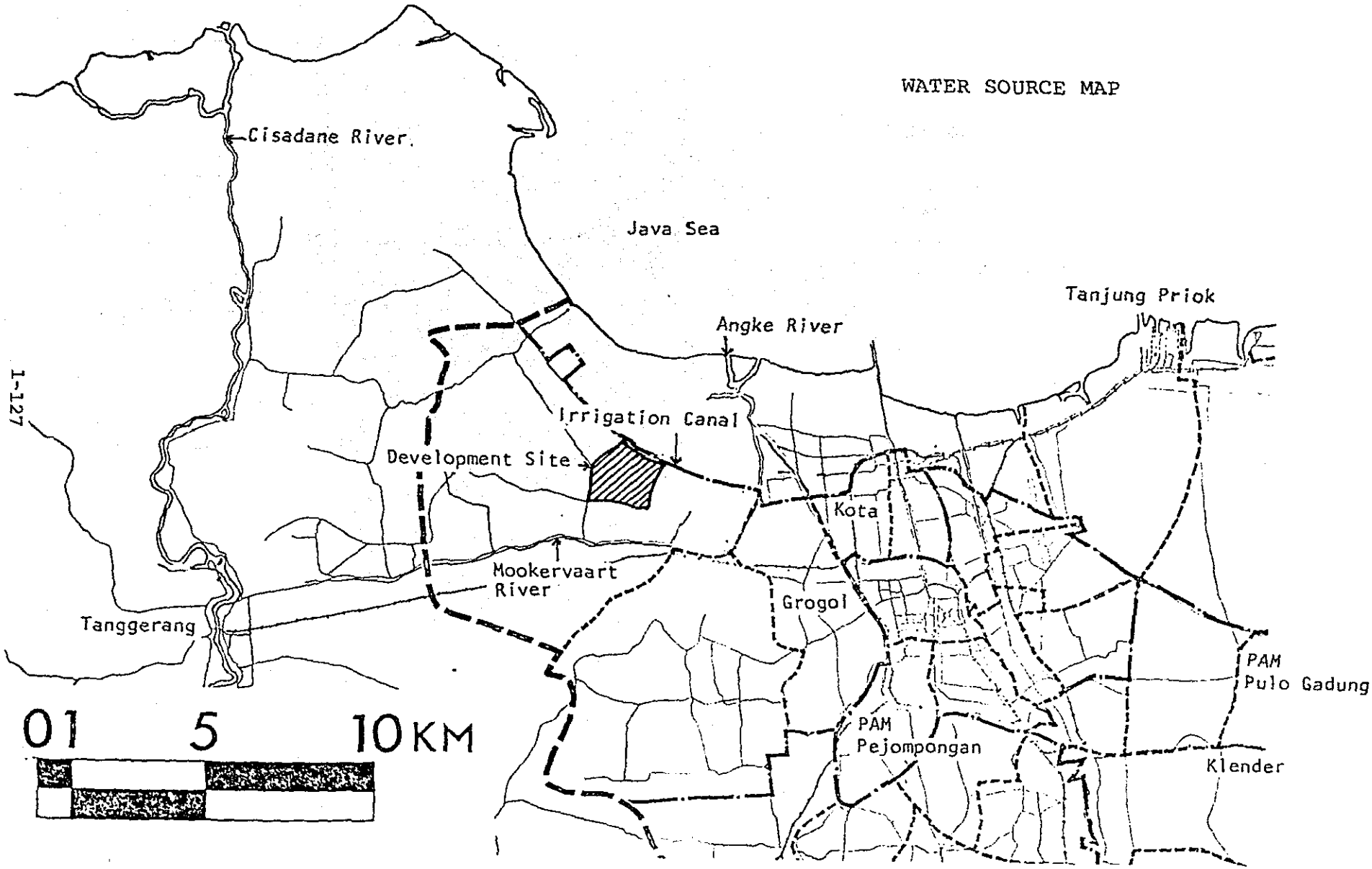
J. Subjects for the Next Phase

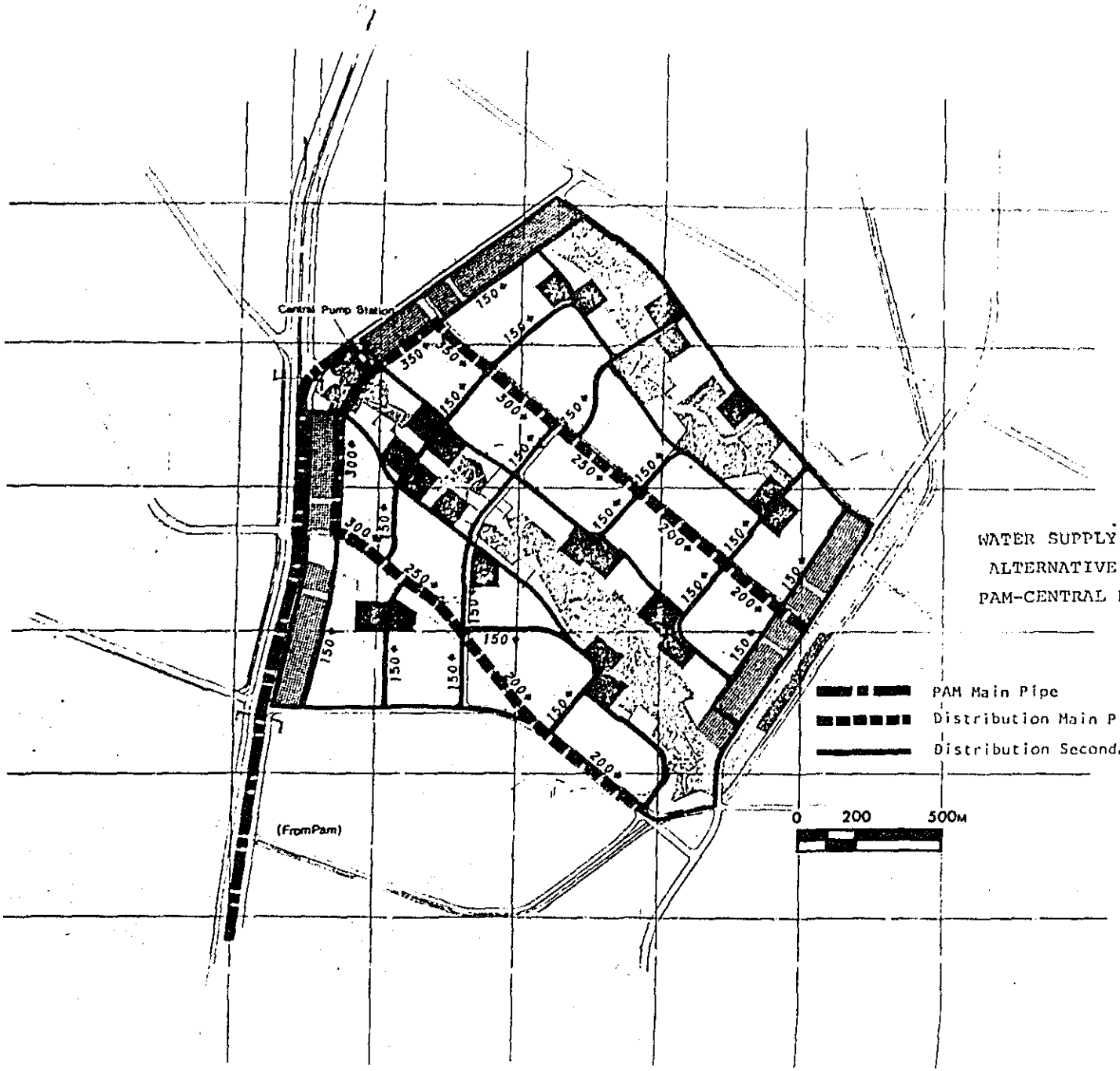
(Water Source)

