(5) The scale of each purification plant shall be the respective quantity of water to be newly developed plus 10% of water necessary for the purification plant itself, and the facilities shall be operated 15 hours a day. Thus, the purification plants shall have the following capacities.

- West Purification Plant

$$25{,}622\ m^3/day \times 1.1 \times \frac{24}{15} = 45{,}095\ m^3/day$$

- East Purification Plant

$$10{,}944\ m^3/day \times 1.1 \times \frac{24}{15} = 19{,}260\ m^3/day$$

(6) The facilities of the purification plant shall be designed according to the facility standards of Japan, and its treatment flow shall be as follows:

Intake ⟶ Receiving well ⟶ Mixing basin ⟶ Flocculation basin ⟶ Coagulation basin ⟶ Filter basin ⟶ Clear water reservoir ⟶ Water transmission pump ⟶ Overhead tank.

(7) Since the raw water from the Sitalakhya River is thought to have high turbidity ranging between 80 and 150, suspended matter would have to be precipitated by injecting aluminum sulfate ($Al_2(SO_4)_3 18H_2O$) to remove turbidity. Filtration is planned at a daily rate of 120 m by the rapid filtration method. In the case of rapid filtration, bleaching powder will be used for disinfection by chlorine after filtration.

(8) The scale of each facility was determined on the basis of the following design: The water flow shall pass through the receiving well in 1.5 minutes at a velocity of 0.6 m/sec, through the

mixing basin of a detour channel type in 1.0 minute at a velocity of 1.6 m/sec, through the flocculation basin in 30 minutes at a velocity of 15 to 30 cm/sec and through the coagulation basin in three hours at a velocity of 15 to 20 cm/min. The rapid filtration basin shall have filtration rate of 120 m/day. The clear water reservoir that concurrently serves as the water transmission pump well shall have the capacity to store a two-hour supply of water to adjust the imbalance between the quantity of water filtered and the quantity of water conveyed due to the fluctuation in demand of water.

The sludge from the filter basin and coagulation basin shall be disposed of by discharging it into the river.

(9) The combined total capacity of the overhead tanks shall be about 20% of the estimated quantity of water supply, with 2 sets of 2,000 m^3 in capacity, 2 sets of 1,000 m^3 and 2 sets of 300 m^3 on the western side and 2 sets with 1,000 m^3 capacity on the eastern side.

(10) For distributing pipes, PVC pipes shall be used for pipes of 200 mm (8") or less in diameter and cast iron pipes for pipes of 250 mm or more in diameter.

Table Current Status, Condition of Water Supplying Facilities and Potable Water Supplying Facilities Plan in Both Districts of Narayanganj

