REPORT

ON

THE WATER SUPPLY EXTENSION PROJECT

FOR THE CITY OF DJAKARTA

INDONESIA

AUGUST 1963

JAPANESE SURVEY TEAM

DISPATCHED BY

OVERSEAS TECHNICAL COOPERATION AGENCY OF JAPAN

JICA LIBRARY
1055069[7]

REPORT
ON
THE WATER SUPPLY EXTENSION PROJECT
FOR THE CITY OF DJAKARTA
INDONESIA

AUGUST 1963

国際協力事業団
受入月日 '84. 4.20
登録No. 02746
108
61.8
KE

Gentlemen,

We wish to express our sincere appreciation to the following persons who have kindly cooperated with us by supplying information and data pertinent to our investigation, guiding us in making required field surveys and providing many other conveniences, whereby we have been able to carry out our studies;

Governor of Djakarta City:	Honorable Dr. Guberuuy Soemarno
Deputy Governor, Djakarta City:	Mr. Henggantung
Assistant Governor, Djakarta City:	Mr. H. Sapi-ie
Technical Advisor, Djakarta City:	Mr. L. O'Brien
City Secretary, Djakarta City:	Mr. A. Poerwadi
Director, Public Works Bureau, Djakarta City:	Mr. D. Manuhutu
Waterworks Division, Djakarta City:	Mr. Irwin Nasir
Waterworks Division, Djakarta City:	Mr. Milono
Waterworks Division, Djakarta City:	Mr. Mailangkay
City Planning Dept. Djakarta City:	Mr. G. Kapitan
City Planning Dept. Djakarta City:	Mr. Hally Desar
Housing Dept. Djakarta City:	Mr. R. Puspo Harsono
Ministry of Foreign Affairs, Indonesian Government:	Mr. Umor Jadi
Ministry of Foreign Affairs, Indonesian Government:	Mr. Sunadi
Ministry of Public Works, Indonesian Government:	Mr. Soefaat
Ministry of Public Works, Indonesian Government:	Mr. L.T. Hian
Ministry of Public Works, Indonesian Government:	Mr. H. Notosugondo
Ministry of Public Works, Indonesian Government:	Mr. M. Martodinomo
Ministry of Public Works, Indonesian Government:	Mr. S. Sigit
Ministry of Public Works, Indonesian Government:	Mr. M.A. Zacharias

August 21st, 1963

Hiromu Tanabe, Dr. of Engineering,
Chief of Japanese Survey Team
for The Water Supply Extension
Project of Djakarta City

C O N T E N T S

Introduction

The Japanese Survey Team for the water supply extension project of Djakarta City, dispatched by Overseas Technical Cooperation Agency, left Tokyo on March 1, 1963 and arrived at the city on the same day and stayed there to March 26. The object of the team was to survey the present status of water supply in the city and to obtain basic data necessary for working out an extension project in the future.

As our stay there was during the rainy season of the district, we had rain almost every day. The rain being of a squall type did not disturb our survey works, but on the contrary, brought us relief of refreshing nature in a tropical country.

With the rapid and wonderful development of the city after the war through various social and economical causes, it has now grown into a very large city with a population of about three millions. But its existing waterworks system is not in a good condition that it is barely managing to supply water to less than one million of its citizens, by suspended or reduced water distribution. It is a matter of regret that the majority of its citizens must live on high priced water purchased from water sellers, or on water taken from very foul wells and rivers.

Our team, as its first step, set about on an actual survey of the existing waterworks. We were surprised to find that the metrological instruments of water supply, such as water pressure gauges, water meters, filtration-rate meters, filtration-loss head meters, consumers' water meters etc., were almost all damaged and out of order. The lack of essential data for the maintenance of its water supply works, such as exact daily intake quantity, discharge from purification plants, water consumption of citizens, leakage in distribution system etc., must be said to be a serious obstacle in the management of the waterworks.

Furthermore, it was found through our chemical examinations that the water supplied there could not be considered absolutely safe for drinking.

Our team, on the other hand, conducted a specific survey to locate new water sources to be used for the extension project. Inside and outside the city, there are several rivers of considerably large size. As our surveys were made in the rainy season, these rivers were observed to have plenty of water.

But it is reported that the rivers usually dry up in dry season from April to October and so prove they cannot be considered to be satisfactory water sources for the Djakarta Raya in the future.

The water in these rivers is not only turbid and red brown in color, owing to the soil, but also badly polluted by domestic sewages, refuse, human excreta and socalled "MANDIE" - a religious practice in the rivers. It was presumed its pollution would be much more intensified in dry seasons. Based upon these facts, we have arrived at the conclusion that these rivers are not suitable for water sources of the new water supply plan.

The water sources for the city water supply should generally be abundant and stable in quantity, sanitary certified in quality, located in districts where construction works and maintenance are economical.

Consequently, the intake plan in our project is to draw water from the end of the west channel of the Djatiluhul water system now under construction by the French economical aid and where plentiful and good water for the expected increased population of approx. four millions in the future may be available.

It has also been found that the site of Gobang on the Tjisadane River which flows about 20 km west of the city is the most suitable

location for the multi-purpose dam construction. This dam when completed can be used for various purposes such as water supply, power generation, irrigation, flood control .... etc. As for water supply, it will furnish ten millions citizens with sufficient potable water. Furthermore, water can be delivered completely by gravity flow from its source to the end of the distribution pipe lines. This is considered to be the most safe and economical system for the future waterworks.

Based on the above ideas we have mapped out the water supply extension plan for Djakarta city as stated in the following chapters. The execution of the project has been proposed to be accomplished in three stages ... the first stage plan in parallel with urgent plan, the second stage plan and the third stage plan.

1. Study of existing water system

1.1. Brief history of Djakarta waterworks

The history of waterworks in Djakarta city traces back to 1843 when wells about 83 m in depth were dug in the northern district of the city for the purpose of supplying water. Later in addition, 90 deep wells 100 m to 395 m in depth were constructed by the Netherland Indie Government.

At the beginning of their operation, water spurted forth from the wells naturally at 10 m water head, but gradually decreased and finally dropped to as low as 2 meters below the ground level. To cope with this situation, 14 pumping stations operating 24 hours a day were installed to pump out the water. This was useful for a while but a gradual lowering of the water level in a number of wells made it necessary to suspend their operation. It cannot be said the water in these wells is very good in quality because of its high temperature and carbonic-acid content together with some contamination by surface water.

Then, a preliminary investigation plan for a new water source was schemed in 1904 to obtain adequate water of good quality from springs at the foot of Mt. G. Salak (2,211 m elevation). Its final design was completed in 1918. Construction work was started in 1920 and completed in 1922.

This water source then began to supply water at approx. 500 litres per second to Djakarta city. But the water, later was distributed also to Bogor city and several villages along the pipe lines. The quota for Djakarta city is now limited to approx. 300 litres per second.

After The Second World War, a large scale migration of local people to the capital was made due to the disturbed public peace in the provinces caused by the Independence War and by the bountiful supply of

foreign relief goods concentrated in the capital.

Thus the population of Djakarta city has grown several times as large as that in prewar days. Such rapid increase in population has come to cause a water famine in various places in the city and become a menace to the life of the citizens as a whole. Under such conditions, the project for developing new water sources has become an urgent problem of the city. In 1957, a new water purification plant was constructed at Pedjompongan, through the technical guidance of a French company named Degremont, water being taken in from the Bandjir Canal. Its projected capacity of water delivery was 2,000 litres per second. But the water delivery today is considered to be far less than that in the original plan, owing to the shortage in supplying maintenance materials, improper administration, poor supply of electricity and insufficient water pipes.

With an ever increasing population in the city, the demand for potable water ic rising in a steady curve and even a maximum utilization of the present facilities appears to fail to meet the increasing demand. The most important and urgent problem for Djakarta city is to extend its waterworks service by finding new water sources as soon as possible.

1.2. Population served and water consumption

The population of Djakarta city today is said to amount to approx. 3,000,000. But the exact number of citizens served with water is not known. According to the city authorities the population served directly by pipes is approx. 1,000,000 people. In addition, those people served through 448 public water selling taps .... called hydrants... and 90 public utilities like common washing places are reported to reach approx. 500,000.

The present management of these hydrants and public utilities is not pertinent. Most of them are damaged more or less and water is left flowing. Some of them are used as children's playground or as lavatories. They are generally left in a very unsanitary condition.

As to water meters for the private consumers, approx. 50 % of the total 100,000 private taps have meters but most of them are broken and left unrepaired. Also, the exact amount of water flow from the purification plant is not available owing to damages or troubles in the water gauges.

Under such conditions it was difficult to obtain the actual quantities of water being supplied. The following data show the estimated delivering quantities computed from the operating time of the distributing pumps in 1962 at Pedjompongan.

Roughly estimated water delivery in 1962

data by Djakarta city waterworks

(District)	(Average daily)	(Daily maximum)
Djakarta	134,733 cubic m.	140,400 cubic m.
Kebajoran	4,819 "	16,470 "
Tg. Priuk	1,600 "	4,444 "
(Total):	141,152 cubic m.	161,314 cubic m.

These figures were only obtained mathematically based on the hourly capacity of the pumps. But the actual delivered quantity could fluctuate considerably according to the decreased capacity of the pumps and variation of hydraulic pressure in the pipes. Consequently, it is presumed that the actual delivered quantity must be far less than the above figures.

As to the water flow from the Bogor, the intake quantity has been measured exactly but the amount diverted on the way is not known. It may be presumed, according to the rough estimation at the service reservoir, approx. 300 litres per second..... 26,000 cubic m. per day..... is being conveyed.

1.3. Current status of existing waterworks facilities

1.3.1. Bogor water system

(A) At the foot of Mt. G. Salak (279.21 m elevation) there are 16 collecting wells and galleries and the spring water is flowed in junction well. The water after being sterilized with bleaching powder is supplied to the city by a gravity flow system. The environment of the facilities is excellent with no fear of contamination from the outside. But their spring water is very small in quantity being only 33 litres per second per collecting well of the largest size. At the junction well, measuring weirs are installed so as to measure water from the collecting wells. The projected quantity of water for Djakarta city taken in at the sources, was 500 litres per second but the actual supply to the city is now limited to approx. 300 litres per second, the rest being allocated to Bogor city and other towns and villages along route of the water pipes.

Two lines of water pipes with 500 mm diameter are installed between the source of Bogor and the place 22 km away from Bogor city. Two lines of water pipes with 600 mm diameter are equipped in the next 33 km length upto the Djakarta city.

At Passareba 43 km away from the water source, one service reservoir with a capacity of approx. 20,000 cubic meters consisting of two basins (30 m x 50 m each) is provided for the purpose of adjusting water delivery and for disinfecting water. High water level of reservoir

is 44.82 m above the sea, which is felt to be too low for the new section in the south of the city (El. 20 m to 25 m).

(B) Water quality of Bogor system

The test result and general observation are specified in the following table. But as the examination was conducted on the spot with portable simple test apparatuses, our result may not be used as quite final or most reliable data.

Result of water examination on Bogor system

Sampling places	Pasar Rebo reservoir	Spring water of Bogor source
Test date:	March 6, '63	March 6, '63
Weather:	fine	fine
Weather of previous day:	fine	fine
Atmospheric temperature:	28.5 °C	30.0 °C
Water temperature:	23.5 °C	23.0 °C
Turbidity (ppm):	0	0
Color (apparent):	0	0
Odor:	normal	normal
pH:	6.9	6.7
Alkalinity ($CaCO_3$ ppm):	60	65
Acidity ($CaCO_3$ ppm):	15	26
Ammonia nitrogen (N ppm):	0	0
Nitrite nitrogen (N ppm):	traces	0
Nitrate nitrogen (N ppm):	very slight	very slight
Chloride (Cl ppm):	10.0	6.0
Sulphate (SO_4 ppm):	traces	traces
Iron (total ppm):	0.04	0.05
Manganese (total ppm):	0	0
Total hardness ($CaCO_3$ ppm):	45	49.5
Coliform group:	0	0
Residual chlorine (Cl_2 ppm):	traces	——
Findings:	* Traces of Nitrite nitrogen are founded, but they can be disappeared through chlorination * Of good quality	* Of good quality

1.3.2. Pedjompongan water system

(A) The river surface water induced into the grit chamber from the confluence of the Bandjir Canal and the Krukut river is pumped up into the purification plant. After being treated there, it is stored in the water reservoir for a while and then water is supplied to the consumers. The projected capacity of the facilities was 2,000 litres per sec., but their actual supplying quantity now is considered to have been curtailed through poor management and frequent damages. The main facilities of the purification plant are as follows:

(a) Intake facilities:

Water conduit ..... 2 meters in width, 1.7 meters in depth	
Grit chambers (with mud removing equipment) ..... 15 m x 50 m	2 basins
Intake pumps ..... vertical type, 1,800 cubic m/h x 11.5 m x 125 kw	6 pumps

(b) Treatment facilities:

Chemical mixing basins ..... automatic mixing (venturi flume)	1 basin
High rate sedimentation basin ..... round type, 23 meters dia.	6 basins
Rapid sand filters ..... 3.8 m x 9.8 m	48 beds

(c) Chemical feeders:

Alminium sulphate solution tank and feeder	1 set
Lime feeders ..... crashing equipment, solution tank, feeders	1 set
Hypochlorous calcium solution tanks ..... gravity flow system	2 tanks

(d) Distribution facilities:

Water reservoirs ..... capacity 8,000 cubic m each	4 reservoirs

Pumps	3,600 cubic m/h x 42 m x 535 kw	3 pumps
	1,800 " " " 258 kw	2 "
	360 " " " 55 kw	3 "
Main pipes	900 mm dia.	2 lines

Two lines of water pipes stretch out from the purification plant and the water is divided into two trunk lines, 900 mm and 800 mm respectively. The pipes of the Pedjompongan system and the Bogor system are connected together in the city. A great defect in the distributing facilities lies in the smallness of pipe diameters. The length of trunk lines with pipes over 250 mm in diameter is only about 70 km and the branch lines from the main are of pipes 1" to 1-1/2". Most of these pipes were laid about 40 years before and too obsolete to allow water to flow properly. This is considered to be the main cause of the great amount of leakage and decreased capacity in water distribution.

Length of existing city water distribution pipe net

(diameter)	(length)
900 mm	8,000 meters
800	2,200
600	19,800
550	2,600
450	6,200
400	13,200
350	16,000
250	5,200
Total length:	73,200 meters

Number of water-meter (as of October 1962)

(dia.)	(Turbine type)	(Dry type)	(Wet type)
1/2 inch	37	215	48,428
3/4	121	-	849
1	49	-	69
1-1/4	40	-	94
1-1/2	28	-	48
2	55	2	13
3	5	-	3
4	-	-	2
6	3	-	-
8	1	-	-
10	5	-	-
Total:	344	217	49,506
Grand Total:			50,067

The total number of installed water meters is reported to amount to 50,067 as shown above, but it appears the number of effective meters is very small. The installation rate of water-meter is only 50 % of the total private taps totaling 100,000. The manufacturers of these water-meters are mainly as follows:

Bopp & Renther

Siemens

Piparsberg

Aster

Woltmans

The maintenances of these water-meters do not appear easy because of the varieties in manufacture.

(B) Result of water examination on Pedjompongan system

Sampling places:	Raw water from Bandjir canal	Treated water by high rate sedimentation	Taps in former Asian game champion lodging	Taps in hydrant near Wismer hotel
Test Date:	March 11, '63	March 11, '63	March 7, '63	March 12, '63
Weather:	fine	fine	fine and occasional rain with thunder	fine
Weather of previous day:	fine and occasional rain with thunder	fine and occasional rain with thunder	fine	fine
Atmospheric temperature:	31°C	31°C	30.5°C	30.0°C
Water temperature:	25.0°C	26.5°C	26.5°C	26.0°C
Turbidity (ppm):	80	5	0	0
Color (apparent):	35	0	0	0
Odor:	little muddy odor	normal	normal	normal
pH:	6.9	6.5	over 8.6	6.9
Alkalinity ($CaCO_3$ ppm):	26	20	25	22
Acidity ($CaCO_3$ ppm):	7	5	0	5.5
Ammonia nitrogen (N ppm):	0	traces	0	0
Nitrite nitrogen (N ppm):	traces	traces	0	0
Nitrate nitrogen (N ppm):	very slight	very slight	very slight	traces
Chloride (Cl ppm):	8.5	8.0	6.0	5.0
Sulphate (SO_4 ppm):	traces	very slight	very slight	very slight
Iron (total ppm):	0.2	0.03	0.05	0.02
Manganese (total ppm):	0	0	0	0
Total hardness ($CaCO_3$ ppm):	28.0	25.2	31.5	27.0
Coliform group:	+	+	+	+
Redidual chlorine (Cl ppm):	-	-	traces	-
Findings:	* Contaminated. * Prechlorination is needed.	* Turbidity must be lowered.	* Treatment was found to be insufficient. * Post chlorination and pH control must be intensified.	