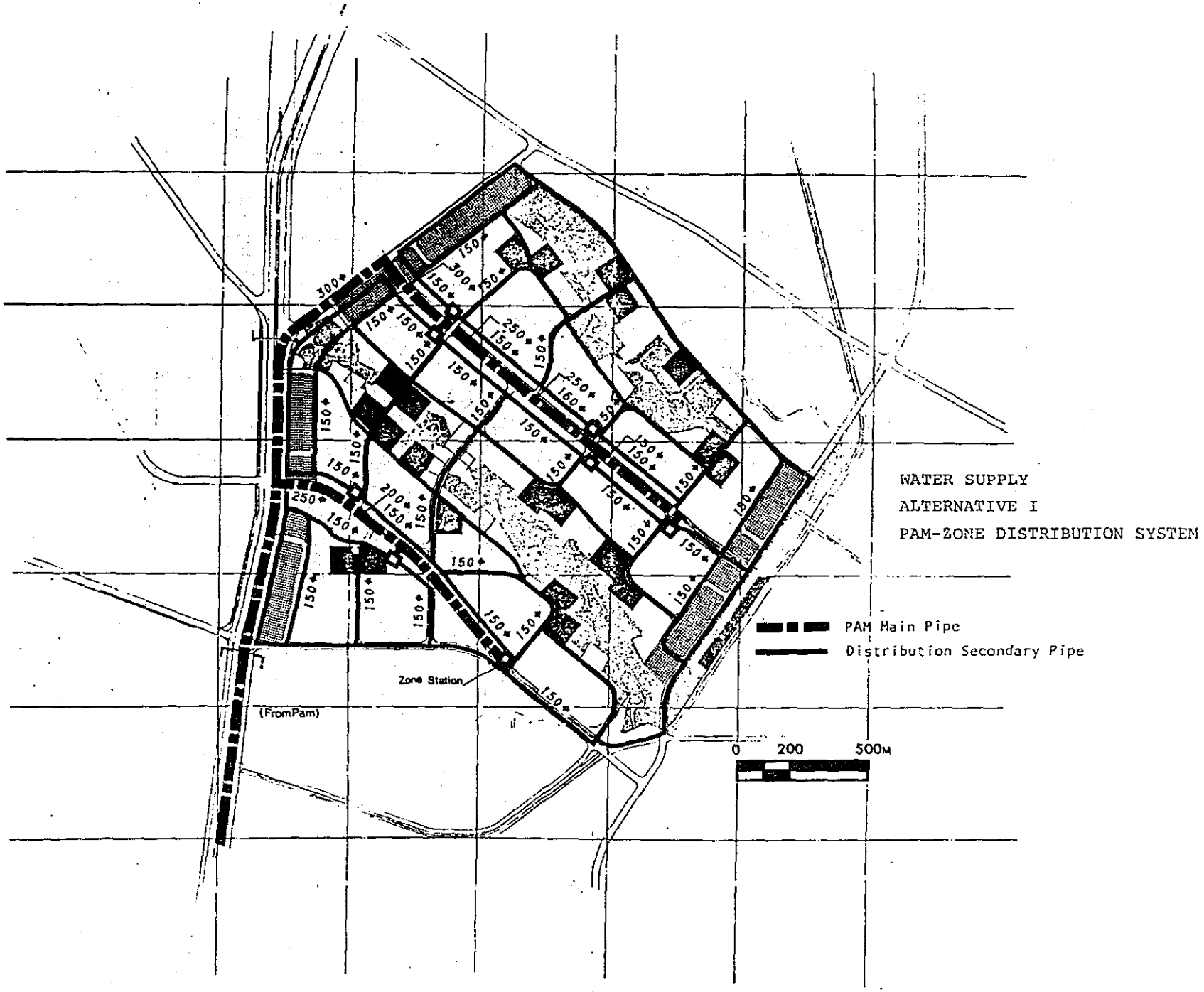
- Final water source should be PAM water.
- When PAM's facilities are not functioning at the time of the completion of houses, other sources should be determined taking into consideration the scale and characteristics of the stage implementation.program. For instance, when the implementing area is small, deep wells may be used in view of water quantity and quality. But as the area becomes large, deep wells may not be able to use because of lack of capacity and a consequent subsidence.

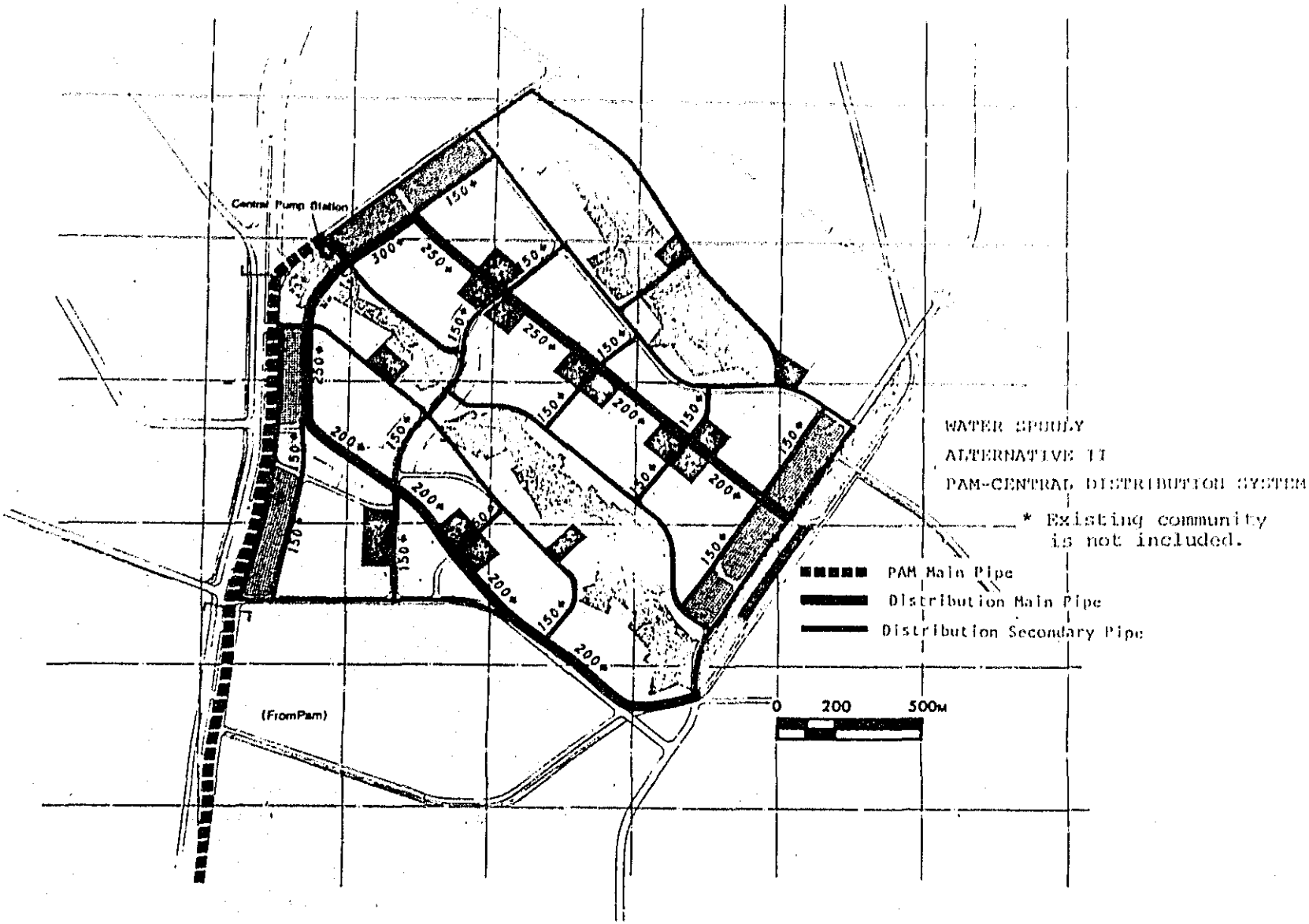
(Distributiin System)