Description			District	Western District	Eastern District
Current Status of Town			Location	Belongs to Dhaka Div., located on the west side (right bank) of the Sitalakhya River, about 20 km south-east of Capital City Dhaka.	Belongs to Dhaka Div., located on the east side (left bank) of the Sitalakhya River, about 20 km south-east of Capital City Dhaka.
			Population (estimated as of 1983)	263,000	87,000
			Size of Town Area	19.4 km^2	
			Major Industries	Being closer to Capital City Dhaka and therefore more covenient, population is larger than the Eastern District and branches of major government agencies are located. Comprises a commercial district.	Shipbuilding and light industries are developed along the Sitalakya River and small scale commercial districts are also located.
			Operating Condition of DPHE's Water Supplying Facilities	Water is being supplied even now, but facilities are remarkably time-worn. Due to sediment deposited in part of pipeline, passage of water is disrupted. Disorderly piping works caused shortage of hydraulic pressure and water volume in various places.	
Facilities Already Completed by DPHE			Purification Plant	One in operation. Water supply volume: 3,640 m^3/day	One in operation. Water supply volume: 796 m^3/day
	Production Well	Number		7	2 (another one is choked up)
		Caliver		ø 150 mm - 6 wells ø 200 mm - 1 well	ø 150 mm - 3 wells
		Depth		150 m on average	175 m on average (Depth of choked up well unknown)
		Daily Amount of Water Supply		4,941 m^3/day	1,645 m^3/day
	Pumping Equipment			Multi-stage turbine pump: 4 sets Submerged motor pump: 3 sets	Multi-stage turbine pump: 1 set Submerged motor pump: 2 sets
	Overhead Tank	Combined Capacity		2,010 m^3	1,190 m^3
		Structure x No. of sets		R.C. x 2 sets (1,590 m^3) Steel x 2 sets (420 m^3)	R.C. x 1 set (910 m^3) - Under Construction Steel x 4 sets (280 m^3)
	Distributing Pipe	Type of Pipe		Cast iron pipe and PVC pipe	
		Diameter		ø 25 mm to ø 400 mm	
		Total Extension		72 km	
	House Connection			3,205 households	
	Public Post			528 locations	
Contents of Drinking Water Supply Project			Projected 1990 Population	493,400	
			Estimated Population Supplied in 1990	356,000	114,000
			Estimated Daily Amount of Water Supply	25,622 m^3/day	10,944 m^3/day
	Purification Plant	No. of locations		One location	One location
		Contents of Facilities		1 receiving well, 4 mixing basins, 4 flocculation basins, 4 settling basins, 6 rapid filters, 2 clear water reservoirs	Same as left
		Volume of Water Treated		45,095 m^3/day	19,260 m^3/day
	Water Conveyance Pipe	Type of Pipe		Cast iron pipe	Cast iron pipe
		Pipe Diameter		ø 300 mm and ø 700 mm	ø 450 mm
		Total Extension		2,772 m	750 m
	Overhead Tank	Combined Capacity		6,600 m^3	2,000 m^3
		Capacity x No. of Sets		2,000 m^3 x 2 sets 1,000 m^3 x 2 sets 300 m^3 x 2 sets	1,000 m^3 x 2 sets
		Height		21.5 m	21.5 m
	Distributing Pipe	Type of Pipe		Cast iron pipe and PVC pie	Cast iron pipe and PVC pipe
		Pipe Diameter		ø 100 mm to ø 600 mm	ø 100 mm to ø 450 mm
		Total Extension		33,665 m	17,360 m
	House Connection			0	0
	Public Post			0	0

The part of the project cost to be borne by the Bangladesh Government will be 157 million TK and the annual maintenance and administration cost of these water supply facilities is estimated to be 16 million TK.

For construction, a period of 15 months is required, exclusive of the rainy season and flood season. When the time required for detailed working design, surveying, geological survey and tender is included, altogether 27.5 months are required after consummating the Exchange of Notes.

The execution of this project based on the results of survey and study will enable a stable supply of safe and clean potable water to the inhabitants of Narayanganj Town and thus contribute greatly to the stabilization and improvement of the living conditions of the inhabitants and to its public health environment. It is also expected to accelerate the development and growth of the rural towns. Thus, the implementation of this project is recognized to render sufficient results and therefore to be amply justifiable.

As the project implementation will be the responsibility of the Department of Public Health Engineering with Japanese Consultant and Construction Firm executing construction, DPHE is required to asssign its full-time counterpart staff to Narayanganj Town for construction work supervision and operation and maintenance of water supply facilities.

Lastly the Government of the People's Republic of Bangladesh is strongly requested to take prompt action for the acquisition of construction sites, various procedures necessary for importing materials and equipment, budget appropriations to cover expenses, all of which are to be undertaken by it in implementing this project.