1.3.3. Existing wells

Our water examination also included five shallow wells and three deep wells in the City. The results of the examinations are specified in the following table.

With such limited data, it is very difficult to form a sound judgment on the all wells in the City. But so far as the eight wells are concerned, three out of the eight wells contained manganese. If such water is used as raw water and treated by chlorination, it will invariably be attended by a trouble of "black water".

No pollution was observed in the deep wells but there were some disqualified shallow wells which were considered most likely to menace the public health.

Generally speaking from the existing wells of the city, we cannot expect to obtain water in large quantity to cover the demand of a large population.

Result of water examination of existing wells

Number of position	1	2	3	4	5	# 1	# 2	# 3
	Shallow Wells					Deep Wells		
	Kebajoran Dj. Daksa 5	Menteng I Dj. Talangbetutu	Menteng II Dj. Taman Tangkulangrahn 20	Tjikini Dj. Grobolinggo	Menteng I Dj. H.O.S. Tjokroaminto 103	Kebajoran Blok F/IV	Kebajoran Blok N/II	Kebajoran Blok Q/V
Date	16, Mar. '63	16 Mar. '63	16 Mar. '63	16 Mar. '63	16 Mar. '63	19 Mar. '63	19, Mar. '63	19, Mar. '63
Weather Previous day	Rainy-cloudy	Rainy,cloudy	Rainy,cloudy	Rainy,cloudy	Rainy,cloudy	cloudy	cloudy	cloudy
Test day	Cloudy-fine	Cloydy-fine	Cloudy-fine	Cloudy-fine	Cloudy-fine	cloudy after fine	cloudy after fine	cloudy after fine
Atmospheric temperature (^{o}C)	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Water temperature (^{o}C)	26.0	28.0	24.0	27.0	27.5	25.5	25.0	25.0
Turbidity	0.5	0	3.0	3.0	2.0	0	0	0
Color (apparent)	0	0	0	0	0	0	0	0
Odor	normal	normal	little muddy odor	normal	normal	Slight H_2S	normal	normal
pH	6.8	6.5	6.6	6.2	6.2	7.4	7.8	6.4
Alkalinity ($CaCO_3$ ppm)	108	95	14	70	12	164	256	106
Acidity ($CaCO_3$ ppm)	35	50	10	80	15	13	8	50
Ammonia nitrogen (N ppm)	0	traces	traces	traces	traces	0	traces	0
Nitrite nitrogen (N ppm)	Very slight	Much	Very slight	Very slight	Much	traces	traces	traces
Nitrate nitrogen (N ppm)	traces	slight	Much	traces	Much	traces	traces	traces
Chloride (Cl ppm)	12.0	8.5	15.5	22.0	28.0	7.0	6.0	7.0
Sulphate (SO_4 ppm)	traces	slight	traces	Much	traces	0	0	0
Iron (total ppm)	0.1	0.12	0.2	0.15	0.07	0.02	0.03	0.01
Manganese (total ppm)	traces	traces	0	0	0	traces	0	0
Total hardness ($CaCO_3$ ppm)	126	79	16	99	49.4	113	14.4	88
Coliform group	0	0	+	0	0	0	0	0
Findings	Depth and water level are unknown; motor pump type; environment is good; Contaminated a little, water should be boiled when use	Depth and water level are unknown; motor pump type; environment is good; Contaminated a little, water should be boiled when use	Depth and water level are unknown; tanks, reservoirs, environment are good; Contaminated a little, water should be boiled when use	Open; well-bucket type; environment is bad; Contaminated a little, water should be boiled when use	Motor pump type; environment is good; Much contaminated water should boiled when use	Troubles may occur from H_2S odor and manganese	No component which may cause any trouble was detected.	High acidity may erode iron pipes.

2. Study of basic data for future planning

2.1. Climate condition

The Island of Java is situated at Lat. 7° S and has weather conditions peculiar to the tropics. There is almost no variation in temperature throughout the year and it has a great deal of rain. These weather conditions help the growth of vegetation. Djakarta city lies at the northwest coast of the Island of Java and is the capital of the Republic of Indonesia. The average temperature is 26° - 27° C. The summer season covers the months of April to October and is also called dry season with almost no rainfall. As indicated in the table of rainfall, the annual amount reaches about 2,000 mm, most of which is concentrated in the period from November to March. This period is called the rainy or wet season. They usually have rain of a squall type but almost no rains lasting a long time in this season.

In the dry season, they usually have bright sun and dry days. Small rivers often dry up. The surface of the land is often cracked. Vegetables and grasses happen to be blighted sometimes.

The average annual rainfall in the plains of the northern coast of West Java is about 2,000 mm, while the rainfall in the hilly or mountainous districts in the south ranges from 2,000 mm to 4,000 mm, a comparatively large amount to develop the water sources.

Average Rainfall Records

(Based on Verhandelingen No.37)

Years	1864 -1941	1931 -1941	1908 -1941	1898 -1941	1909 -1941	1917 -1941	1896 -1941
District	Djakarta	Kebajoran	Mandaling	Pasir Salan	Bogor	Djatiluhul	Davangden
Elevation	7 m	25 m	310 m	942 m	280 m	265 m	515 m
Jan.	300mm	285mm	389mm	369mm	322mm	327mm	309mm
Feb.	299	225	375	303	329	343	307
March	210	224	420	331	372	368	348
April	147	190	433	321	346	314	313
May	113	162	288	216	237	231	238
June	96	120	168	153	134	139	146
July	63	60	109	88	96	79	102
Aug.	42	43	116	88	107	64	92
Sep.	66	73	150	99	127	53	106
Oct.	111	94	310	227	259	190	270
Nov.	142	189	459	335	363	313	391
Dec.	204	222	436	399	351	335	331
Total	1,793mm	1,887mm	3,653mm	2,929mm	3,043mm	2,756mm	2,983mm

2.2. River conditions

(A) The object of the surveys was to ascertain the discharge and various conditions of rivers as water sources for the Djakarta water supply extension plan. Selecting the following seven rivers and canals regarded worthy of utilizing as water source from among those flowing around the City, their water quantity and quality as well as their surroundings were studied.

Discharge of Rivers and Canals

(According to the report by Djakarta City)

Names of Rivers/Canals	Discharge (cubic meters/sec)	
	Maximum	Minimum
(1) Tjisadane River	1,600	20
(2) Tjiliwng River	250	6.5
(3) Tjiliwng - Bandjir Canal	250	4
(4) Grogol Canal	60	1.5
(5) Sunter River	120	3.8
(6) Tjideng River	40	0
(7) Krukut River	100	0

* Remarks: Detailed records and average discharge of each river and canal are now under survey by Indonesian Authorities.

All of these rivers and canals receive their water from the water source of the Pangrango mountain chain about 60 km south of the city. The river making rapid streams in the mountains and valleys near Bogor, is almost clear. But as the river reaches the open field, it immediately begin to flow in slow and meandering streams and to make swampy grounds here and there. At the same time the reddish brown soil of volcanic ash strata becomes mixed in the river, the color of which then changes into yellowish brown.

Waterworks for flood control and irrigation have been considered by the Dutch government. Consequently, many channels and canals for drainage and irrigation can be seen in the city and its vicinities. The water in these canals and channels is also yellowish brown in color and is being used for "MANDY". The canals and channels are extremely polluted with waste water, domestic refuse, and garbage which are thrown by thoughtless people.

(B) Water quality

The water sources in Djakarta City include springs in the Bogor area and surface water in the Bandjir Canal. The ground water around the Bogor area which is considered to be free from pollution, is the best source of raw water for waterworks. But its discharge is not enough to cover the demand of such a big city as Djakarta. This situation compels the utilization of the surface water of rivers in addition.

The main source for the waterworks of the City is now the Bandjir Canal. Its capacity can practically meet the present demand of citizens, though not adequately. But from the point of environment it is feared that the water is exposed to rather high contaminations.

It is recommended, from the point of public health, water from the down stream of such rivers should absolutely not be used as the source of waterworks.

The following 5 sites were selected as possible new water sources. It is recommended that the site having the best water both in quality and quantity should be selected.

Tangerang canal

Downstream of the Tjisadane

Downstream of the Sunter

Upstream of the Tjisadane, near Gobang

Djatiluhur canal, now under construction

With regard to the water quality of existing and proposed sources, the results of our examinations are indicated in the following tables.

Judging from all the data so far stated, it can be concluded the water near Gobang up the Tjisadane River is the best source of raw water for waterworks among the suggested five sources.

Following is the test result on water quality of selected water sources. But as stated before, our examination was conducted on the spot with portable simple apparatuses and the following result may not be used as quite final accordingly.

Result of water examination on the selected water sources

Sampling places	Tangerang canal	Downstream at Tangerang area	Gobang district	Downstream of the Sunter
Date	11 Mar., '63	11 Mar., '63	13 Mar., '63	18 Mar., '63
Weather — Previous day	fine after thunder shower	fine after thunder shower	fine	cloudy after thunder shower
Weather — Test day	fine	fine	fine	cloudy
Atomospheric temperature (°C)	30.0	30.0	31.0	30.0
Water temperature (°C)	26.5	26.5	27.5	26.0
Turbidity (ppm)	150	45	55	150
Color (apparent)	40	20	40	80
Odor	muddy odor	little muddy odor	little muddy odor	little contaminated odor
pH	6.6	7.0	7.0	6.7
Alkalinity ($CaCO_3$ ppm)	32	32	22	18
Acidity ($CaCO_3$ ppm)	15	6	4.5	8
Ammonia nitrogen (N ppm)	0	traces	traces	traces
Nitrite nitrogen (N ppm)	traces	traces	traces	traces
Nitrate nitrogen (N ppm)	very slight	very slight	traces	traces
Chloride (Cl ppm)	8.0	5.5	5.0	6.5
Sulphate (SO_4 ppm)	traces	traces	traces	traces
Iron (total ppm)	1.0	0.3	1.0	0.55
Manganese (total ppm)	0	0	0	traces
Total hardness ($CaCO_3$ ppm)	24.3	23.2	18.0	18.0
Coliform group	+	+	+	+
Findings	Contaminated	Contaminated	Little contaminated	Much contaminated

2.3. Forecasting population and proposed population to be supplied with water

(a) Forecasting population

The total area of Djakarta Raya amounts to 53,000 hectares and the population in the area is approx. three millions in all. The houses of citizens are concentrated in the central part of the area consisting of three districts, Djakarta, Kebajoran and Tandjung Priuk covering about 20,000 hectares.

The density of population in the area is about 150 persons per hectare showing a considerably high density. Consequently, increased population in the future is assumed to be concentrated mainly in the suburbs around the by-passes.

The statistical information on the population in the past was found very difficult to obtain because of deficiency in vital statistics and census returns. But according to the City authorities the population in the City in 1918 and 1935 was approx. 200,000 and 450,000 respectively. In 1941 it went up to approx. 600,000 and at the end of war in 1945 it jumped up to approx. 1,600,000. With a remarkable increase eversince, the population as of the end of 1962 reached approx. 3,000,000.

Such increase in the population may be attributed to the massive migration of country people to the city in the early stage of the Independence and to the concentrated supply of American relief goods into the town.

It can readily be imagined the cityward tendency of the population will be strengthened further more. The City authorities are mapping out the future population in 1975 as approx. 4,000,000.

In our plan, we estimated future population as follows:

Years	Total population
1962	3,000,000
1970	3,600,000
1975	4,000,000
1985	4,750,000
1995	5,500,000

(b) Proposed population to be supplied with water

The present water supply area of the city includes the three districts of Djakarta, Kebajoran and Tandjong Priuk constituting its central parts. According to a rough estimate by the city authorities the pervasion rate of water supply in the area is still very low.

The population directly supplied through waterworks is approx. one million or only about one-third of the whole population and those indirectly supplied by means of hydrants or public utilities are approx. a half million. Though both be added the population supplied is only fifty percent of the total.

Such low rate of pervasion may have been caused by long established religious customs such as bathing in the rivers and by the poor economic conditions of citizens, but it is mainly due to a very low capacity of the existing city waterworks.

The primary target of waterworks facilities should be to make a complete distribution to all citizens, but the planned rate of pervasion in water supplying is 90 to 95 percent in Japan.

In this extension plan we have schemed the present pervation rate, fifty percent will be raised up step by step and will reach 90 percent by the target year, 1975. The target of pervasion rate by years and population supplied is as follows:

Target Years	Total Population	Pervasion Rate	Population to be water supplied by Private-tap	by common-tap	Total
1962	3,000,000	50 %	1,000,000	500,000	1,500,000
1970	3,600,000	70 %	1,800,000	700,000	2,500,000
1975	4,000,000	90 %	3,100,000	500,000	3,600,000
1995	5,500,000	90 %	4,500,000	500,000	5,000,000

2.4. Water consumption and delivery quantity per capita per day

(a) Water consumption per capita per day in cities differs considerably according to the climate, manners and living customs as well as the standard of cultural life there. It also changes to a great extent by the season and by the hour.

It is an ordinary practice that the consumption per capita per day is usually decided referring to the examples of other cities having similar features and economical development as well as the actual water supplying result in the past years.

The following table shows the actual water supply result and proposed supplying quantity in the cities of Japan and Far East Asia.

Maximum consumption in several cities — Data in 1960

City Name	Water Served Population	Maximum consumption per capita/day	
		past result	proposed
Tokyo	7,000,000	371 Litres	500 Litres
Osaka	3,000,000	476 "	597 "
Kobe	1,030,000	410 "	500 "
Yokohama	1,080,000	462 "	600 "
Manila			500 "
Bangkok			500 "

The number of present water consumers in Djakarta city including those people supplied by hydrants and public utilities is reported to be approx. 1,500,000 and the maximum water consumption per day is approx. 150,000 cubic meters.

Such data say the maximum consumption per capita per day may be approx. 100 litres. As to the existing hydrants and public utilities, one stand of them is supplying water for approx. 1,000 persons and the water is being carried and sold in buckets. It may be imagined that the consumption through hydrants and public utilities is being placed under an inevitable restriction and is very small in quantity accordingly.

In the future, those hydrants and public utilities which are not perfectly sanitary and efficient, should be removed and demolished. The common taps, in their places, should be installed in many districts .... so as to supply water to the citizens in sufficient quantity. However, even these common taps should gradually be reduced with improvements in their living standards, and the people will be able to buy water through a service pipe in each house when the proposed projects are completed.

Considering above situations, the water consumption per capita per day has been estimated as follows:

Proposed maximum consumption

Years	Supplied by private taps	supplied by common taps
1962	100* - litres/capita/day	
1970	150 "	50 litres/capita/day
1975	250 "	60 "
1995	350 "	100 "

* include common taps

It can be estimated that the average daily supply in a year amounts to eighty-five percent of the daily maximum supply.

There is considerable variation in hourly maximum supply in a day. In Japan, the ratio of hourly maximum supply to daily maximum supply is about 130 % in larger cities and about 150 % in small cities.

In our plan, the hourly maximum supply has been proposed to be 30 % over the daily maximum supply according to the data in Japan, because of no reliable statistics in Djakarta city.

(b) Daily maximum supply quantity

Based on the above maximum supply per capita per day, the daily maximum supply quantity has been proposed as follows:

Proposed daily maximum supply quantity

Target years	Supplied population	Supply Quantity (capita/day/litre)	Maximum Supply Quantity	
			cubic m/day	cubic m/sec
at present	1,000,000 (private tap) 500,000 (common tap)	) 100	150,000	1.8
1970	1,800,000 (private tap) 700,000 (common tap)	150 50 } 120	305,000	3.5
1975	3,100,000 (private tap) 500,000 (common tap)	250 70 } 220	795,000	9.2
1995	4,500,000 (private tap) 500,000 (common tap)	350 100 } 325	1,620,000	18.7

Above maximum supply quantity includes water for all uses, such as domestic, commercial, governmental, fire fighting, industrial, harbor and also includes the leakages in the pipe lines.