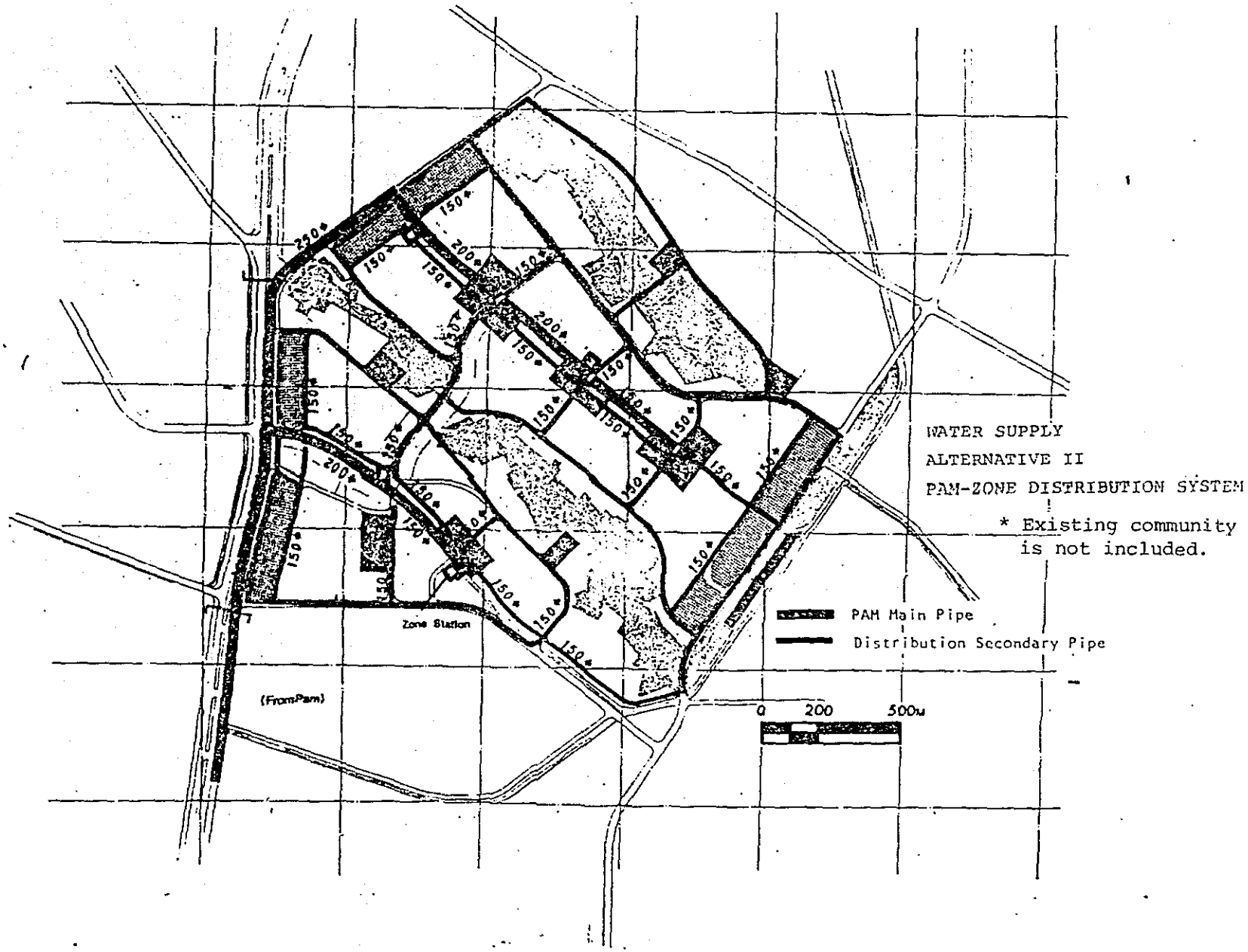
- The distribution system has close relations with the type of water source and the implementation schedule.
- When the water source is PAM or river water the central distribution system is advantageous except for in case very small implementation area.
- When deep wells are the water source, generally, zone distribution system is advantageous.
- In both cases, appropriate zones and pressure system should be determined taking into consideration the implementing scales.


WATER SOURCE MAP
Cisadane River
Java Sea
Tanjung Priok
Angke River
Irrigation Canal
Development Site
Kota
Mookervaart River
Grogol
Tanggerang
PAM Pulo Gadung
PAM Pejompongan
Klender
0 1 5 10 KM


Central Pump Station
(FromPam)
WATER SUPPLY
ALTERNATIVE I
PAM-CENTRAL DISTRIBUTION SYSTEM
PAM Main Pipe
Distribution Main Pipe
Distribution Secondary Pipe
0 200 500M


WATER SUPPLY
ALTERNATIVE I
PAM-ZONE DISTRIBUTION SYSTEM
PAM Main Pipe
Distribution Secondary Pipe
Zone Station
(FromPam)
0
200
500M


Central Pump Station
(From Pam)
WATER SUPPLY
ALTERNATIVE II
PAM-CENTRAL DISTRIBUTION SYSTEM
* Existing community is not included.
PAM Main Pipe
Distribution Main Pipe
Distribution Secondary Pipe
0
200
500M


WATER SUPPLY
ALTERNATIVE II
PAM-ZONE DISTRIBUTION SYSTEM
* Existing community is not included.
PAM Main Pipe
Distribution Secondary Pipe
0 200 500m
Zone Station
(From Pam)

4-3-3 Sewerage

A. Outlines of Planning

- Sea or big rivers are necessary to discharge sewage without treatment for a large-scale and high-density housing areas such as Cengkareng project. However, there is neither sea nor big river in or around the Cengkareng district.
  Further as the site is swampy and has a high ground water lebel particularly in the rainy season, the percoration treatment system is not acceptable.
  At present, DKI Jakarta has no sewerage plan covering Cengkareng Therefore, an exclusive-use sewage treatment plant will be constructed at the project site for discharging treated water into the drainage system.
- Sewage and Rain water are discharged on separate systems.
- Toilet, mandi and kitchen sewerage are discharged on the same pipe system and treated together.
- As the site is large and flat, discharge by gradient is impossible and so pump stations are to be provided with generator sets.
  As to number and position of the pumping stations, further study is required.
- The sewage treatment system to be selected will be suitable to the climatic conditions at the project site and will run at a low cost.

B. Calculation of Sewage

- Based on the planned water supply, sewage capacity shall be established.

a. Average 1 household daily sewage (net)		400 lit./day/house
b. For public facilities	a x 0.1	40 lit./day/house
c. Average sewage discharge to drainage (gross)	(a+b) x 0.9	400 lit./day/house
d. Max sewage discharge to drainage	c x 1.25	500 lit./day/house
e. Peak flow ratio	c x 4	(population larger than 10,000)
	c x 6	(" less " ")

. Average daily sewage of the project area would be (50 house/ha).

	for housing area	for commercial area (30ha)	Total
Alternative I	5,120 M^3/day	800 M^3/day	5,920 M^3/day
Alternative II	3,200 M^3/day	800 M^3/day	4,000 M^3/day

* In Alternative II, sewage in the existing community is discharged to the project facilities maximum sewage capacity will be as same as that of Alternative I.

Sewage density depends on various conditions, but generally is high in the case of high living standards. Of BOD, COD and SS commonly used as the index of sewage density, a BOD value of 40gr./capita/day (average sewage density: 500mg/lit.) has been adopted.