THE BASIC DESIGN REPORT ON

THE ESTABLISHMENT PROJECT

FOR

WATER SUPPLY FACILITIES IN

THE PEOPLE'S REPUBLIC OF BANGLADESH

(NARAYANGANJ TOWN)

TABLE OF CONTENTS

LIST OF DRAWINGS

ABBREVIATIONS

GOB	:	Government of Bangladesh
GOJ	:	Government of Japan
M.L.G.R.D.C. & R.A.	:	Ministry of Local Government, Rural Development, Cooperatives and Religious Affairs
L.G. Div.	:	Local Government Division
DPHE	:	Department of Public Health Engineering
WASA	:	Water and Sewage Authorities
EPCB	:	Environment Pollution Control Board
CE	:	Chief Engineer
SE	:	Superintending Engineer
EE	:	Executive Engineer
SDE	:	Sub-Divisional Engineer
SAE	:	Sub-Assistant Engineer
G.W. & E.	:	Ground Water & Exploration
SIR	:	Survey, Investigation & Research
P&C	:	Programme & coordination
V.S.	:	Village Sanitation
ADB	:	Asian Development Bank
UNICEF	:	United Nations Children's Fund (former United Nations INternational Children's Emergency Fund)
WHO	:	World Health Organization
W/S Scheme	:	Water Supply Scheme

EXCHANGE TABLE

1 in = 25.4 mm

1 ft = 12 in = 30.48 cm

1 yd = 3 ft = 91.44 cm

1 mile = 1,760 yd = 5,280 ft = 1.60934 km = 1,609.34 m

1 acre = 43,560 ft^2 = 4,046.86 m^2 = 40,4686 a = 0.00405 km^2

1 $mile^2$ = 640 acre = 25,899.9 a = 2.58999 km^2

1 ft^2 = 144 in^2 = 0.09290 m^2

1 in^2 = 6.4516 cm^2

1 yd^2 = 9 ft^2 = 0.83613 m^2

1 gal (1 mp. British) = 4.54596 liters = 0.00455 m^3

1 oz (ounce) = 28.3495 g

1 lb (pound) = 16 oz = 453.592 g = 0.45359 kg

1 long ton (British ton) = 1.01605 t

1 short ton (American ton) = 0.90718 t

gpcd : gallons per capita (per) day

gpd : gallons per day

lakh : 100,000 (one hundred thousand)

crore : 10,000,000 (ten million)

lac : lakh

CHAPTER 1 INTRODUCTION

The Government of Bangladesh is exerting efforts to improve and promote social welfare and public health so that its people might enjoy a healthy and civilized life. A part of its efforts as a result is being directed to implementing water supply improvement projects with the objective of supplying safe and clean potable water to the urban dwellers. In the two major cities of Dhaka and Chittagong, the Water and Sewage Authorities (WASA) is in charge of implementing the water supply projects with the assistance of the World Bank while in the other district towns and sub-divisional towns (which are now district towns, too), the Department of Public Health Engineering (DPHE) is undertaking those projects. There are altogether 66 district towns and sub-divisional towns combined, excluding Dhaka and Chittagong, and for these towns, DPHE has formulated 10 projects which it is now implementing. For six of these projects, the Netherlands and the Asian Development Bank (ADB) have decided to give their assistance while on one other project, DPHE is sounding out Denmark and Sweden in the hope of gaining their assistance. As for the other three projects, the Government of Bangladesh started out to execute them by its own funds, but because of financial difficulties it has become difficult to implement them according to plan. As a matter of fact, there is no prospect whatsoever that any of them would be completed by the initially scheduled target years. Because of this, the Government of Bangladesh has requested the Government of Japan for its cooperation in the form of grants in aid for the 27 Sub-Divisional Towns Water Supply Project which is one of the three projects which the Government of Bangladesh began implementing by its own funds.

In response to this request, the Government of Japan has decided to conduct a preliminary study, and the Japan International Cooperation Agency dispatched a Preliminary Study Mission to Bangladesh to confirm the contents of this request as well as conduct a survey and study of the project background, and the appropriateness of taking it up as a grants in aid program. The Mission has discussed the project with the concerned authorities of the Government of Bangladesh and has also collected relevant data and conducted field reconnaissance at four of the towns which had been selected from those covered by this project during the period from January 10 through January 27, 1984.