The river surface water, which is the main source of water supply in Djakarta city, has a high turbidity all the year round. Therefore, it must be estimated that a comparatively large amount of water is required in the process of water purification. In our intake plan, the quantity of water intake is planned to be 10 % over the water supply quantity.

Our proposed supply plan by years is as follows:

Proposed supply quantity

Unit: cubic m/sec

Target years	Water demand	Water supply quantity				
		By existing plant without Bogor System	By proposed plant			Total
			1st. stage	2nd. stage	3rd. stage	
1963	1.8	1.8				1.8
1970	3.5	1.8	1.7			3.5
1975	9.2	1.8	1.7	5.7		9.2
1995	18.7	1.8	1.7	5.7	9.5	18.7

3. Outline of proposed project

3.1. Construction schedule

As stated above, the water demand in the city is largely exceeding present water supply quantity. But the causes of water shortage include mainly damages and troubles in the existing water facilities. Therefore, an urgent project for repairing and improving the existing facilities is needed as the first step. We named this project "URGENT PLAN".

In parallel with the above plan, the so-called "FIRST STAGE PLAN" --- with 1.7 cubic meters/second water supply scheme - - - has been proposed. And next, following the "FIRST STAGE PLAN", 5.7 cubic meters/second water supply scheme has been proposed as the so-called "SECOND STAGE PLAN".

In our "FIRST" and "SECOND" stage plans, the raw water has been planned to be drawn from Djatiluhul water canal. In view of the rapid increase of water consumption in the city, it is considered to be most appropriate to carry out these two projects together at the same time. But we divided them in two stages due to the funds for construction.

To meet a greater demand of water for Djakarta Raya after 30 years, the so-called "THIRD STAGE PLAN" - - - 9.5 cubic meters/second water supply scheme - - - has been proposed. In our plan, the multiple purpose dam which may be used for water supply, irrigation, flood control and power generation ... etc., has been planned to be constructed in Tjisadane near Gobang at the west side of Bogor city.

It is to be noted, that if funds permit, it would be most advantageous to carry out the "THIRD PLAN" in precedence of other two plans, from the point of maintenance cost and management of waterworks.

Construction Schedule of Proposed Project

Project Name	Target Year	Construction Schedule	Proposed Water Supply Population	Proposed Total Water Supply Quantity
URGENT PLAN	1963	1963-1964	1,500,000	1.8 cubic m/sec
FIRST STAGE PLAN	1970	1964-1965	2,500,000	3.5 "
SECOND STAGE PLAN	1975	1968-1970	3,600,000	9.2 "
THIRD STAGE PLAN	1995	1973-1978	5,000,000	18.7 "

3.2. Urgent plan

Since the existing installations were constructed with a great amount of cost and labor, it is most desirable to make repairs completely and to operate under perfect management. Necessary expenses for these works must be considered as inevitable. Also it is hoped these plan will be started at once and be accomplished in a short time ... within one year at the longest.

As the head loss at the end of the water trunk line is about 30 meters by the results of hydraulic account from the Hardy-Cross Method using electronic automatic computer, and the lift of the distributing pump is 42 meters, the hydraulic head is only 10 meters or more. Accordingly almost no water can run out of the service pipes with 1" and 2" diameter off from the trunk line. To raise up the decreased capacity of the existing treatment and distributing facilities and to solve the shortage of water supply, the following repairs is to be proposed. In this way the water head at the end of service pipelines can be expected to be maintained at 20 m - 25 m.

Necessary repairs and improvements for Pedjompongan treatment plant and other facilities are as follows:

A. Repairs of Pedjompongan treatment plant

(1) Intake facilities:

Repairs of clarifiers	2 sets
Replacement of intake pumps	2 stands

(2) Treatment facilities:

Replacement of the filter sands and gravels	48 basins
Repairs of back washing equipment	1 set

(3) Distributing facilities:

Replacement of distributing pumps	2 stands
Repairs of pumping wells	1 set

(4) Repairs and new installation of various gauges:

B. New laying of city distribution pipes

Total length: approx. 60,000 meters

Diameter of pipes: 600 mm to 100 mm

C. Recleaning and repairs of existing pipes

D. New installation of water meters for consumers

approx. 100,000 houses

3.3. First stage plan

A. Decision of water source

The water supply area under the first stage plan covers the city districts, the outskirts of Djakarta by-pass and part of the satellite. The population to be supplied will be 2,500,000 and the required water consumption is estimated to be 3.5 cubic m. per sec. Since 1.8 cubic m/sec can be covered by the existing sources, 1.7 cubic m/sec should be supplied under this plan. The rivers and canals running through the city are considered most convenient from the point of their distance. But as already pointed out the quality in these rivers and canals is not

only very inferior but its quantity in dry season is reduced to a very small. On the other hand the construction of the Djatiluhur dam project has been started from 1953 at a site about 200 km east of Djakarta city. After its completion, water will not only be supplied to farming lands for irrigation but also 11.0 cubic m/second will be delivered at least to Djakarta City. Since the construction of the water way from the proposed dam will be completed in 1965, it is believed it is most appropriate to draw these water at a site near Galur for the first stage plan.

Galur is located nearly outside of the city and is higher than the city elevation. Therefore, the water through Djatiluhur canal is almost free from pollution by citizens. Furthermore, there can be much advantages in delivering operation owing to the difference of ground height.

In the event of delayed progress of the Djatiluhur project in construction schedule, water must be taken through a temporary canal from the Bekasi and the Sunter rivers. Even after completion of the Djatiluhur dam, in case of troubles or accidents in its operation, water must be also taken from the same rivers. The output of the water in the second stage plan is 5.7 cubic m per sec. When this amount is added to the proposed output in the first stage plan, it will be 7.4 cubic m/sec. As stated above, water amounting 11.0 cubic m/sec from Djatiluhur system can easily cover the required quantity for those two stage plans.

B. Summary of proposed facilities

Intake dam and water channel	1
Grit chamber	1 basin
Intake pumps	4 stands
Raw water main	200 m

Receiving well		1 basin
High rate sedimentation basins		
unit capacity:	45,000 cubic m/Day	4 basins
Rapid sand filters		
unit capacity:	15,000 cubic m/Day	12 basins
Wash water tank		
capacity:	1,200 cubic m	1
Chemical feeders		1 set
Clear water Reservoirs		
capacity:	15,000 cubic m	2
Distributing pumps		4 stands
Electric generator		1 stand
Main control building		1
City distribution pipes		
Dia. 900 mm to 100 mm		Total 1,000,000 m length

3.4. Second stage plan

The second stage plan is a project to be completed in 1975 for the purpose of supplying water to a population of 3,600,000 in the district of Djakarta Raya. The intake to be increased by this project is 6.2 cubic meters per sec. Raw water for this project will be intaken from the Djatiluhur canal, the same as the first stage plan.

Summary of proposed facilities

Grit chamber		
unit capacity:	1,200 cubic m	3 basins
Raw water main		1,200 m
Receiving wells		3 basins

High rate sedimentation basins		
unit capacity:	45,000 cubic m/Day	12 basins
Rapid sand filters		
unit capacity:	15,000 cubic m/Day	36 basins
Wash water tank		
capacity:	1,200 c.m.	1
Chemical feeders		1 set
Clear water reservoirs		
capacity:	15,000 cubic m.	6 basins
Distribution pumps		10 stands
Electric power generator		3 stands
Main control building		1 building
City distributing pipes		
Dia. 1,350 mm to 100 mm		length 880,000 m

3.5. Third stage plan

A. Decision of water source

The required intake for the third stage plan is 10.4 cubic meters per sec. The water of the Sunter, Tjiliwng, Krukut and Tjisadane rivers running through the city and its outskirts is not considered for the water sources of this plan from the point of their flow quantity and quality, judging from the results of our survey and the data submitted by the city waterworks and the irrigation dept. of the Government.

After the consideration of the circumstances, the intake plan from the up-stream of the Tjisadane river, by constructing dam and reservoir, has been proposed. The catchment area of the Tjisadane river is about 840 square kilo meters and the yearly rainfall in the upstream area reaches about 4,000 mm. However, a great amount of such water is now

used only for irrigation in the fields and no excess water can be used for city water supply at the present time. The construction of the dam and reservoir should be contemplated to store flood outflow in the rainy season and to supply the required amount in the dry season. The dam is planned to be constructed at the site near the confluence of the Tjisadane and the Tjianten where the water level of the river bed is El. 100 meters. Then, the water can be delivered to the city by natural flow, with no fear of water supply suspension by the stoppage of electric current.

B. Summary of proposed dam and reservoir

(1) Stream flow of Tjisadane river above dam site.

Catchment area	840 square kilometers
Yearly average rainfall	4,280 mm (Year 1919 - 1941)
Average daily flow at dam site ..	82.3 cubic m/sec
Yearly average amount of flow ...	2,600,000,000 cubic m.

(2) Proposed reservoir

High water level	El. 150 meters
Low water level	El. 135 meters
Effective depth	15 m.
Total storage capacity	300,000,000 cubic m.
Effective storage capacity	220,000,000 cubic m.
Reservoir area	21 square kilometers

(3) Proposed dam

Site	near Gobang
Type	Earthfill dam
Height	60 m.
Crest length	1,200 m.
Elevation of dam top	El. 155 m.

(4) Proposed electric generating plant

Turbine ..... Vertical caplan
Maximum capacity 26,000 kw.

Generator ..... Enclosed, vertical shaft
Maximum capacity 29,000 kw.

C. Summary of proposed intake, treatment, distributing facilities

Intake canal ..... length 300 m.

Intake tower 1

Treatment plant ..... Capacity 9.5 cubic m./sec receiving well, sedimentation, rapid sand filters, chemical feeders

Raw water main ..... length 1,300 m

Clear water reservoir ... capacity 200,000 cubic m.

City distribution pipes . approx. 1,200,000 meters

D. A brief observation on an intake plan from the canal near Pesing

During our stay in the city, we were told about an idea to intake water for city waterworks from the canal near Pesing by one of the city engineers. By our brief observation on the matter, the idea is not considered as appropriate for the future project because of the following several reasons.

(1) Comparison in initial construction costs between Pesing plan and our third stage plan:

Items of expenses	Pesing Plan (US$)	Gobang Plan (US$)
* Dam construction	same with Gobang plan	same with Pesing plan
* Water main required length Pesing plan 5 Km Gobang plan 40 Km)	2,900,000	22,000,000

Items of expenses	Pesing Plan (US$)	Gobang Plan (US$)
* Intake pumps required only in Pesing plan	550,000	none
* Special expenses for construction of treatment plant owing to the swampy ground	8,300,000	none
* Special earth work expenses for construction of treatment plant	11,100,000	none
* Distribution pumps	2,000,000	none
(Total):	24,850,000	22,000,000

(2) In our Gobang Plan, to construct a water treatment plant near Gobang, water is planned to be distributed by gravity flow and no electricity expenses for distribution are required. Consequently, maintenance cost will be far less than that of the Pesing Plan and also troubles caused by suspension of electric services will not occur in our Gobang Plan.

(3) As to the quality of water, that taken in at Gobang is much better in quality than that of Pesing. Consequently, the chemical expenses necessary in water treatment process will be far less than that of Pesing.

(4) In our Gobang Plan, water can also be supplied to the proposed cities from the main pipe lines between Gobang and Djakarta.

4. Cost estimates for proposed project

(A) The following chart shows the roughly estimated construction cost of each plan on the preceeding pages. The estimates are purely calculated cost in relation to the master planning of our surveys. A more accurate estimate cannot be given till a detail design and calculation is made in the future. We, therefore, cannot be fully responsible for the figures in these estimates and request the readers to consider them only as a reference.

(B) "Cost for foreign commodity" is the cost of machineries, pipes, pumps, valves, ... etc. to be imported, in addition to the necessary engineering services for detail designing and construction supervising. The above does not include the import duty in Indonesia and all other landing expenses after C.I.F. Djakarta.

(C) "Cost for local fund" is the amount required in Djakarta for the following:

Cost of local labor,

Cost of locally purchased materials,

Cost of local transportation and storage,

Cost of local contingency.

As stated above in (A), all costs are rough estimates but the figures for the local fund expenses were especially difficult to estimate because of the following reasons;

* Big fluctuation in actual foreign exchange rate.

* Unstableness in local material and labor cost.

Therefore, we first calculated the construction cost, including labor cost for erection and required material cost for construction,

in Japan in U.S. Dollar. Then we compared material cost, working efficiency, and wages of the laborers in Djakarta and in Japan to arrive at the assumed figures.

Cost estimate for proposed project

Unit: US$ 1,000

(Project name)	(Cost for foreign commodity) First year	Second year	Third year	Total	(Local fund)	(Total)
1. Urgent plan						
(a) Improvement of existing plant at Pedjompongan	240	-	-	240	40	280
(b) Extension pipe net	920	-	-	920	300	1,220
(c) Repair & reclean-ing of pipes	820	-	-	280	50	330
(d) Water meter	-	-	1,210	1,210	120	1,330
(e) Consultant fee	80	-	-	80	60	140
Total of (1)	1,520	-	1,210	2,730	570	3,300
2. First stage plan						
A. First step project:						
(a) Intake, treat-ment, distribut-ing system at Galur	-	2,750	-	2,750	1,980	4,730
(b) Pipe net	-	4,870	-	4,870	1,980	6,850
(c) Consultant fee	860	-	-	860	370	1,230
Total of (A)	860	7,620	-	8,480	4,330	12,810
B. Second step project:						
(a) Pipe net	-	-	4,460	4,460	1,760	6,220
(b) Water meter	-	-	1,140	1,140	110	1,250
Total of (B)	-	-	5,600	5,600	1,870	7,470

3.	Second Stage Plan			
	(a) Intake, Purification service Reservoir	9,350	6,230	15,580
	(b) Pipe Nets 878,000 m length	9,670	3,210	12,880
	(c) Water Meters 130,000 Pcs	1,600	120	1,720
	(d) Consultant Fees	1,300	560	1,860
	Total of 3.	21,920	10,120	32,040
4.	Third Stage Plan			
	(a) Water Reservoirs, Dam, Penstock, Turbine Pumps, Generators	13,330	18,170	31,500
	(b) Intake, Purification Plant, Pumping Station	19,440	6,860	26,300
	(c) Distribution Facilities Pipes, Reservoirs	32,080	12,120	44,200
	(d) Water Meters 140,000 Pcs	1,530	130	1,660
	(e) Consultant Fees	6,400	-	6,400
	Total of 4.	72,780	37,280	110,060

(Unit: US$ 1,000)

* Remarks: (a) All above costs should be subject to market fluctuations in material prices and foreign exchange rate.

(b) Import duty in Djakarta is not included in above costs.

5. Management and administration of waterworks

The purpose of water service is "to supply plenty of clean water with moderate price to improve the public health and living conditions" and the management and administration must be carried on upon this principle.

It is necessary, in this connection, the water supply system from the source to the consumer should be both sanitary and efficient. Therefore, administrators of waterworks must always try to make a thorough administration over all installations and should have full knowledge of the actual status of management. The knowledge of administrators should cover the extension project of work, management of purification plants, quantity of water consumed by houses, water pressure, quality of water, collection of water fees, etc. They should form the persons engaged in business into a smooth and efficient organization.

In order to perform a most sound maintenance of installations, it is advisable to establish a self-supporting accounting system so that the required expenses for works may not be effected by general financial conditions.

With regard to the water rate and fees, its rate and collection method may differ according to the social and economical situations of countries but it is most desirable to furnish water meter to all consumer for securing a right and proper collection of fees and reliable information on the actual operating status of waterworks facilities.

It is also essential that a minimum necessary number of skilled employees should be secured for proper operation of the water services. The number may differ according to the scale of the waterworks and the organization. In Japan, it is figured that one person is required to every 1,000 - 1,500 persons of the population served. It was found that

the number of persons employed in the existing waterworks of Djakarta City is rather small.

In conclusion, the management and administration of waterworks should be made along the following lines:

(a) An accounting system including self-supporting system should be established so that necessary expenses may be disbursed when needed.

(b) Water rates should be decided to promote a sound management of the waterworks.

(c) The minimum necessary number of skilled employees should be secured by all means.

(d) All installations and gauges should always be maintained in perfect condition.

Conclusion

This report includes the results of investigation made by our Team in Djakarta City during a period of 25 days.

The present water consumption of the city amounts to only about 150,000 cubic m per day and the citizens now reaching about 3,000,000 are seriously suffering from the shortage of water. For securing the dignity of a large capital and international city, it is considered to be of a great importance for Djakarta City to work out a speedy solusion to the matter. In addition, a large increase in the population of the City is requiring more quantity of water in their consumption.