C. Sewage Treatment Systems

o The proposed sewerage treatment system are as follows:

ZONE TREATMENT	Septic Tank
CENTRAL TREATMENT	Oxidation Pond
	Lagoon (w/aerator)
	Activated Sludge

They can be further divided into several types, depending on their construction and the devices employed.

a. Zone Treatment System

. Sewerage from households are discharged to septic tanks placed in different places. Treated sewerage by the tank is lead to one of the 3 discharge pump stations and then finally discharged to the nearest drainage.

. In this study, treating capacity of septic tanks will be studied for 12 household and for 72 household types.

. A septic tank system can not develop a good treating quality. If its discharge water is led into the small drainages at the project site, a means to prevent humans from entering the area is necessary since it has BOD values of 100 - 150mg/lit.

. Further, periodical sludge discharge is necessary.
Therefore, the large quantity of septic tanks requires very troublesome maintenance labour.

. Refer to "Rencana septic tank" as to the specifications of septic tanks, which are summarized below.

- o Sewage storage capacity : 400 lit./house/day x 1 day
- o Sludge " " : 150 lit./house/year
- o Sludge discharge : 1 time/year

b. Central Treatment System

. Sewerage water from residences is lead to one of the 3 pump stations and then sent to a central treatment system. Processed sewerage is discharged to the drainage running on the east side of the site.

. The central treatment system is capable of developing a high treatment grade and can discharge treated water to the rather big drainage. Therefore, danger to human can be reduced to a level less than that of the zone system. Further, it is advantageous in respect to sludge discharge and other maintenance care because treatment installations are concentrated.

Various types of treatment systems ranging from an oxidation pond system to an activated sludge system can be considered for selection. Here, some major types will be examined.

b-1 Oxidation pond system

Operation is easy since the treatment plant requires no motive power except for the circulating pump and has a functions simply. On the other hand, treatment capacity depends on atmospheric temperature, sun shine ratio and other environmental conditions because its process is similar to that of a natural purification system, and a wide area is required because of the slow decomposition process. It must be installed a considerable distance from residential districts since there is a possibility of generating odor, flies, methane gas, and so on. It is suitable for the tropical project site because of the long daylight hours.

It is known widely because it has already been used at Cirebon, Tanggerang and so on in Indonesia.

- BOD value of discharge water; Max. 60 - 90mg/lit.
- Oxidation pond capacity: 400 lit./house/day x 30 days
- Construction: by earth banking

b-2 Lagoon with aerator

This combination system of oxidation pond and aerator has been developed for stabilizing and improving treatment capacity and reducing the required space.

It is intermediate in performance between the oxidation pond and activated sludge systems.. As compared with the activated sludge system, it is not expected to develop as stable a performance, but ensures much easier maintanance. Therefore, although still in the development stage, it can be considered pratical.

The following are its major specifications.

- BOD value of discharge water: Max. 60mg/lit.
- Lagoon capacity: 400 lit./house/day x 3 days
- Construction: by earth banking

b-3 Activated sludge system

This system which mainly depends on aerobic treatment with active sludge is now used extensively throughout the world. It is stable in performance, although skill is necessary for sludge control and maintenance care.

The required space is small and installations can be reduced to a compact size. A sludge treatment plant is necessary because a considerable quantity of excess sludge is produced.

The following are its main specifications.

- BOD value of discharge water; Max. 30mg/lit.
- Construction: Concrete structure

D. Sewage pump station

. As the site is large and flat, discharge to drainage by gradient is not possible in any sewerage treatment system.
For pump stations, a separate generator set is necessary and proper maintenance is required. Basically, it is desirable to have pump stations in one place but if the piping to pump stations become too long, the pipe must be laid very deep which will increase the cost of work and the maintenance becomes difficult. Therefore, in this plan, the maximum depth of the pipe is set for 6 M and pump stations are placed in 3 different places.

. A number of submersible sewer type pumps will be employed, including an stand-by one. Their capacity will be estimated by the formula: (ave. hourly discharge capacity) x 3

. The number of installations and the location of pump stations will be examined in the feasibility study.

E. Piping Work

. The minimum pipe diameter will be 150 mm$^{\circ}$, and the minimum soil coverage depth at pipe ends will be 0.6m.
Piping capacity will be estimated in terms of peak flow.
Piping diameter and gradient will be determined so that the flow velocity at maximum flow will be 0.6 - 3.0m/sec.
Manholes will be provided at maximum interval of 100m in terms of pipe length, with one junction chamber for every two houses.

. A minimum gradient of 1/500 will be given to pump discharge piping.

. Economical concrete pipes will be used for drainage piping where gradient flow is used, and ACP for pressurized pumping mains.

F. Construction Cost

RP/Gross M^2 (In case of Alternative II)

		Equipment	Pipe	Total Cost
ZONE TREATMENT SYSTEM	Septic Tank (12 houses/unit)	560(595)	580(600)	1,140(1,195)
	Septic Tank (72 houses/unit)	435(475)	580(600)	1,015(1,075)
CENTRAL TREATMENT SYSTEM	Oxidation Pond	225 (345)	625(655)	850(1,000)
	Lagoon (With aerator)	365 (545)	625(655)	990(1,200)
	Activated Sludge	705(1,070)	625(655)	1,330(1,725)

Note: The above cost includes generator and sewerage pump stations.

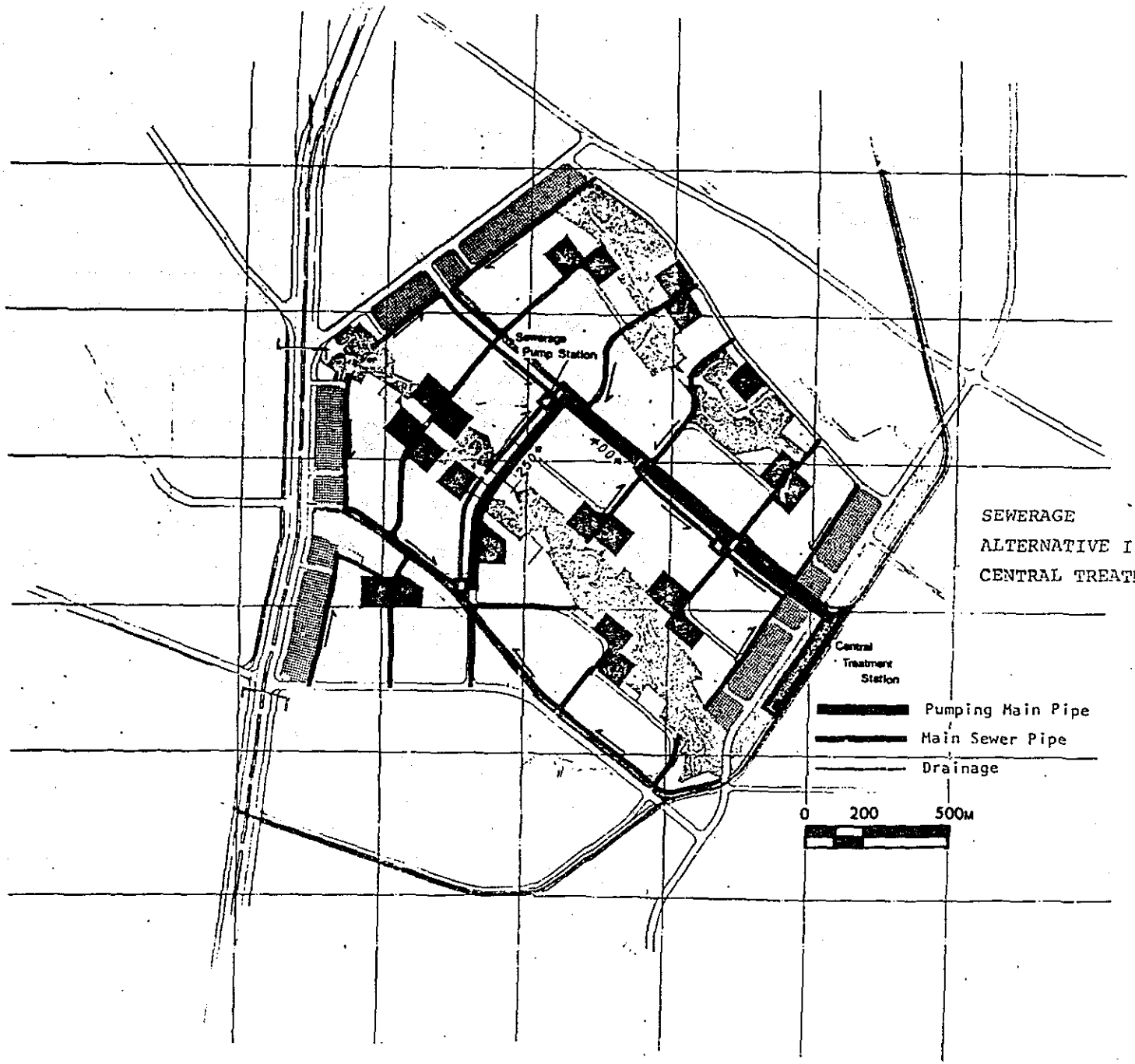
* No. in blanks shows the construction cost of the project area in case the existing community is included, but not included the cost of inside facilities of them.