During this preliminary study, the Government of Bangladesh has requested Japan's cooperation on two additional projects, namely:

(1) Narayanganj Town Water Supply Project (which is one of the three projects which the Government of Bangladesh is implementing by its own funds)

(2) Sanitary Facilities Improvement Project

The water supply scheme for Rangamati town is politically a high priority project in terms of its being a countermeasure for the minority races and other reasons, but as of now, the Government of Bangladesh seems to have determined to implement the scheme by its own funds instead of counting on any foreign aid.

After a series of discussions held with the concerned authorities of the Government of Bangladesh and selecting eight towns to be taken up for basic design survey, the Mission has signed the minutes of the meeting.

The Government of Japan has had the Japan International Cooperation Agency conduct a basic design study of the eight towns based on the results of the preliminary survey. The Basic Design Study Team was in Bangladesh from April 1, 1984, through June 12, 1984, and during this time it has collected data, carried out observations and conducted field reconnaissance which were necessary for developing the basic design for the eight towns selected in the preliminary study. It has also held consultations with the concerned authorities of the Government of Bangladesh. After returning to Japan, the team has made an analytical study of the hydrogeographic and hydrographic data collected and put together its basic design survey report as hereunder.

The eight towns for which the basic design was developed this time are as follows:

(1) Narayanganj
(2) Narsingdi
(3) Jenidah
(4) Chuadanga
(5) Gaibandha
(6) Kurigram
(7) Feni
(8) Sunamganj

This report summarizes the water supply plan for Narayanganj Town. The report on the other seven towns has been compiled in a separate volume.

CHAPTER 2 PROJECT BACKGROUND

Since the prevalent state of drinking water supply, waterworks administration, system, and contents and implementation status of the drinking water supply program in Bangladesh as a whole are detailed in a separate report (on seven towns), these have been omitted here.

2-1 Conditions of Existing Water Supply Facilities

A drinking water supply system is already in operation in Narayanganj Town. Most of the water supplying facilities which are being used now were constructed during the days of British rule and when the country was still called East Pakistan. These facilities are extremely timeworn and some of the distributing pipes are jammed with sediments so that water is unable to pass through them. To cope with the yearly growing water consumption the distributing pipes in the jammed sections are either being replaced or being constructed anew. Partly because these construction works are being executed without preparing a master plan based on forecast future demand and partly because of a disorderly distributing system, these facilities lack adequate water pressure and because in some areas the pipe diameters are not large enough, they are unable to cope with demand.

The currently operating water supplying facilities are as outlined below.

(a) Currently operating production wells: 9

(b) Currently chocked up production wells: 1

(c) Purification plant for treating river water:
At 2 locations

(d) Daily quantity of water supply:

From production wells:	6,556 m³
From purification plants:	4,436 m³
Total	10,992 m³

(e) Distributing system

Total length of pipeline:	72 km
Currently in service:	35 km
Timeworn or unusable:	37 km

(f) Overhead tank

RCC overhead tank:	3 sets with combined capacity of 2,500 m³
Steel overhead tank:	7 sets with combined capacity of 700 m³
Total	10 sets with combined capacity of 3,200 m³

(g) Number of house connection: 3,205 houses

(h) Public post: At 528 spots

(i) Hand pump: At 931 spots

The principal particulars of production wells, pumps and other facilities are as presented in Table 2-1, the plan of the existing water supply facilities is as presented in Fig. 2-1, the plan of the facilities of the existing purification plants is as presented in Fig. 2-2 (western district) and in Fig. 2-3 (eastern district).

Through these facilities, 10,992 m^3/day of water is being supplied, which is equivalent to water consumption of about 115 thousand people, indicating a water supply pervation of 32.7% to Narayanganj Town's current population of 350,000.