The project contained in this report has been drawn out as a basic principle for constructing new and complete waterworks for the City of Djakarta in consideration of their present status and future development.

Two ideas has been proposed in this plan: one is an urgent plan for increasing the efficiency of the existing facilities and the other is an extension plan of the waterworks to meet a possible increase in the future water demand with a long term yearly construction plan. The population and water consumption in the future will fluctuate to a great extent according to social conditions and it is therefore not an easy task to make a correct estimation. But based upon the data so far collected by us and from the examples of several other countries, we have formed our report as shown.

The summation of the proposed plans is as follows:

(1) Urgent plan: For the purpose of operating existing Pedjompongan system at its capacity of 1.8 cubic m per sec., all defects in its facilities should be repaired urgently and at the same time additional distribution pipes should be laid for sufficient

supply to 1,500,000 citizens. Further, water meter should be installed to all houses to record water consumption.

(2) First stage plan: Fixing a goal of increased population supplied with water in 1970 at 2,500,000, additional 1.7 cubic m/sec will be produced and delivered to the citizens, constructing new water treatment plant at Galur and laying new water distributing pipes in the City. This plan should be completed by 1965.

(3) Second stage plan: The goal of this project is a sufficient water supply for 3,600,000 citizens in 1975. The construction work has the same feature as that of the first stage project but is separated from each other in view of working expenses and time. The planned supply area includes all of Djakarta City and an additional 5.7 cubic m/sec. is to be provided. The plan should be completed by 1970.

(4) Third stage plan: This project has been planned to cope with the time when the population reaches 5,000,000 or when a great shortage arises in the estimated water supply stated previous pages. The target of the project is to build a multi-purpose dam near Gobang up the Tjisadane for irrigation, power generation, flood control and water distribution and especially to deliver water to the City by gravity flow through the proposed main pipes with about 40 kilo meters in length.

In addition to the construction of the dam, a electric power plant and water treatment plant, water delivering pipes will be laid. Part of the work should be finished not later than 1975 to let water run through the pipes and the whole project should be completed by 1988.

On the other hand, a number of defects were found in the existing facilities, in the management and organization of the waterworks. Damages and troubles in machinery and gauge, defects in operation, shortage of working fund and imperfect administrative organization, stand in the way of an efficient management of the waterworks. Unless a necessary improvement is made in these lines as soon as possible, it is feared that even the extension work in the future may share the same fate.

In conclusion, it is our sincere hope that Djakarta City will eliminate its water shortage as soon as possible and operate a smooth and efficient waterworks in the future. We shall be very happy if the basic idea in our report is utilized as a guide for one of the most important developments in the City.

Organization of the surfey team

The survey team was composed of the following members.

Chief : Hiromu Tanabe
Doctor of Engineering
President, Japan Sanitary Engineering Consultants, Co., Ltd.

Member : Akira Takamatsu
Chief of Programming Section, Development Survey Division, Overseas Technical Cooperation Agency of Japan

Member : Masakazu Aoyama
Registered Consulting Engineer
Japan Sanitary Engineering Consultants, Co., Ltd.

Member : Masami Uchida
Registered Consulting Engineer
Pharmaceutist, Japan Sanitary Engineering Consultants, Co., Ltd.

Member : Shigeki Nakajima
Registered Consulting Engineer
Japan Sanitary Engineering Consultants, Co., Ltd.

Member : Sadakatsu Tazawa
Civil Engineer, Japan Sanitary Engineering Consultants, Co., Ltd.

"Report on The Water Supply Extension Project for

The City of Djakarta"

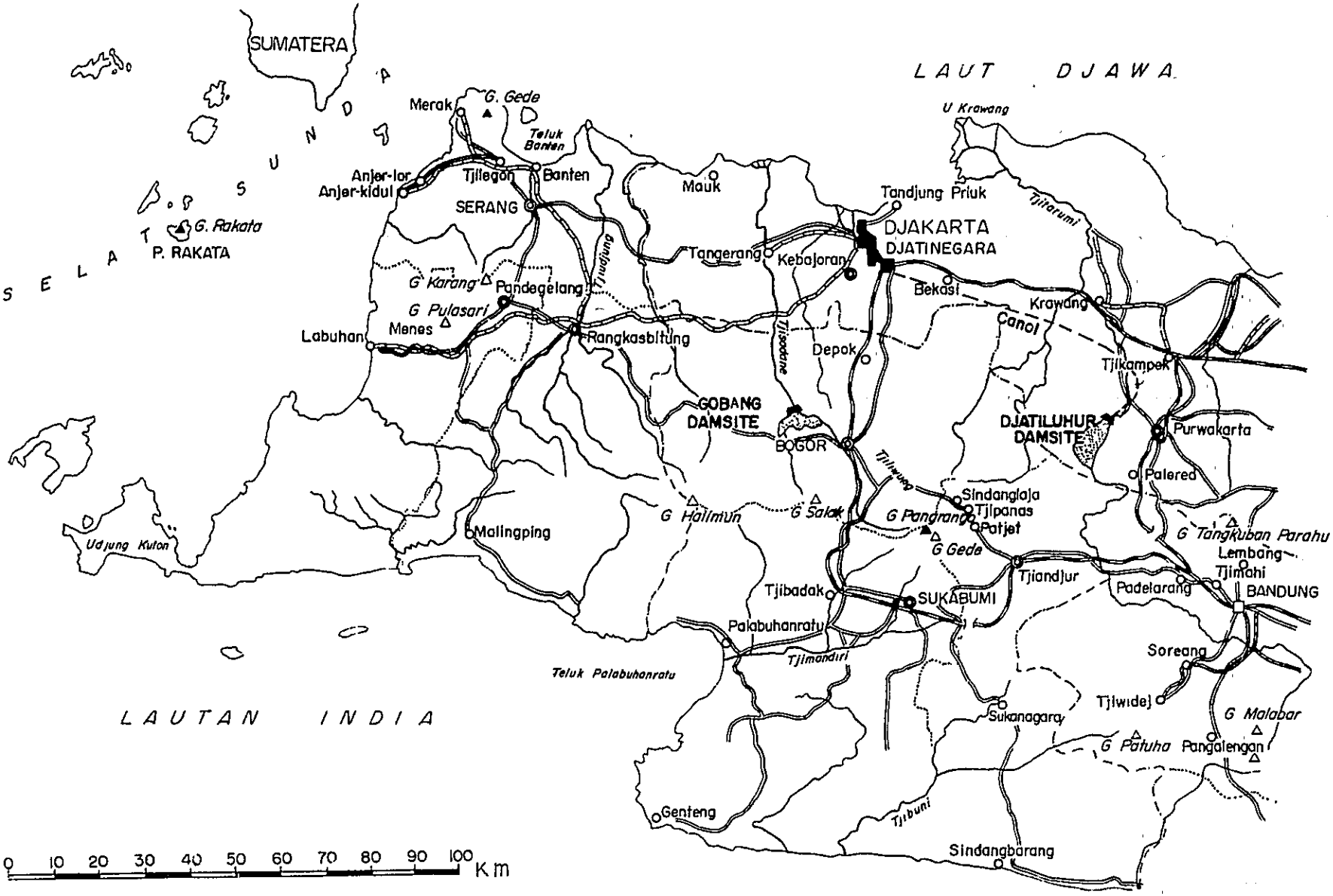
Surveyed and designed by: TANABE, Hiromu
Chief of Japanese Survey
Team dispatched by Overseas
Technical Cooperation
Agency of Japan

Edited by: Tohzee, Hiroshi
Nihon Suido Consultants

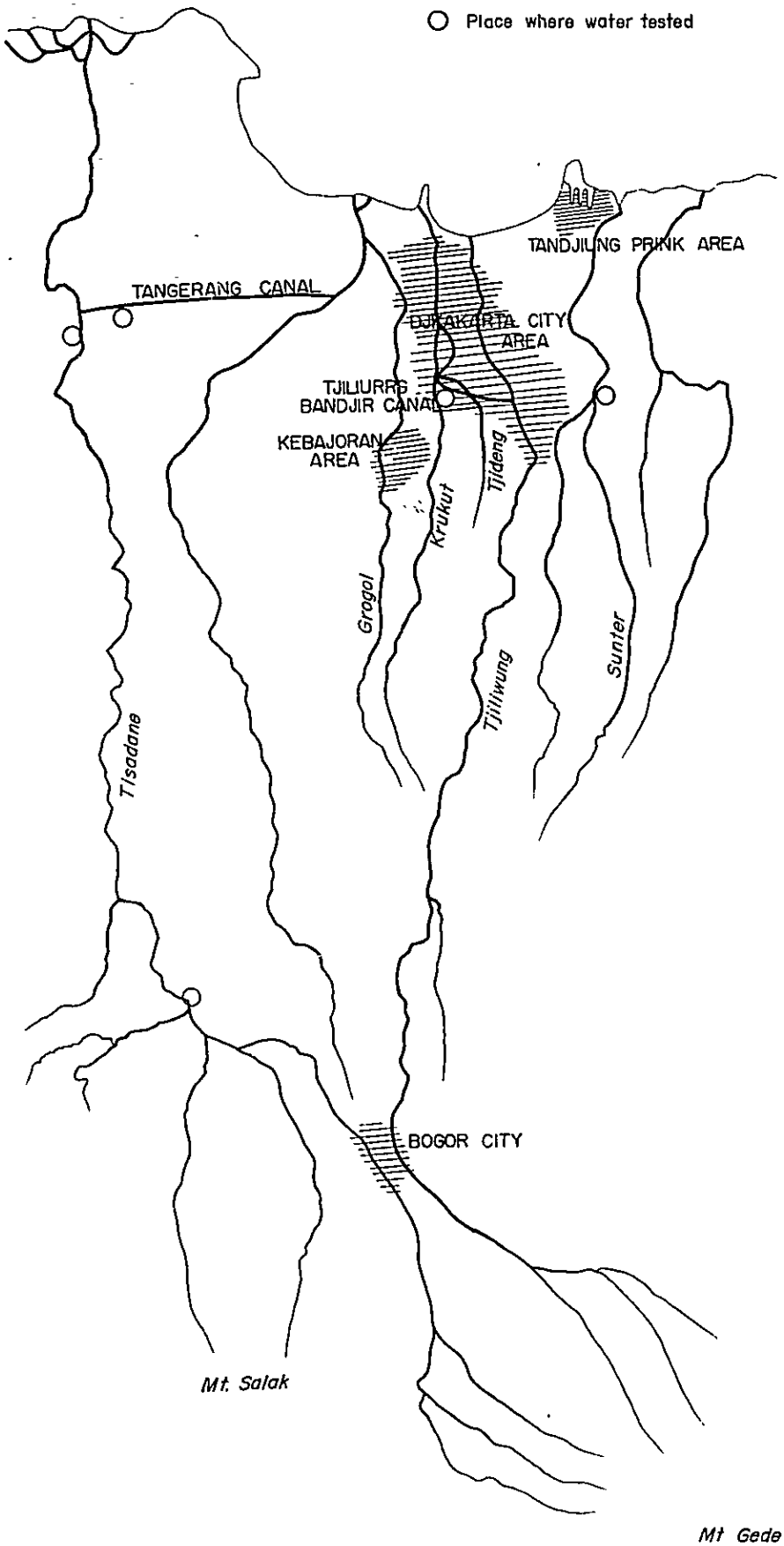
Publisher: Overseas Technical Cooperation Agency
of Japan