G. Subjects for the Next Phase

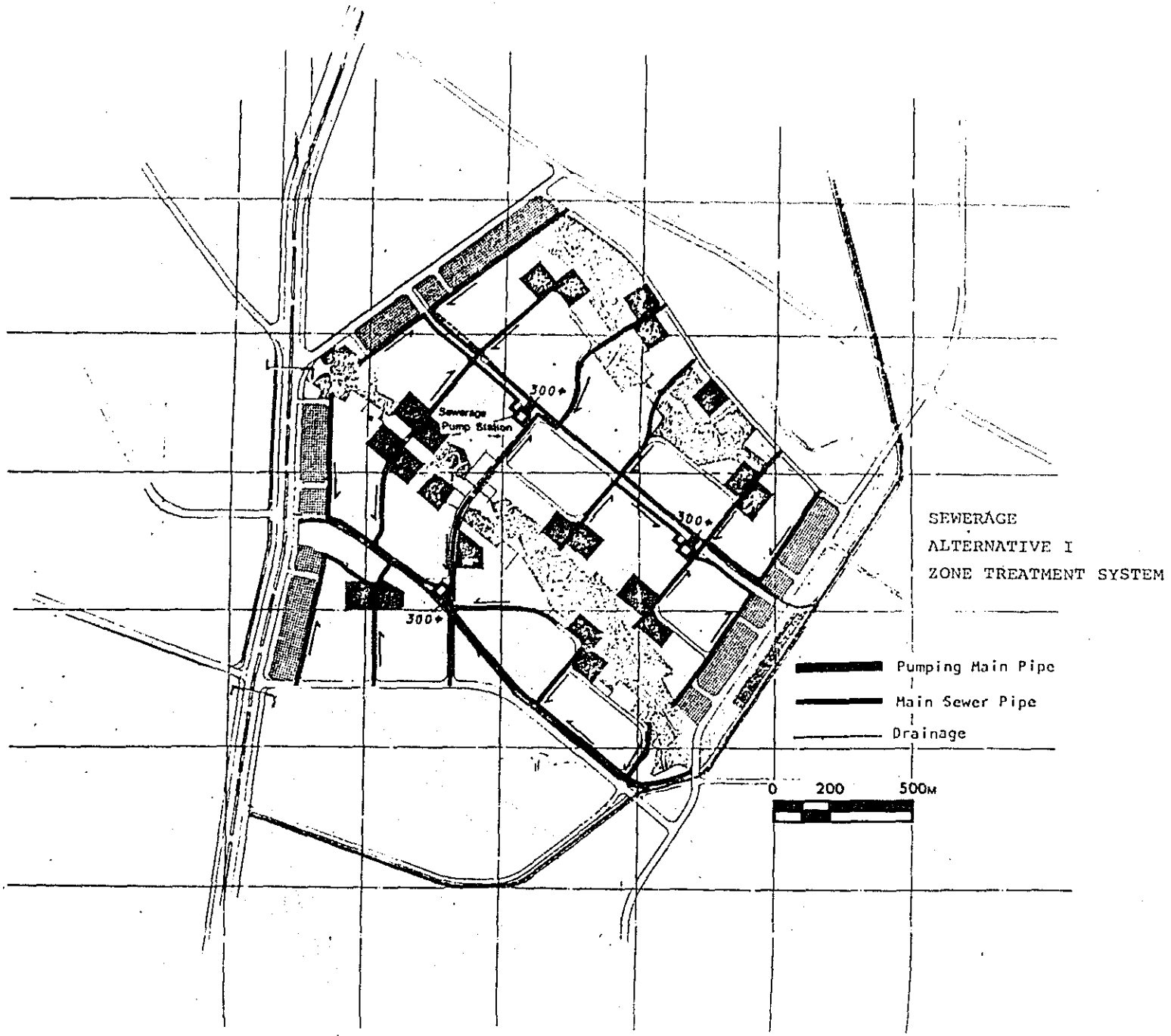
(Treatment system)

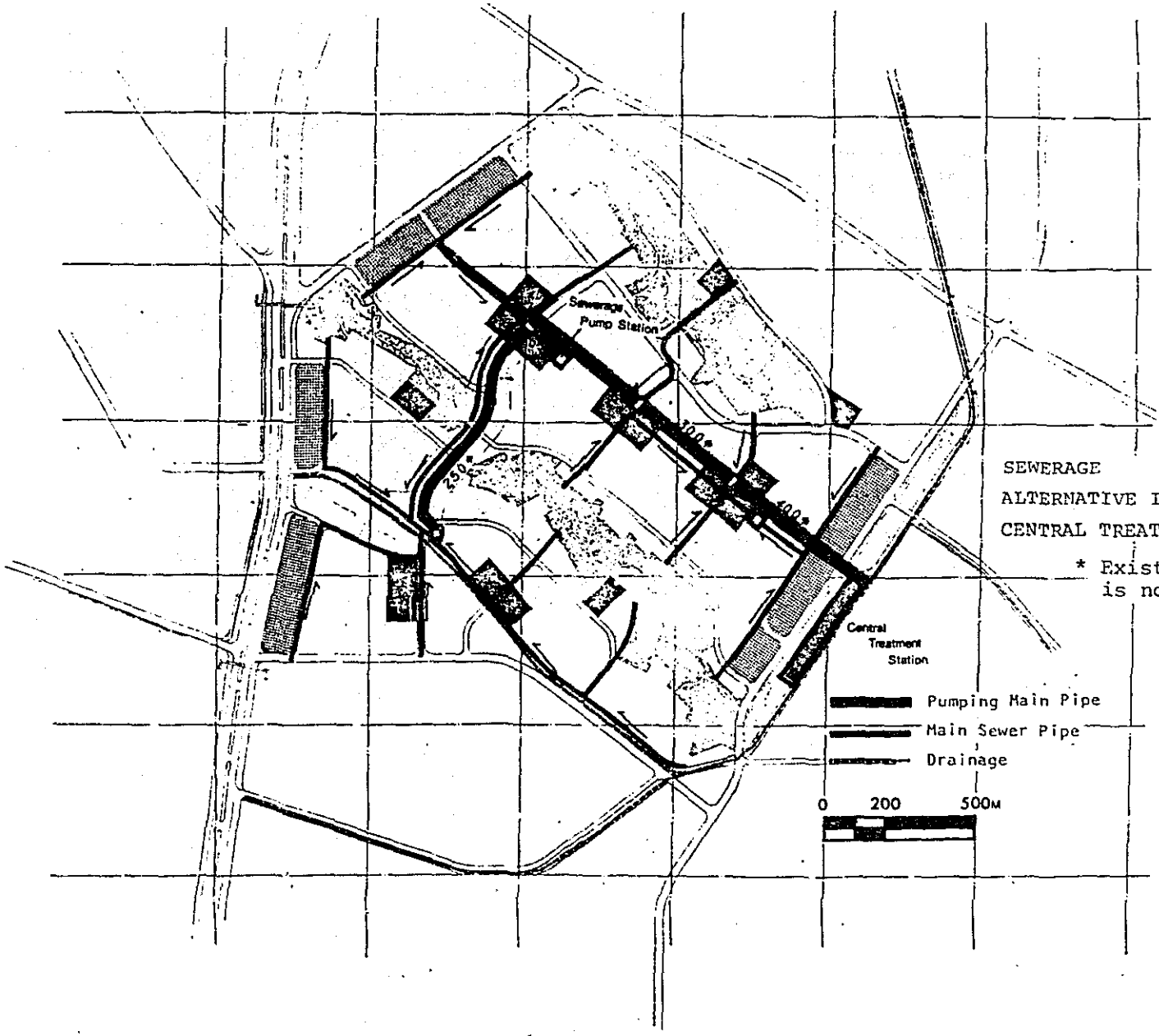
- The results of the study are as follows:
  - o A Lagoon system of the Central system (with aerator) is generally recommended since the performance is stabilized and maintenance is easy.
  - o A septic tank system is high in construction cost, elimination of sludge is difficult, and there are no merits.
  - o An oxidation Pond system is lowest in construction cost but it requires much space (5 to 6% of planned area). The area is 14 ha in case of Alternative I and 8 ha in case of Alternative II and securing that large space is difficult.
  - o The activated Sludge Method is high in efficiency but the construction cost is extremely high compared to other methods.