Date: August 20, 1963

MAP OF WEST JAVA

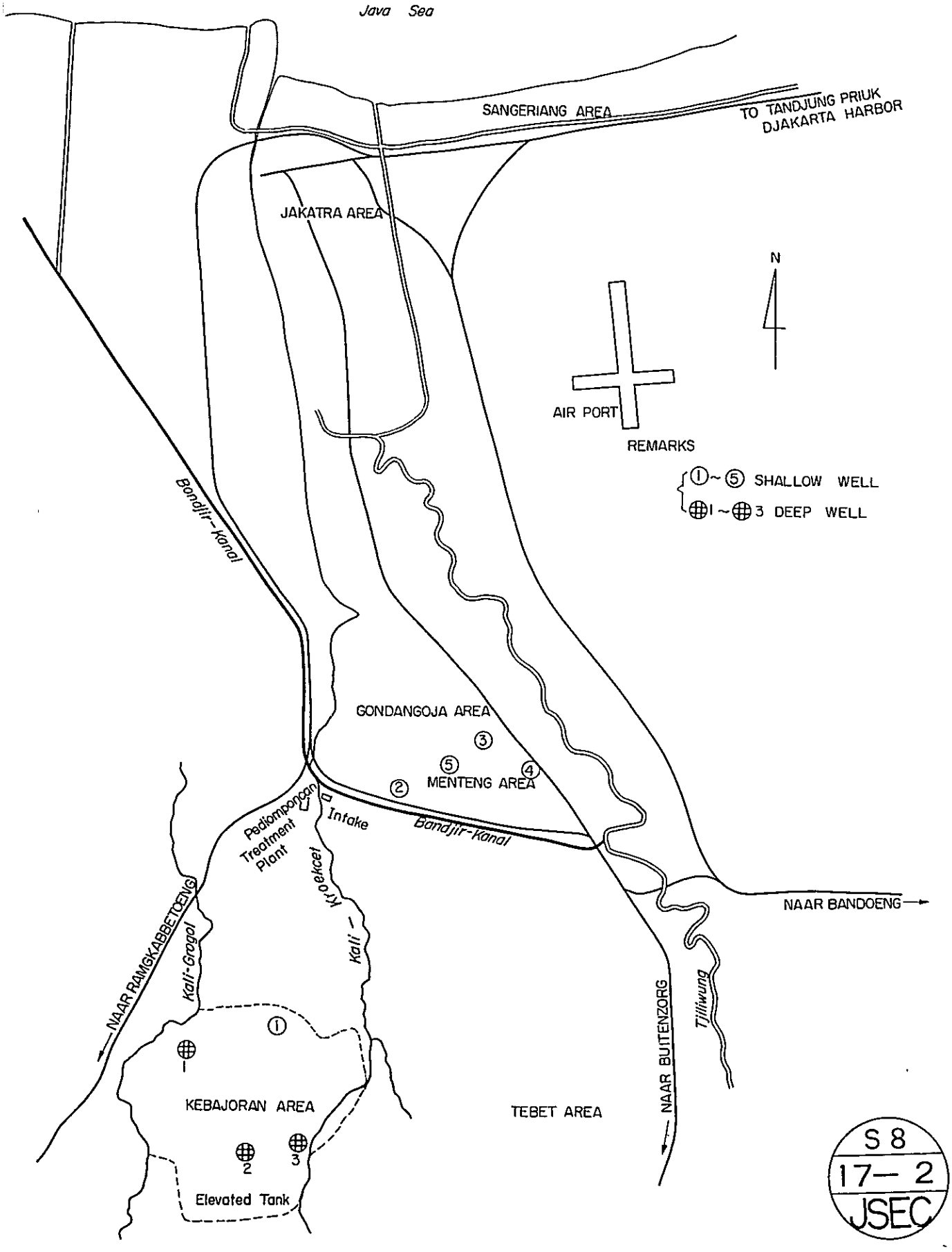


MAP OF RIVERS AND CANALS



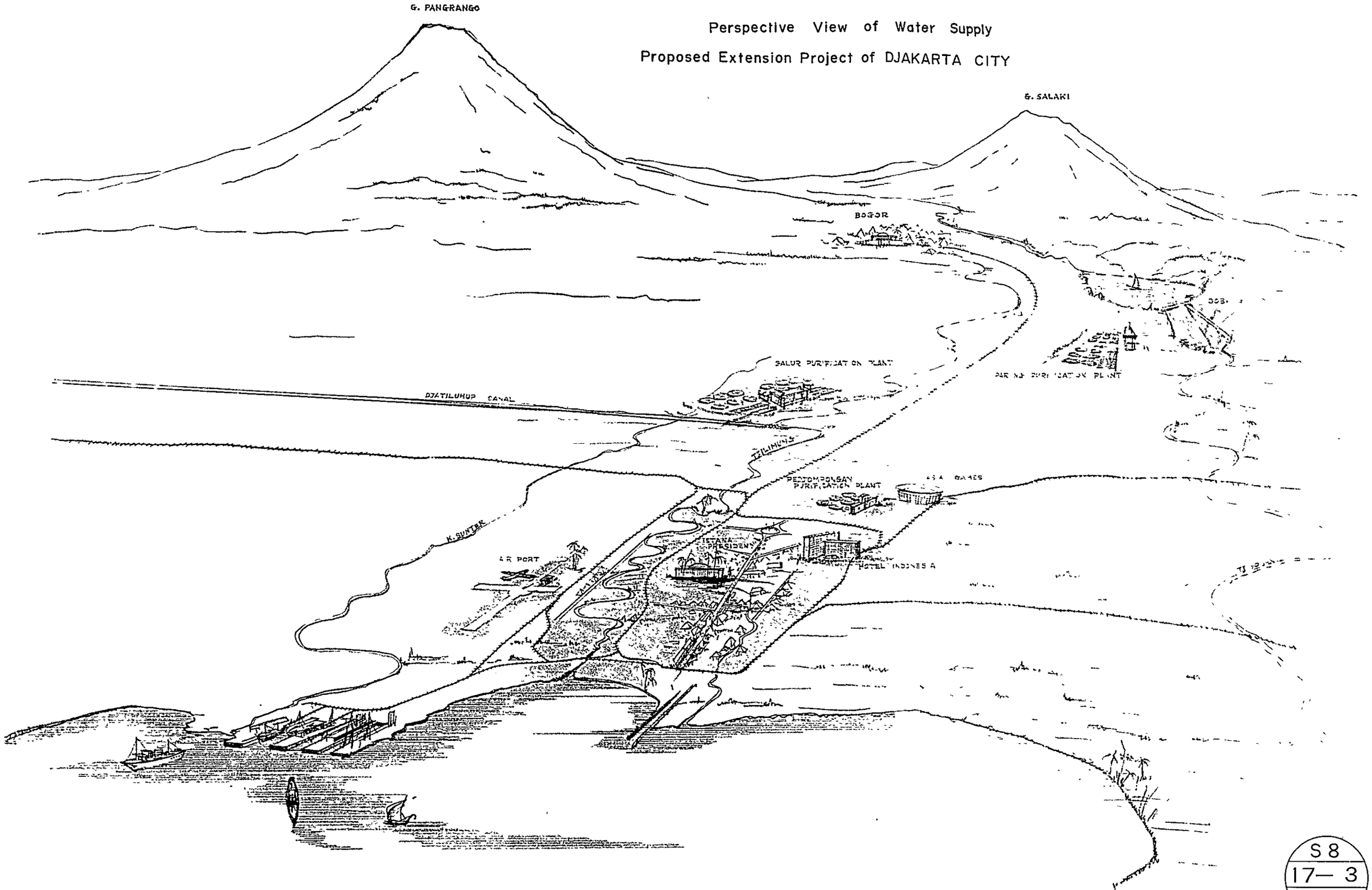
S 8
17— 1
JSEC

LOCATION OF WELLS



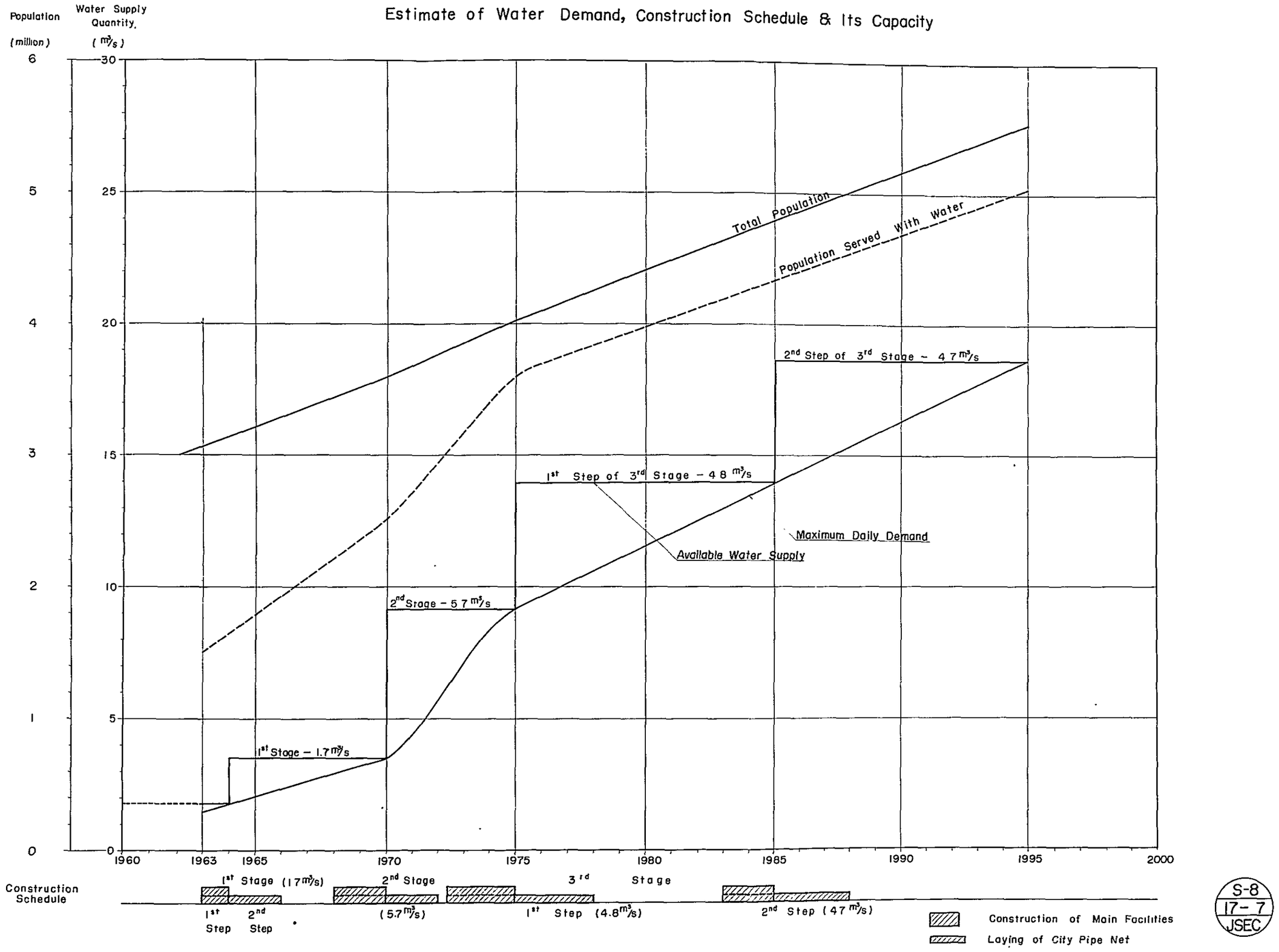
S 8
17— 2
JSEC

Perspective View of Water Supply
Proposed Extension Project of DJAKARTA CITY



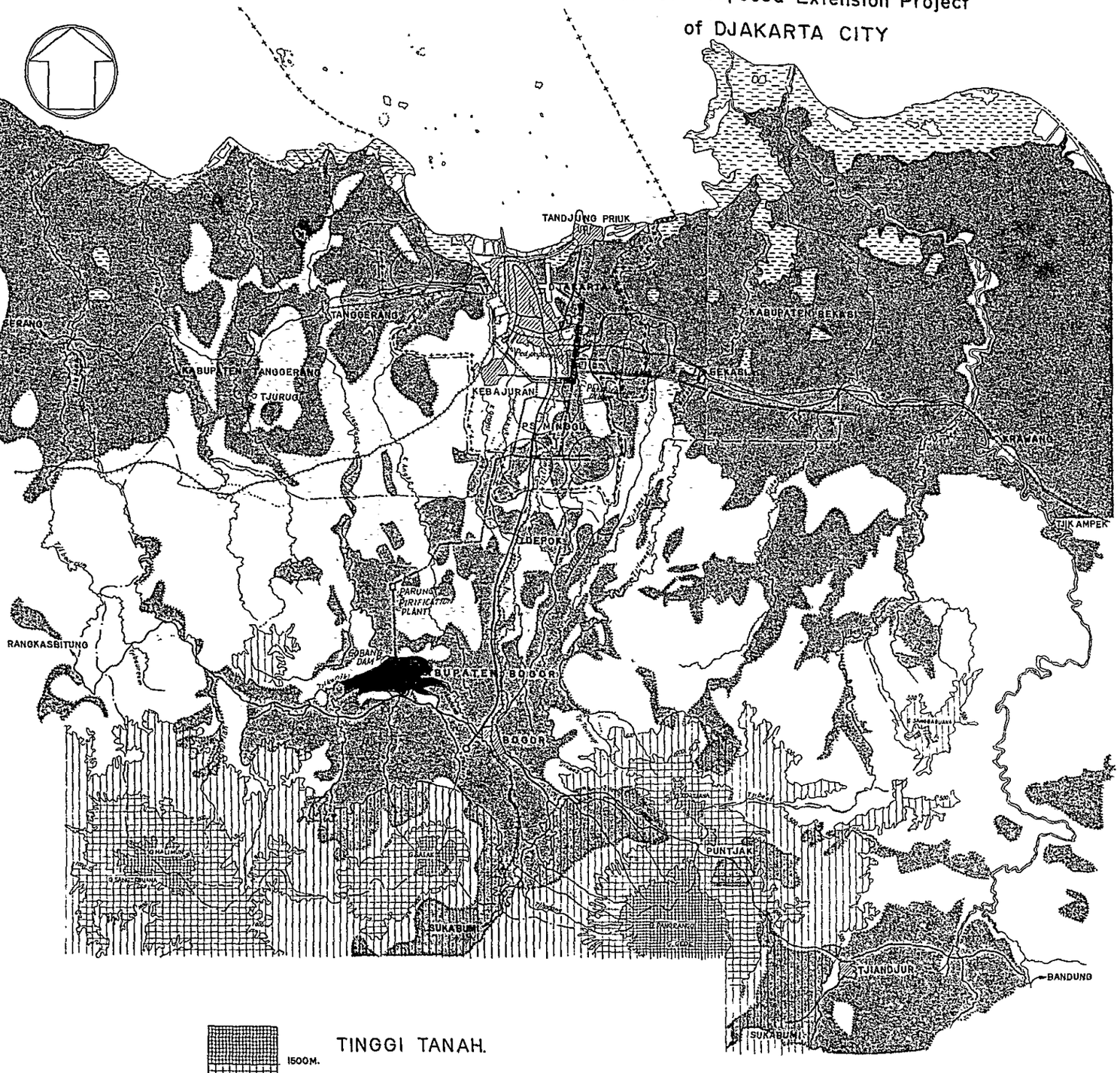
S 8
17— 3
JSEC

Estimate of Water Demand, Construction Schedule & Its Capacity



S-8
17-7
JSEC

Plan of Proposed Extension Project of DJAKARTA CITY



TINGGI TANAH.

1500M.
1000M.
500M.
0M

HEIGHT OF LAND.

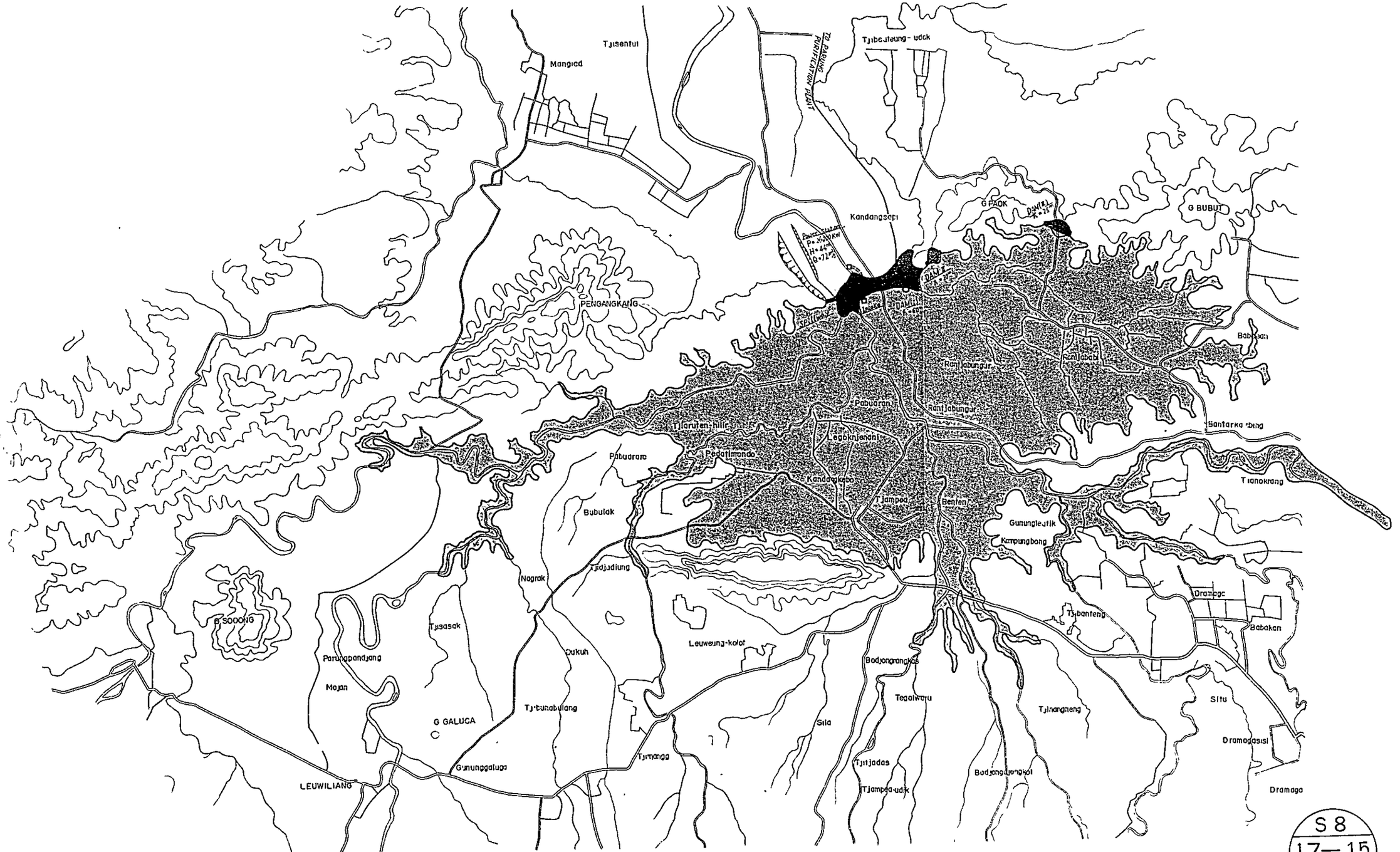
Existing
1st Stage Project
2nd "
3rd "

SKALA 1 : 250.000

5 0 5 10 15 20 25 km

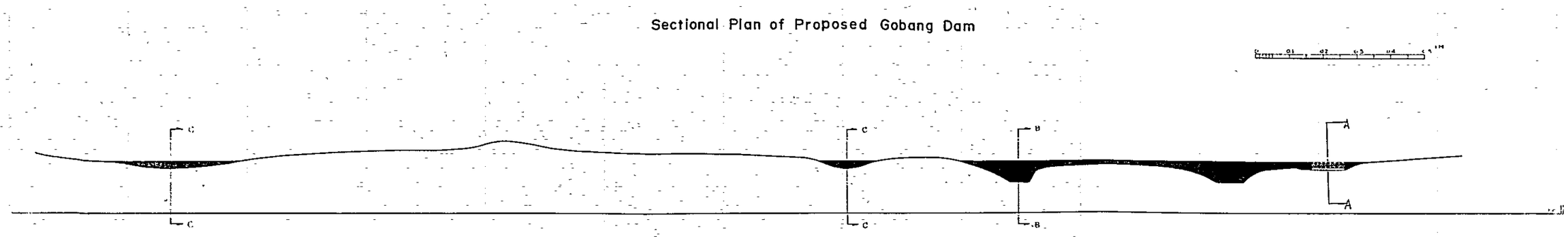
S 8
17—14
JSEC

Plan of Proposed Gobang Reservoir

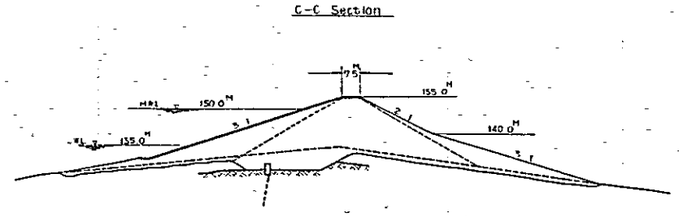


S 8
17—15
JSEC

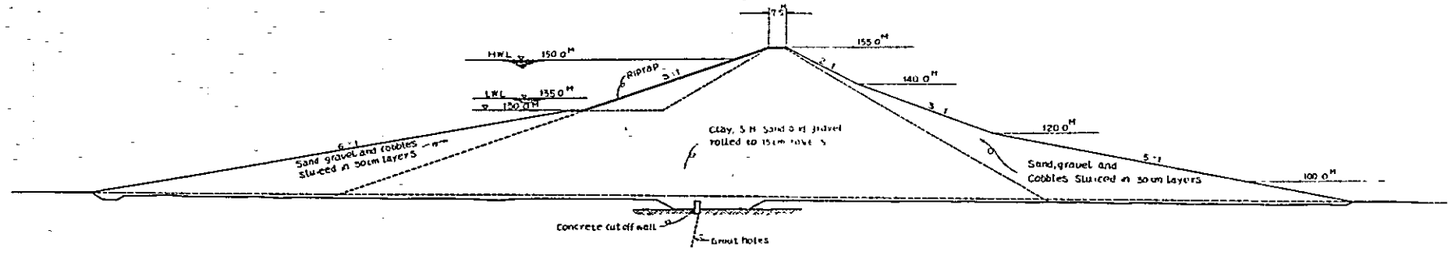
Sectional Plan of Proposed Gobang Dam



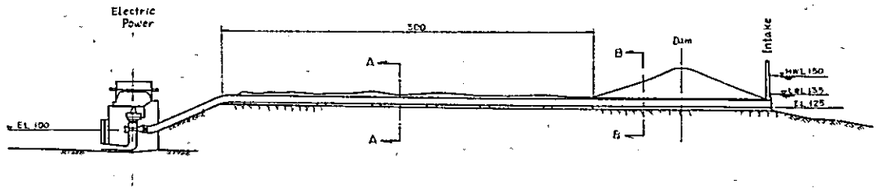
C-C Section



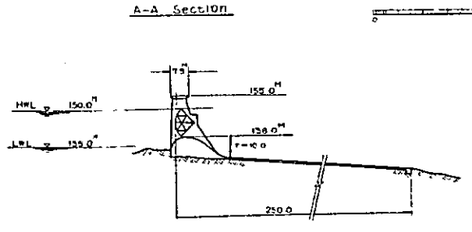
B-B Section



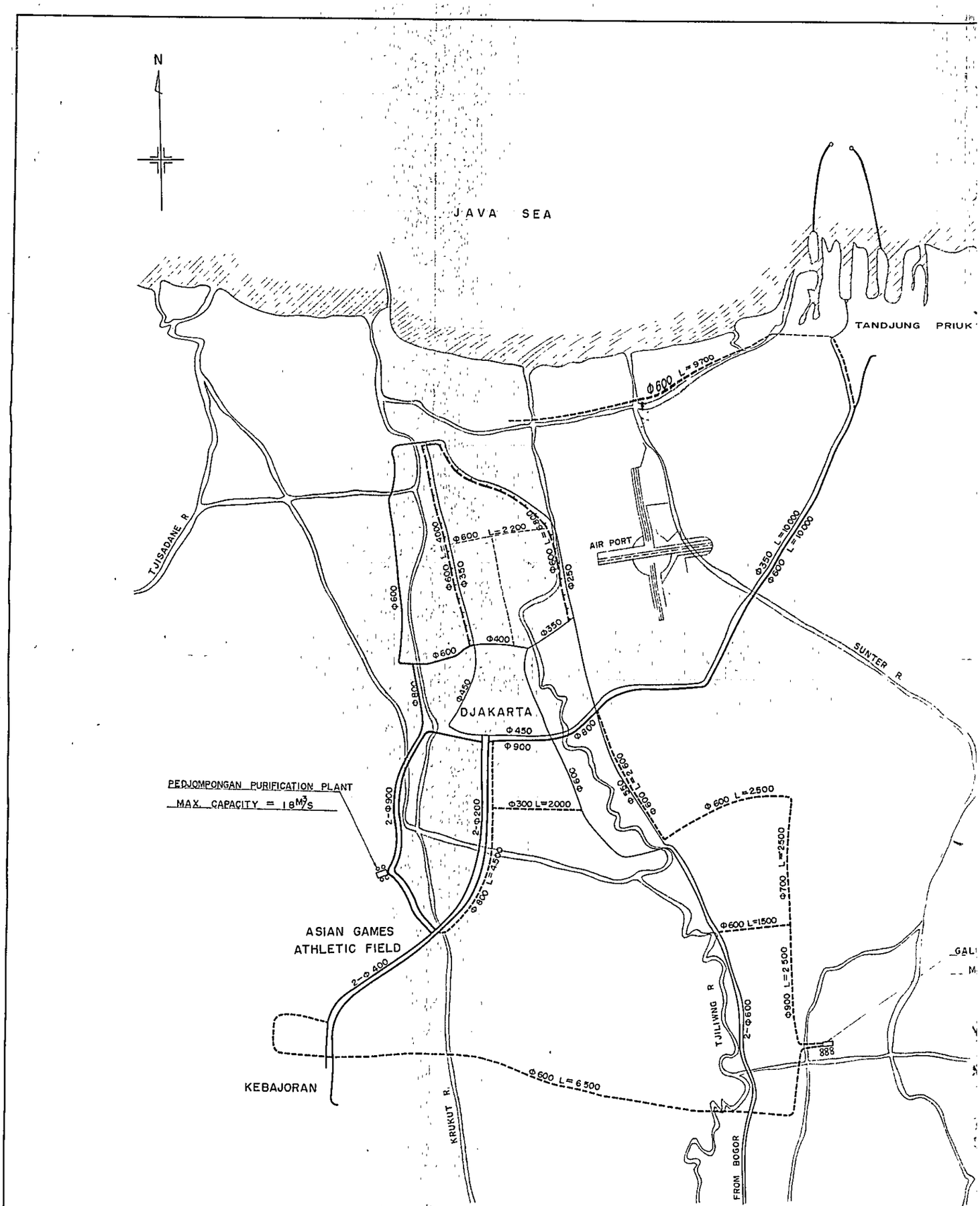
Pipe-Line of Electric Power Station

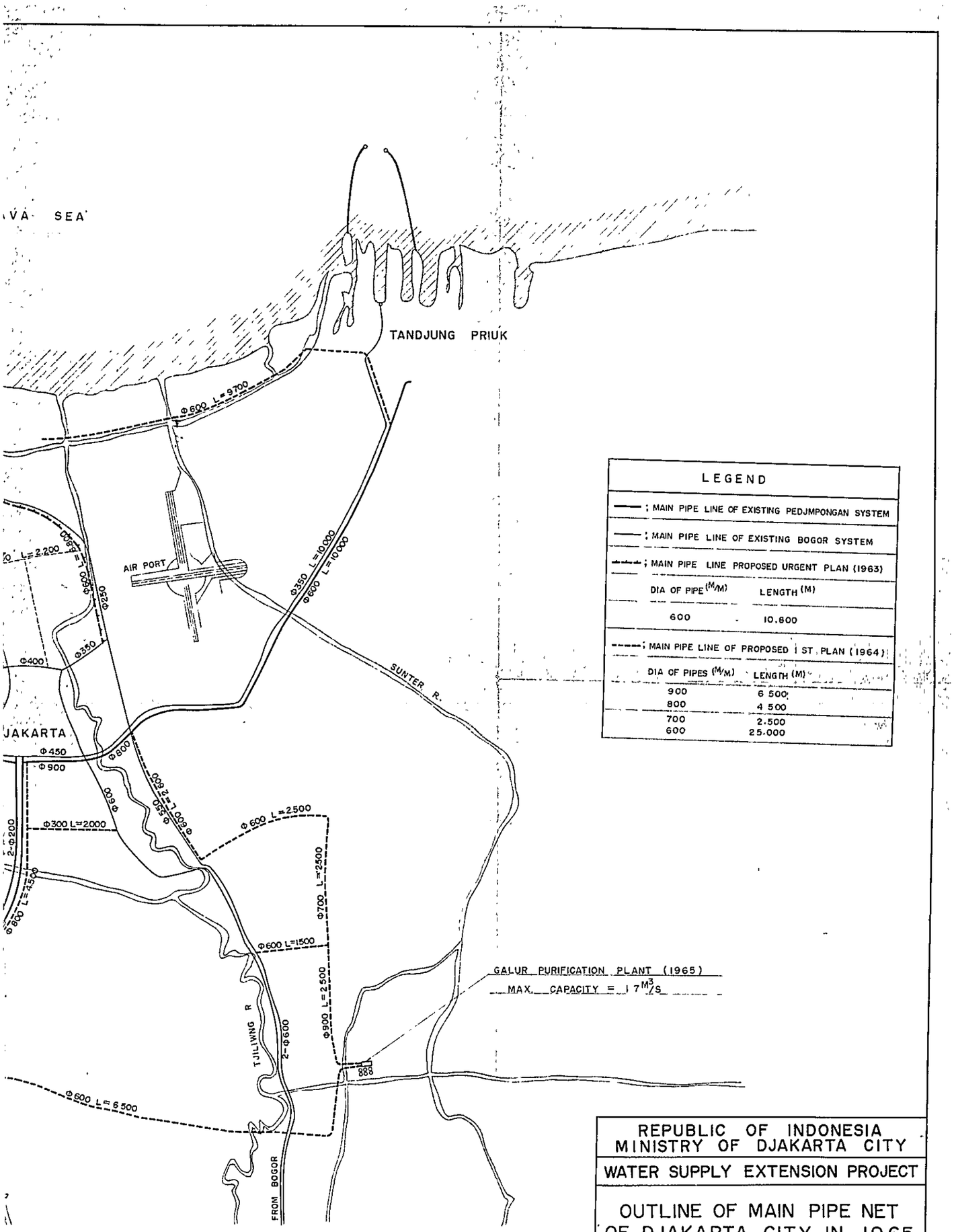


A-A Section



S 8
17—16
JSEC


N
JAVA SEA
TANDJUNG PRIUK
Φ600 L=9700
TJISADANE R
Φ600 L=4000
Φ600 L=2200
Φ600 L=800
Φ600
Φ350
Φ600
Φ250
Φ350
Φ400
Φ600
Φ350
AIR PORT
Φ350 L=10000
Φ600 L=10000
SUNTER R
Φ800
DJAKARTA
Φ450
Φ900
Φ800
Φ800 L=1000
Φ800
Φ600 L=2500
PEDJOMPONGAN PURIFICATION PLANT
MAX. CAPACITY = 18 M3/S
2-Φ900
2-Φ200
Φ300 L=2000
Φ700 L=2500
Φ600 L=4500
Φ600 L=1500
ASIAN GAMES
ATHLETIC FIELD
2-Φ400
Φ900 L=2500
TJILIWING R
2-Φ600
KEBAJORAN
Φ600 L=6500
KRUKUT R.
FROM BOGOR