. However, as a whole development at the same time is not possible, sewer treatment system should be restudied in the total implementing schedule taking into consideration the scale and characteristics of the implementation program and progress of drainage system and land acquisition.



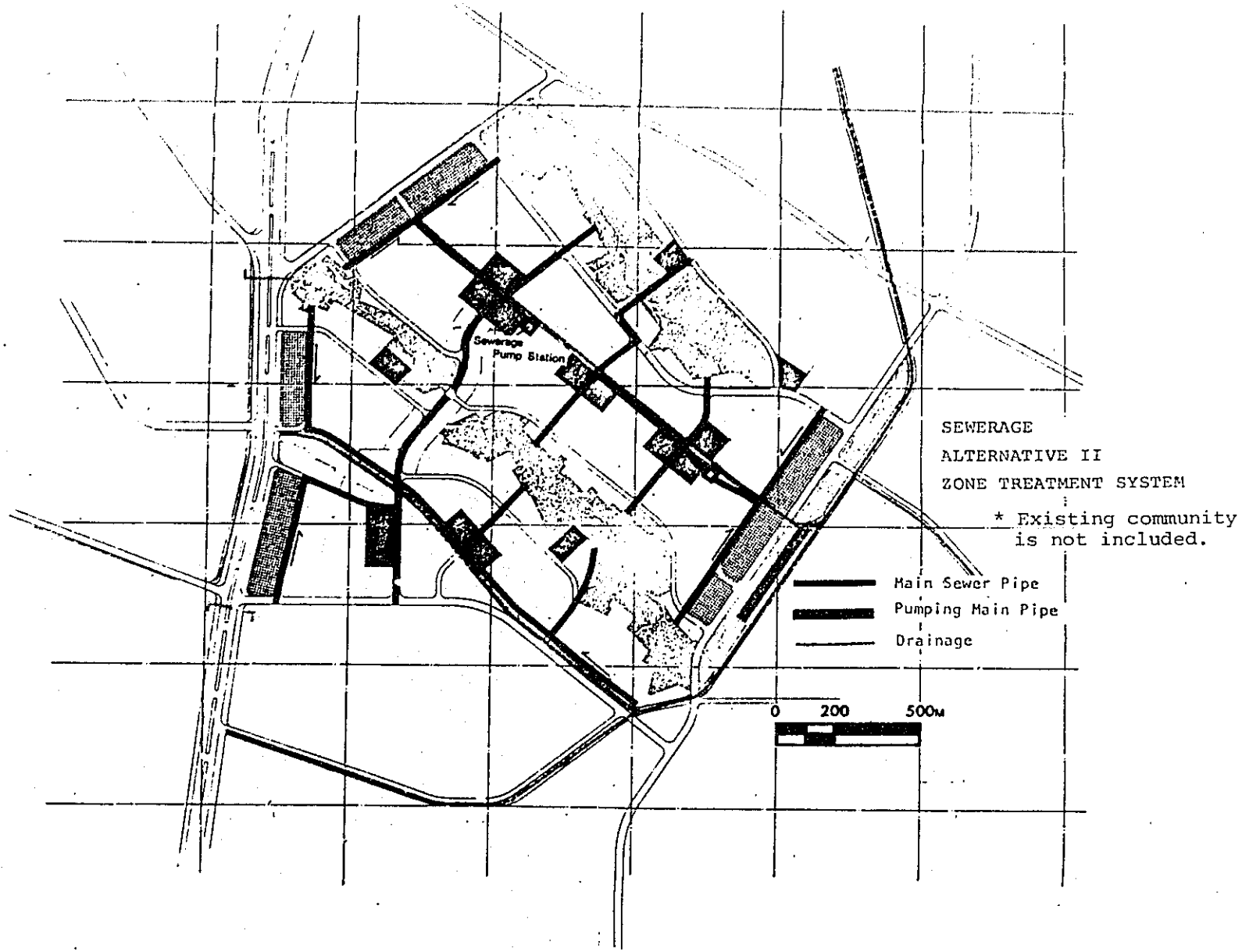
SEWERAGE
ALTERNATIVE I
CENTRAL TREATMENT SYSTEM


300φ
Sewerage
Pump Station
300φ
300φ
SEWERAGE
ALTERNATIVE I
ZONE TREATMENT SYSTEM
Pumping Main Pipe
Main Sewer Pipe
Drainage
0
200
500M



SEWERAGE
ALTERNATIVE II
CENTRAL TREATMENT SYSTEM

* Existing community is not included.


Sewerage
Pump Station
SEWERAGE
ALTERNATIVE II
ZONE TREATMENT SYSTEM
* Existing community
is not included.
Main Sewer Pipe
Pumping Main Pipe
Drainage
0
200
500M

4-3-4 Solid Waste

A. Outlines of Planning

The disposal of solid waste should be considered in formulating DKI Jakarta's comprehensive program since it is difficult to secure sufficient space for long-term waste accumulation in the planning area. Therefore, the collected waste is planned to be hauled out by DKI Jakarta's garbage trucks for land-fill outside the project site.

Collection and storage systems as well as control and management systems will be established in the project area to prevent the dumping of garbage in the open spaces around residential districts and into the drainage system.

B. Calculation of Waste Generation

- From the current status and information from Clean the capacity is set for 10 liter/household/day (net) and includes public waste, estimated for 11 liter/household/day.
- Amount of solid waste generated in the planned area will be:

	for housing area	for commercial area (30ha)	Total
Alternative I	141 M^3/day	21 M^3/day	162 M^3/day
Alternative II	88 M^3/day	21 M^3/day	109 M^3/day

C. Treatment System

The following are concerned as Treatment systems.