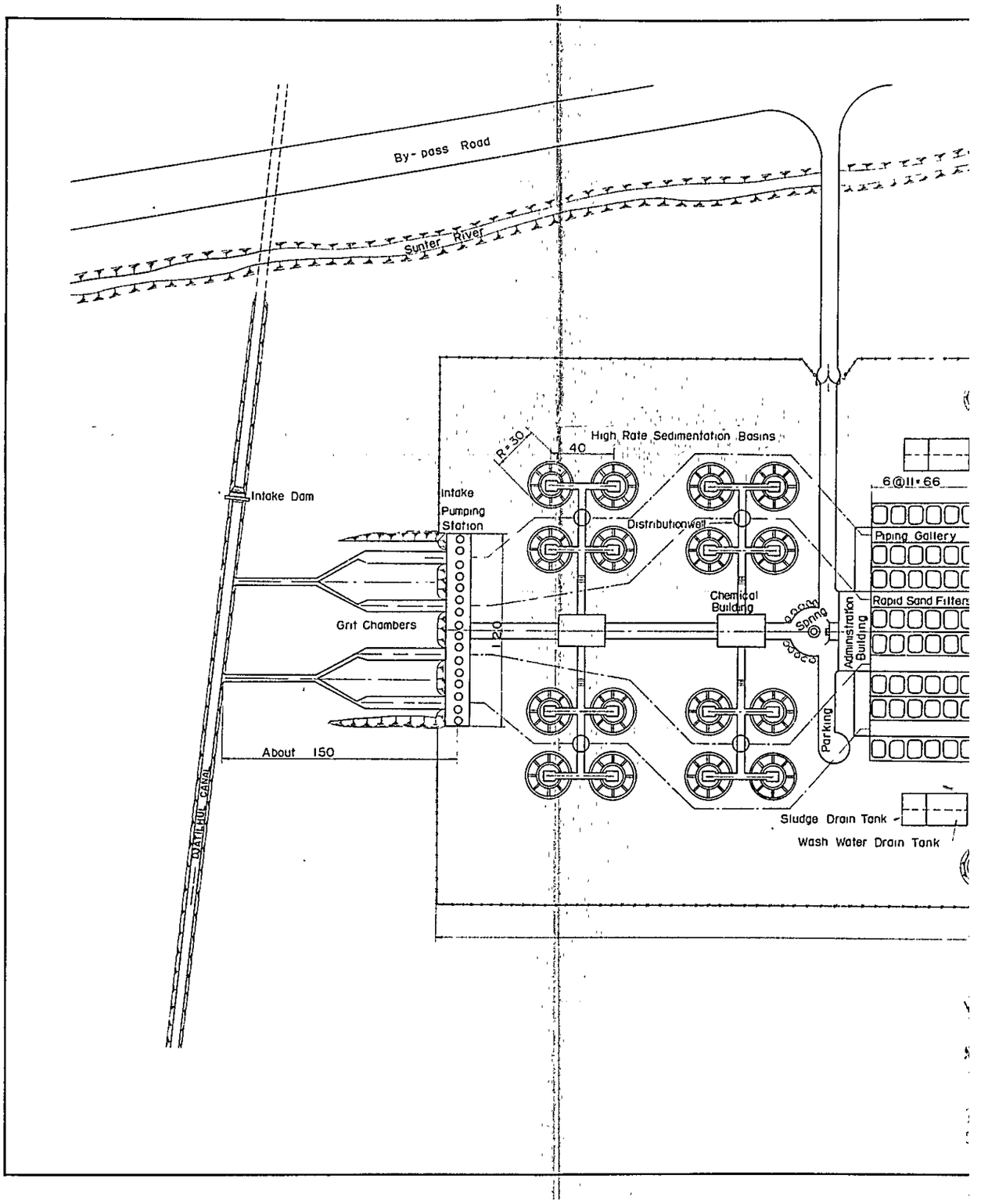
REPUBLIC OF INDONESIA
MINISTRY OF DJAKARTA CITY

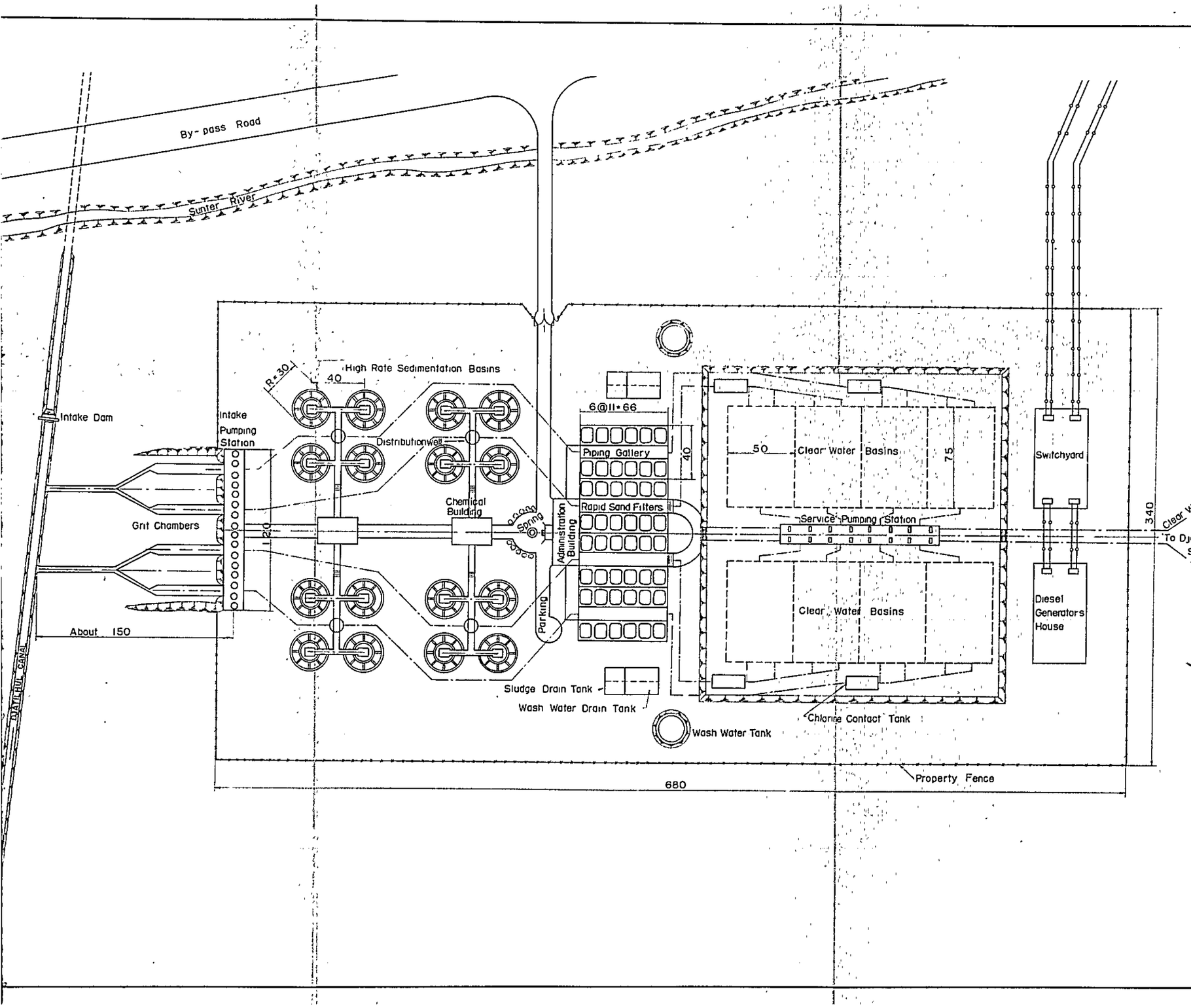
WATER SUPPLY EXTENSION PROJECT

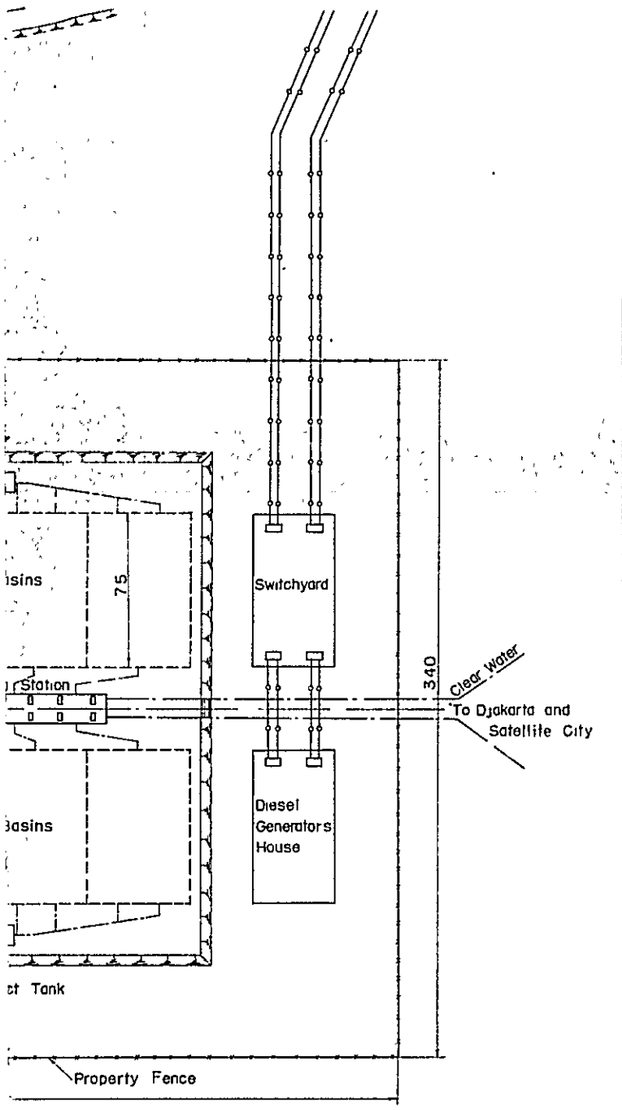
OUTLINE OF MAIN PIPE NET OF DJAKARTA CITY IN 1965

JAPAN SANITARY ENGINEERING CONSULTANTS, CO.
TOKYO JAPAN

DRAWN BY	S.N	DATE: JUNE 1963	17/17
APPROVED	H T	SCALE: 1 50,000	


By-pass Road
Sunter River
Intake Dam
Intake Pumping Station
Grit Chambers
About 150
DAMIPHUL CANAL
R=30
40
High Rate Sedimentation Basins
Distributionwell
Chemical Building
Spring
Administration Building
Parking
6@11=66
Piping Gallery
Rapid Sand Filters
Sludge Drain Tank
Wash Water Drain Tank


By-pass Road
Sunter River
Intake Dam
Intake Pumping Station
Grit Chambers
120
About 150
R=30
40
High Rate Sedimentation Basins
Distribution well
Chemical Building
Spring
Administration Building
Parking
6@11=66
Piping Gallery
Rapid Sand Filters
40
50
Clear Water Basins
75
Service Pumping Station
Clear Water Basins
Switchyard
Diesel Generators House
340
Clear W
To Dj
s
Sludge Drain Tank
Wash Water Drain Tank
Wash Water Tank
Chlorine Contact Tank
Property Fence
680
DJATI HUL CANAL



Unit	Nominal Unit Capacity	Number of Unit 1st Stage Plan	Number of Unit 2nd Stage Plan	Size of Unit	Description
Grit Chambers	1200m³	1	3	7m x 45m	
Intake Pumping Station	20m³/s	1	3	15m x 30m	
High Rate Sedimentation Basins	45000m³/D	4	12	R=30m	Circuler
Rapid Sand Filters	15000m³/D	12	36	11m x 14.3m	Rate of Filteration 120m/D
Wash Water Tanks	1200m³	1	1		Rate of Wash 0.80m/mm. Back Wash time 6 min.
Clear Water Basins	15000m³	2	6	50m x 75m x 4m	Duration Time 4Hr.

Legend

- First Stage Plan
- Second Stage Plan

SCALE 0 50 100 m

REPUBLIC OF INDONESIA
MINISTRY OF DJAKARTA CITY

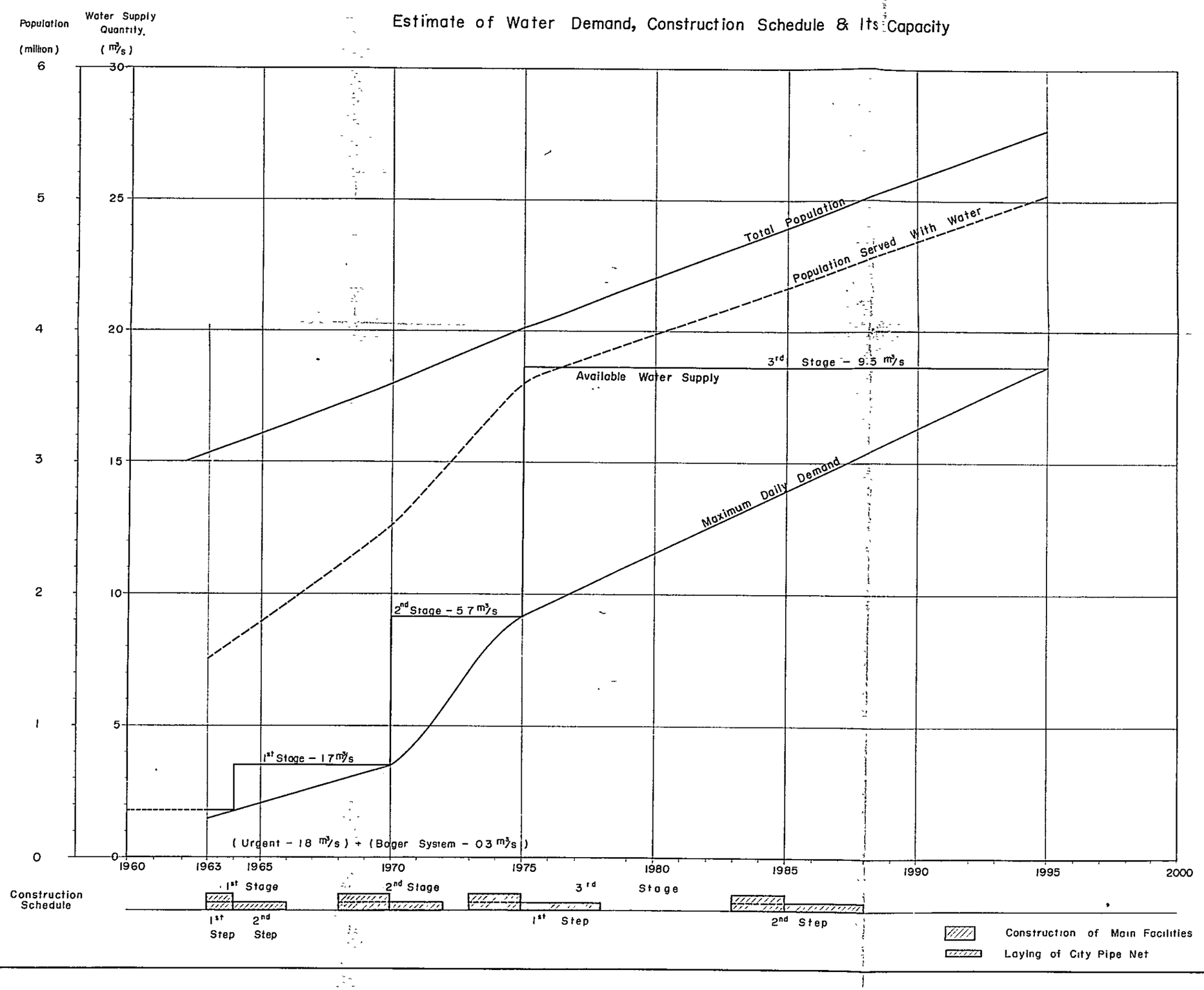
WATER SUPPLY EXTENSION PROJECT

GALUR PURIFICATION PLANT
GENERAL LOCATION

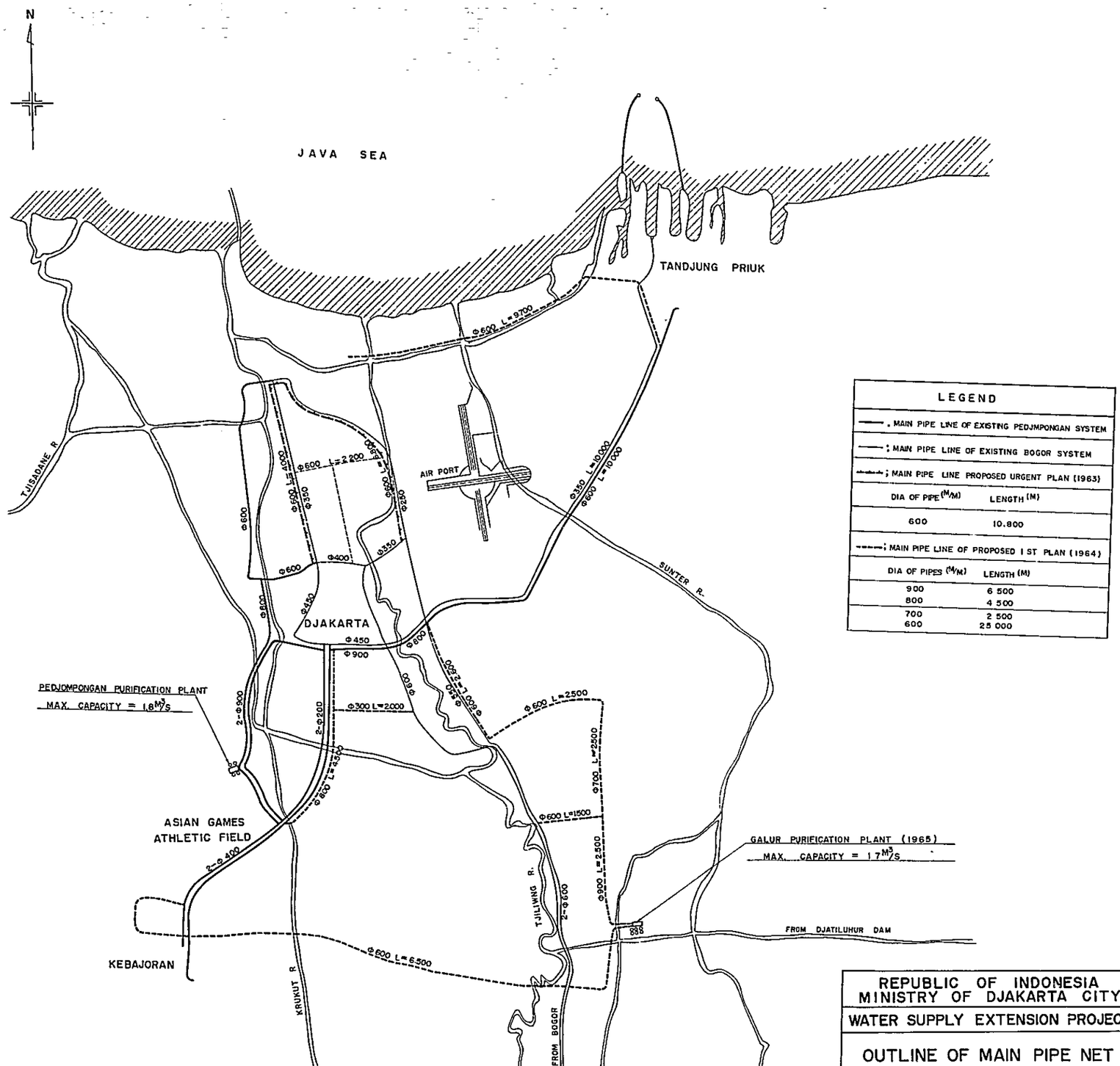
JAPAN SANITARY ENGINEERING CONSULTANTS. CO.
TOKYO JAPAN.

DRAWN BY	S. N	DATE: JUNE 1963	9/17
APPROVED	H. T	SCALE: AS SHOWN	

Estimate of Water Demand, Construction Schedule & Its Capacity



S-8
7 – 17
JSEC



LEGEND	
——— ; MAIN PIPE LINE OF EXISTING PEDJMPONGAN SYSTEM	
——— ; MAIN PIPE LINE OF EXISTING BOGOR SYSTEM	
—·—·— ; MAIN PIPE LINE PROPOSED URGENT PLAN (1963)	
DIA OF PIPE (M/M)	LENGTH (M)
600	10.800
------ ; MAIN PIPE LINE OF PROPOSED I ST PLAN (1964)	
DIA OF PIPES (M/M)	LENGTH (M)
900	6 500
800	4 500
700	2 500
600	25 000

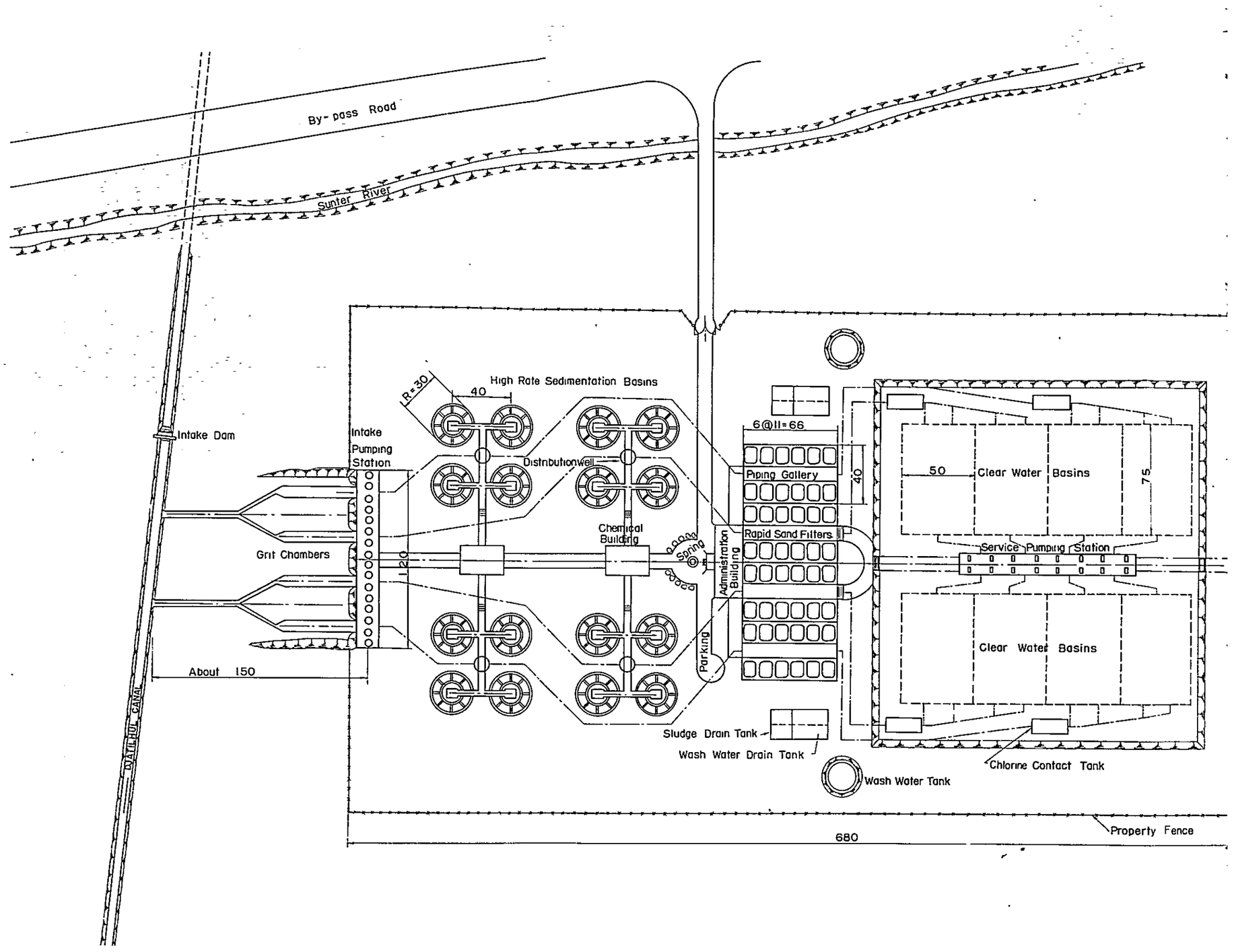
REPUBLIC OF INDONESIA
MINISTRY OF DJAKARTA CITY

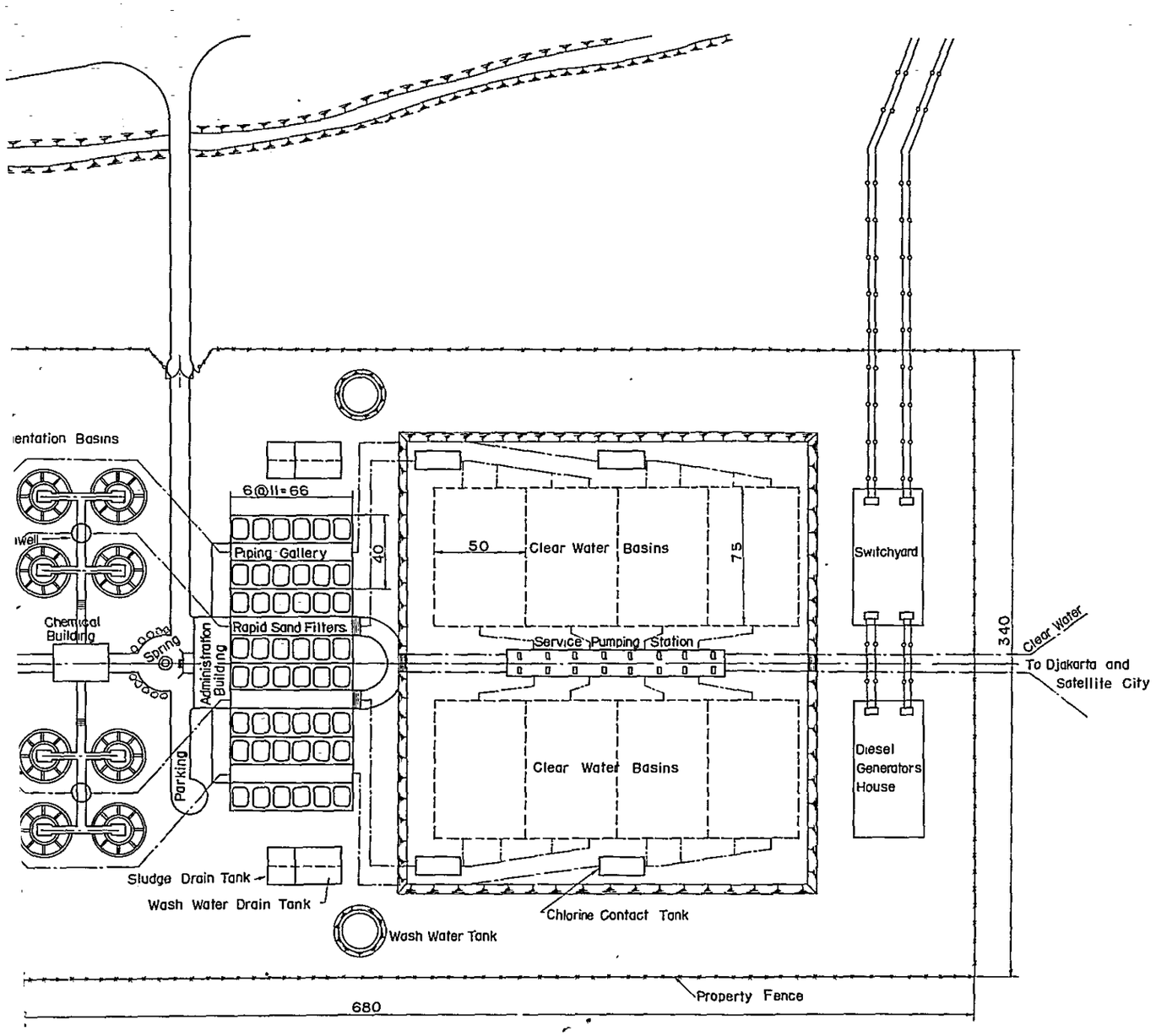
WATER SUPPLY EXTENSION PROJECT

OUTLINE OF MAIN PIPE NET OF DJAKARTA CITY IN 1965

JAPAN SANITARY ENGINEERING CONSULTANTS, CO
TOKYO JAPAN

DRAWN BY:	S.N	DATE: JUNE 1963	17/17
APPROVED:	H.T	SCALE	


By- pass Road
Sunter River
Intake Dam
Intake Pumping Station
Grit Chambers
About 150
DUATEPUL CANAL
R=30
40
High Rate Sedimentation Basins
Distribution well
Chemical Building
120
Spring
Administration Building
Parking
6@11=66
Piping Gallery
Rapid Sand Filters
40
50
Clear Water Basins
75
Service Pumping Station
Clear Water Basins
Sludge Drain Tank
Wash Water Drain Tank
Wash Water Tank
Chlorine Contact Tank
680
Property Fence



Unit	Nominal Unit Capacity	Number of Unit		Size of Unit	Description
		1st Stage Plan	2nd Stage Plan		
Grit Chambers	1.200 m^3	1	3	$7^m \times 45^m$	
Intake Pumping Station	20 m^3/s	1	3	$15^m \times 30^m$	
High Rate Sedimentation Basins	45.000 m^3/D	4	12	$R = 30^m$	Circuler
Rapid Sand Filters	15000 m^3/D	12	36	$11^m \times 143^m$	Rate of Filteration 120 m/D
Wash Water Tanks	1 200 m^3	1	1		Rate of Wash 0 80 m/mm Back Wash time 6 min.
Clear Water Basins	15 000 m^3	2 -	6	$50^m \times 75^m \times 4^m$	Duration Time 4Hr

Legend

= First Stage Plan

= Second Stage Plan

SCALE
0 50 100 m

REPUBLIC OF INDONESIA
MINISTRY OF DJAKARTA CITY

WATER SUPPLY EXTENSION PROJECT

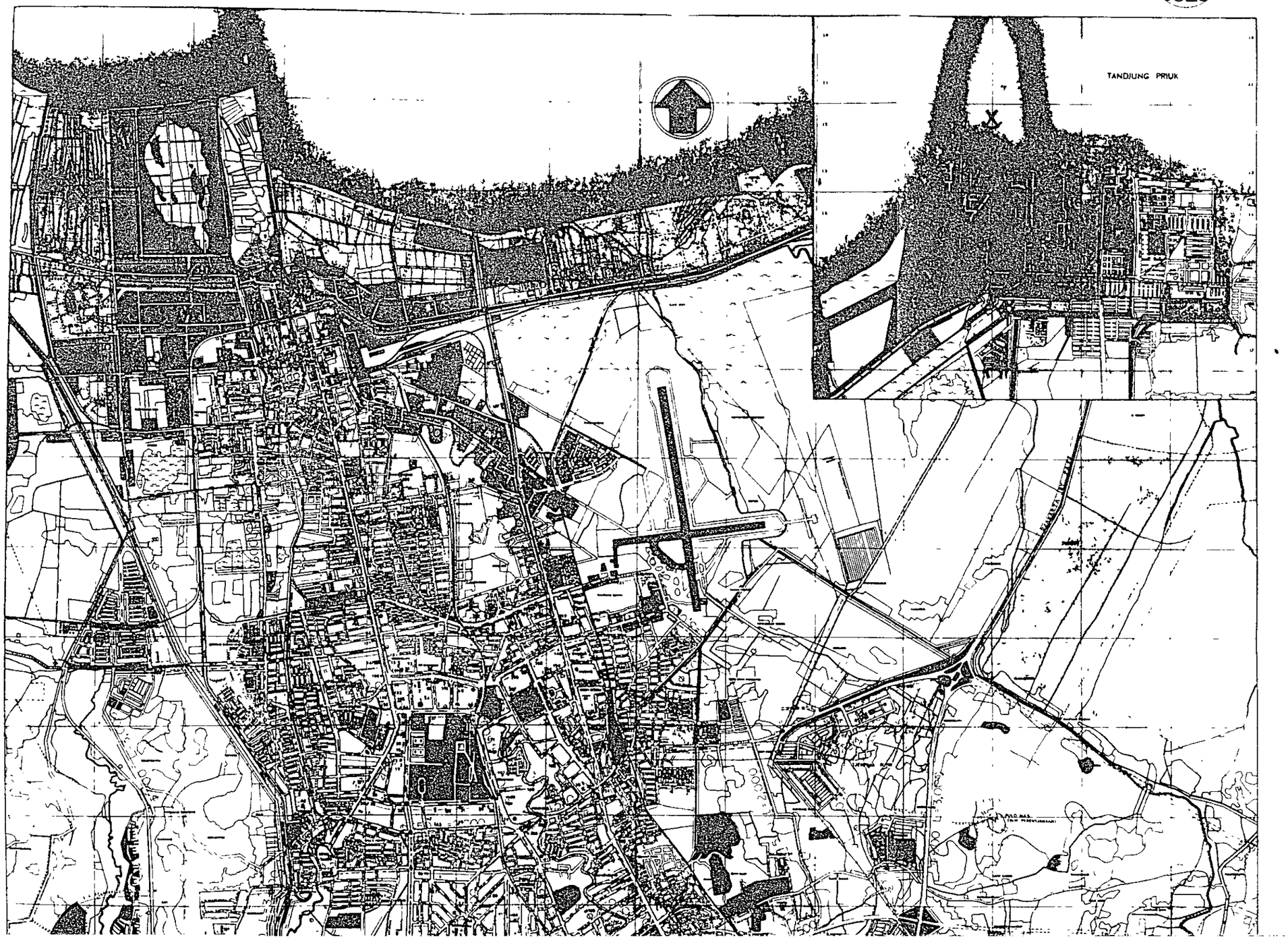
GALUR PURIFICATION PLANT GENERAL LOCATION

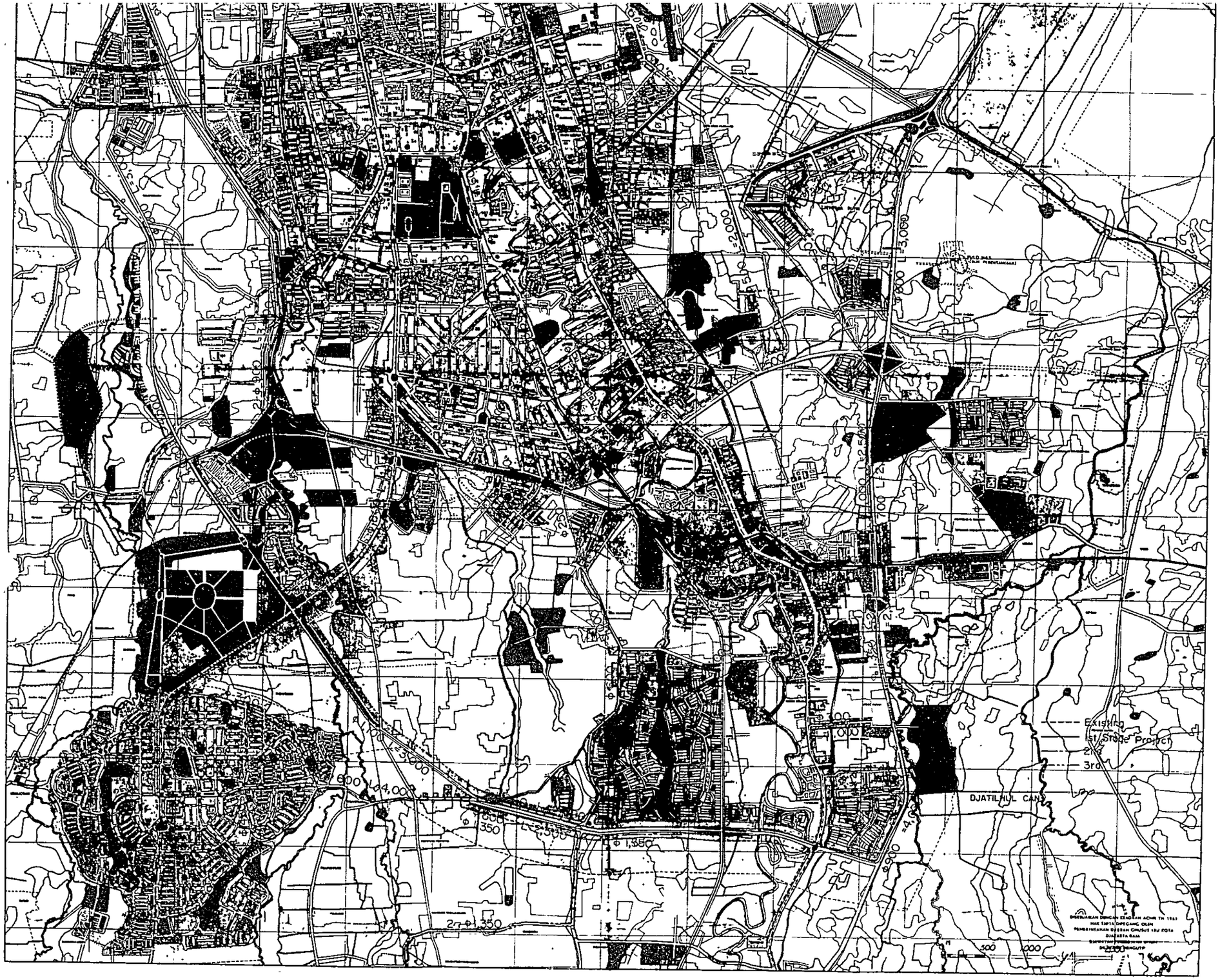
JAPAN SANITARY ENGINEERING CONSULTANTS. CO.
TOKYO JAPAN

DRAWN BY S N	DATE: JUNE 1963	9/17
APPROVED. H. T	SCALE: AS SHOWN	

DISTRIBUTION PIPE NETS

S 8
17-17
JSEC




Existing
1st Stage Project
2nd
3rd
DJATILHUL CANAL