1. Storage system —— Storage container —— Exposed
   Paper bags
   Polyethylene buckets
   Dust boxes
   Containers
   Storage place —— Each house
   Stationary

2. Collection system
   - Collection object
     - Whote collection
     - Separate collection
     - Only combustible
   - Existence of a zone dumping station
   - Frequency of collection
   - Collection method
     - Hand carts
     - Small trucks
     - Garbage trucks

3. Treatment system
   - On-site
     - Accumulation
     - Incineration
   - Off-site
     - Accumulation
     - Incineration
     - Treatment plant (reclaimation recycling etc.)
     - Ocean disposal

4. Executing body
   - DKI Jakarta
   - Perumnas
   - Contractors
   - Resident organizations

Of the above-mentioned systems, the following which are widespread and highly feasible in Indonesia, will be adopted for our plan:

COLLECTION SYSTEM

	House		(Service Body)
Storage	↓	. by container	each family
	Stationary	...1, unit/12 households	
		. by handcart	employee by PERUMNAS
Collection	↓	. 3 times/week	
	Zone Dump Station 1 unit/32ha		
	↓	. by DKI Garbage Truck everyday	DKI CLEANSING DIV.
Treatment	OFF-Site Dump Space... Dumping		

. Accumulation is the only disposal method now adopted in DKI Jakarta. It is increasingly difficult to secure land-fill sites. Garbage disposal must depend on DKI Jakarta's help since it is difficult to continue accumulation for a long period of time in view of the project's scale.

The introduction of compactors of the project site has been advised as a measure for decreasing the transport quantity of garbage. This requires further examination.

D. Construction Cost

20 RP/gross m^2

. The above cost is only for the Central Dumping Station and Storage and the cost of containers and handcarts are not included.

4-3-5 Electricity

A. Outlines of Planning

Electricity will be supplied to all buildings including houses and street lights by PLN as soon as the 20kV line now under construction by PLN around the project site is completed in 1980 or 1981.

The 20kV line will be led into the planning area, and the power supply will be reduced to a given distribution voltage (220/380V) by at a substation.

The design and construction of the supply line will be made by PLN at the request of PERUMNAS.

B. Calculation of Capacity

PERUMNAS and PLN have decided between themselves that the maximum electric capacity per low cost house should be set to 450W. The subject project is intended for social groups with lower incomes than farmer ones. Therefore, power supply will be estimated at 250 - 350W, 300W on the average, per house, and 20% of the total for houses will be secured for use in public facilities, such as street lamps. Therefore, total electric capacity will be estimated at:

	(50 units/ha) for housing area	for commercial area (30ha)	Total
Alternative I	4,608 KW	691 KW	5299 KW
Alterna	2,880 KW	691 KW	3571 KW

C. Construction Cost

- Construction costs have been agreed upon between the two parties as 125 RP/VA. Therefore, the construction unit cost is 225 RP/Gross M^2.

4-3-6 Land Development

- For land development, land filling, banking, drainage, and artificial ground are considered. However, since the survey of the land and surface soil have not been completed yet and it is difficult to judge which is the best method to execute.

- It is, therefore, tentatively being developed by the cut-and-fill method of soil using the cross-sectional drawing of the drainage. This tentative plan is to generally make estimates on developing cost and the most adequate method should be decided after confirming the results of investigation of land and soil character, prices, etc.

- On the above-described assumptions, land development costs are estimated at :

1. Grading ---------- 0.15 m/m^2

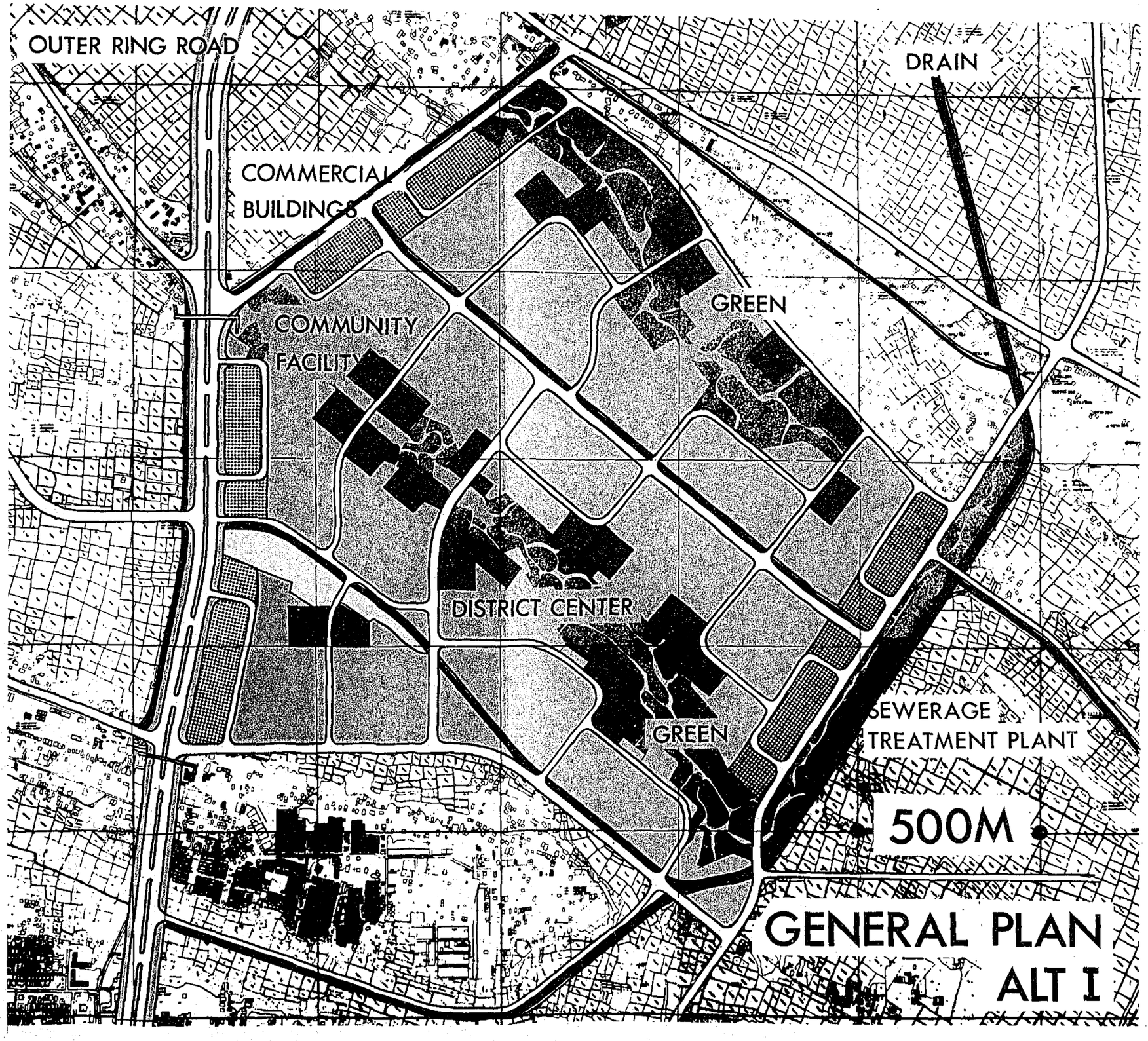
   0.15 m/m^2 x 1,000 RP/m^3 = 150 RP/m^2

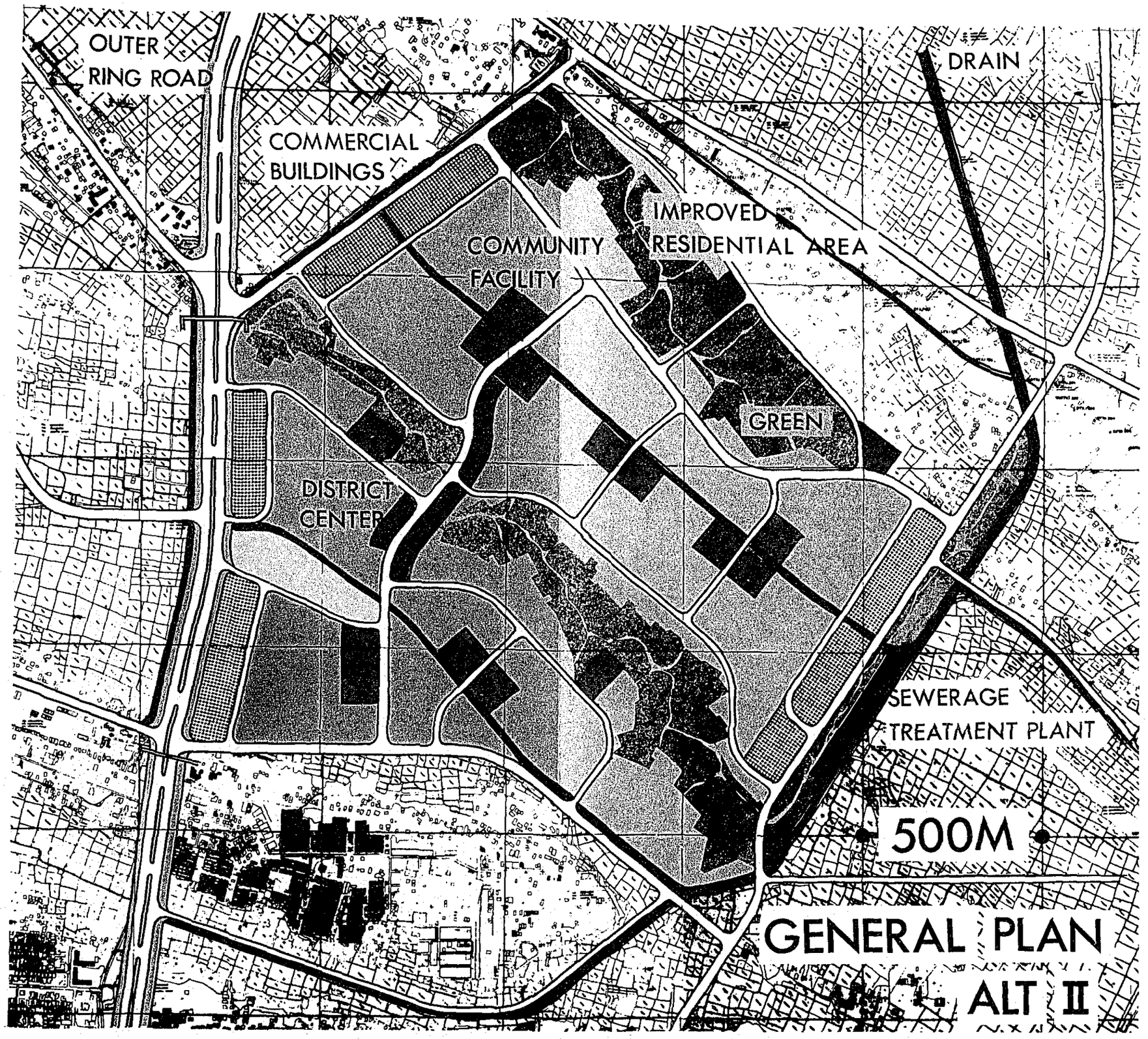
2. Soil movement from outside of the project site

   ---------- 0.15 m/m^2

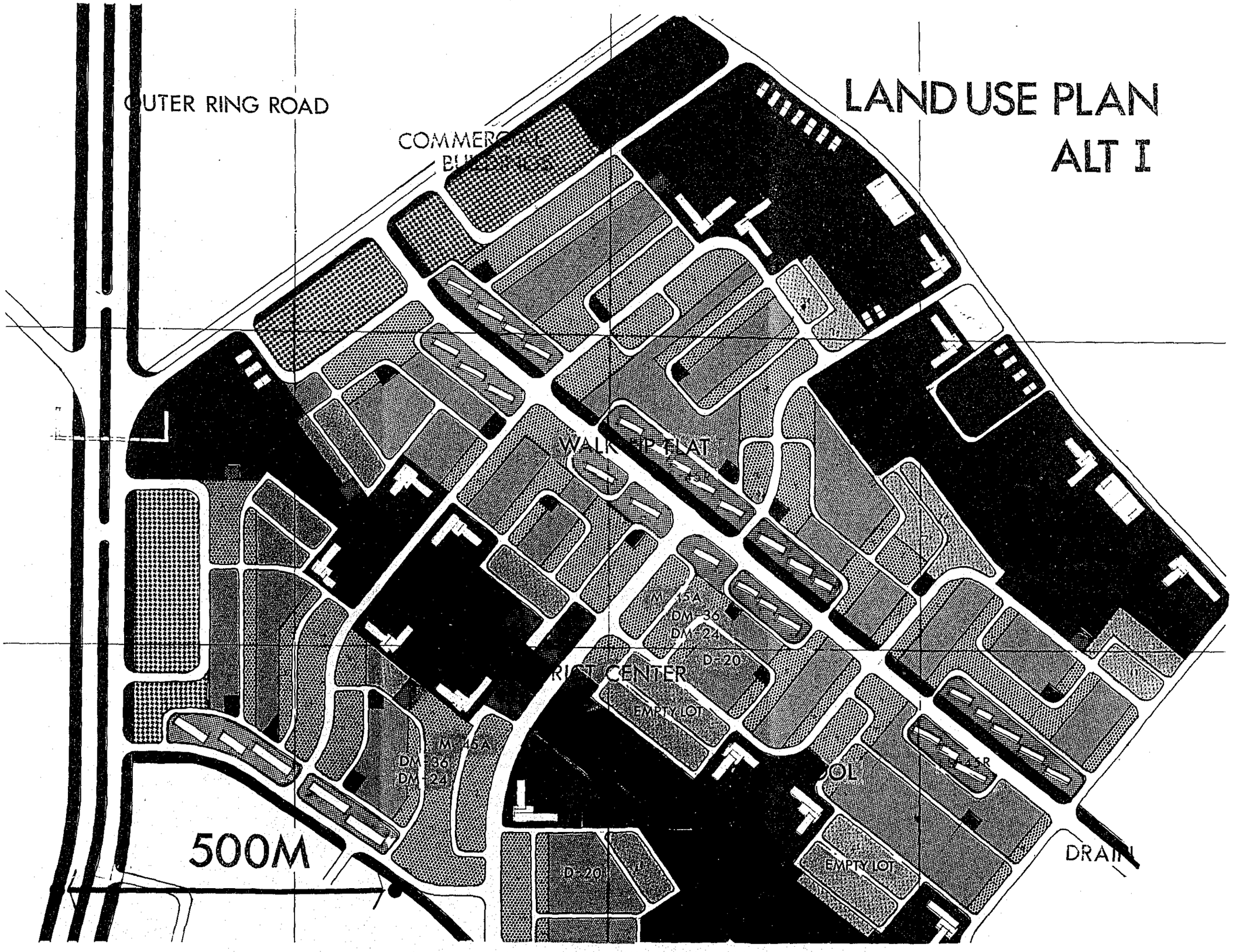
   0.15 m/m^2 x 4,000 RP/m^3 = 600 RP/m^2

3. Total 750 RP/m^2


OUTER RING ROAD
DRAIN
COMMERCIAL
BUILDINGS
COMMUNITY
FACILITY
GREEN
DISTRICT CENTER
GREEN
SEWERAGE
TREATMENT PLANT
500M
GENERAL PLAN
ALT I


OUTER
RING ROAD
COMMERCIAL
BUILDINGS
DRAIN
IMPROVED
RESIDENTIAL AREA
COMMUNITY
FACILITY
GREEN
DISTRICT
CENTER
SEWERAGE
TREATMENT PLANT
500M
GENERAL PLAN
ALT II

LAND USE PLAN
ALT I



LAND USE PLAN
ALT II