Table 2-1 Existing Waterworks Facilities in Narayanganj Town

Item \ No.	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10		
Production Well												
1. Location	Chasara	Tularam College	DEW BH06H	Paik Para	Netaiganj	Kumidire Well Fare Trust	Khanpur	Marine Diesel Training Institute	Ekrampur	Kadam Rosul		
2. Dia.	14" x 8"	15" x 6"	12" x 6"	12" x 6"	12" x 6"	12" x 6"	12" x 6"	12" x 6"	15" x 6"	12" x 6"		
3. Depth	580' - 0"	600' - 7"	232' - 6"	580' - 0"	600' - 0"	650' - 0"	600' - 0"	650' - 0"	512' - 0"	?		
4. Strainer Length	?	100'	60'	100'		100'	60'	100'	100'	50'		
5. Yield	20,000 igph	10,000 igph	20,000 igph	20,000 igph	30,000 igph	20,000 igph	5,000 igph	20,000 igph	10,000 igph	5,000 igph		
6. Date of Construction	1974	1983	1979	1961	1970	1978	1982	1970	1983	1978		
7. Pumping Test												
Yield	20,000 igph	10,000 igph	20,000 igph	20,000 igph	30,000 igph	20,000 igph	5,000 igph	20,000 igph	10,000 igph	5,000 igph		
Static W. Level	25' - 0"	23' - 0"	13' - 10"	18' - 11"	22' - 5"	19' - 3"	21' - 8"	18' - 3"	21' - 0"	21' - 0"		
Drawdown	52' - 6"	42' - 3"	49' - 10"	51' - 11"	45' - 0"	38' - 2"	69' - 8"	41' - 1"	37' - 0"	43' - 8"		
Pump Facilities												
1. Type of Pump	EMU Subm-Pump	B7B T.P	B8D T.P	Subm-P	B10D T.P	B8D T.P	Subm-P	Subm-P	B7B T.P	Subm-P		
2. Stage	2	?	?									
3. Maker		KSB	KSB	KSB	KSB	KSB	KSB	KSB	KSB	KSB		
4. Dia of Pump	?											
5. Pump Capacity												
6. Total Head	130' - 0"	150' - 0"	120' - 0"	120' - 0"	120' - 0"	150' - 0"	130' - 0"	130' - 0"	150' - 0"	130' - 0"		
7. Prime Mover	Subm-motor	Motor	Motor	Motor	Motor	Motor	Motor	Motor	Motor	Motor		
8. HP	15 HP	14.5 kW	30.5 HP	20 HP	35 HP	30 HP	7.5 HP	20 HP	15 HP	7.5 HP		
9. rpm	2,900	1,450	1,450	2,900	1,450	1,460	2,900	2,900	1,450	2,900		
10. Sluice Valve	6" x 1	6" x 1	6" x 1	8" x 1	6" x 1	6" x 1	6" x 1		6" x 1	6" x 1		
11. No-Return Valve	6" x 1	6" x 1	6" x 1	8" x 1	6" x 1	6" x 1	6" x 1		6" x 1	6" x 1		
Pump House	21.6 m^2	14.8 m^2	24.7 m^2	37.5 m^2	23.6 m^2	28.3 m^2	14.1 m^2	22.4 m^2	15.0 m^2	28.1 m^2	(Bani Cinema)	(Nabiganj)
Overhead Tank	x	x	RCC	x	Steel	x	RCC	x	x	RCC	Steel	Steel
1. Capacity			150,000 gal.		45,000 gal.		200,000 gal.			200,000 gal.	50,000 gal.	12,000 gal.
2. Height			65'		40'		65'			65'	40'	40'
3. Date of Construction			?		?		?			Under-construction	?	?

Pipelines

1"	200' - 0"	10"	670' - 0"
1-1/2"	10,625' - 0"	12"	3,666' - 0"
2"	18,200' - 0"	16"	6,566' - 0"
3"	19,300' - 0"		
4"	34,191' - 0"		
6"	56,158' - 0"	Total:	161,916' - 0"
8"	12,340' - 0"		(30.7 miles)
10"	670' - 0"		

*Present supply volume

by Water Treatment Plants
(East) 796 m^3/day
(West) 3,640 "
Sub-Total: 4,436 m^3/day

by Wells
(East) 819 m^3/day
(West) 5,737 "
Sub-Total: 6,556 m^3/day

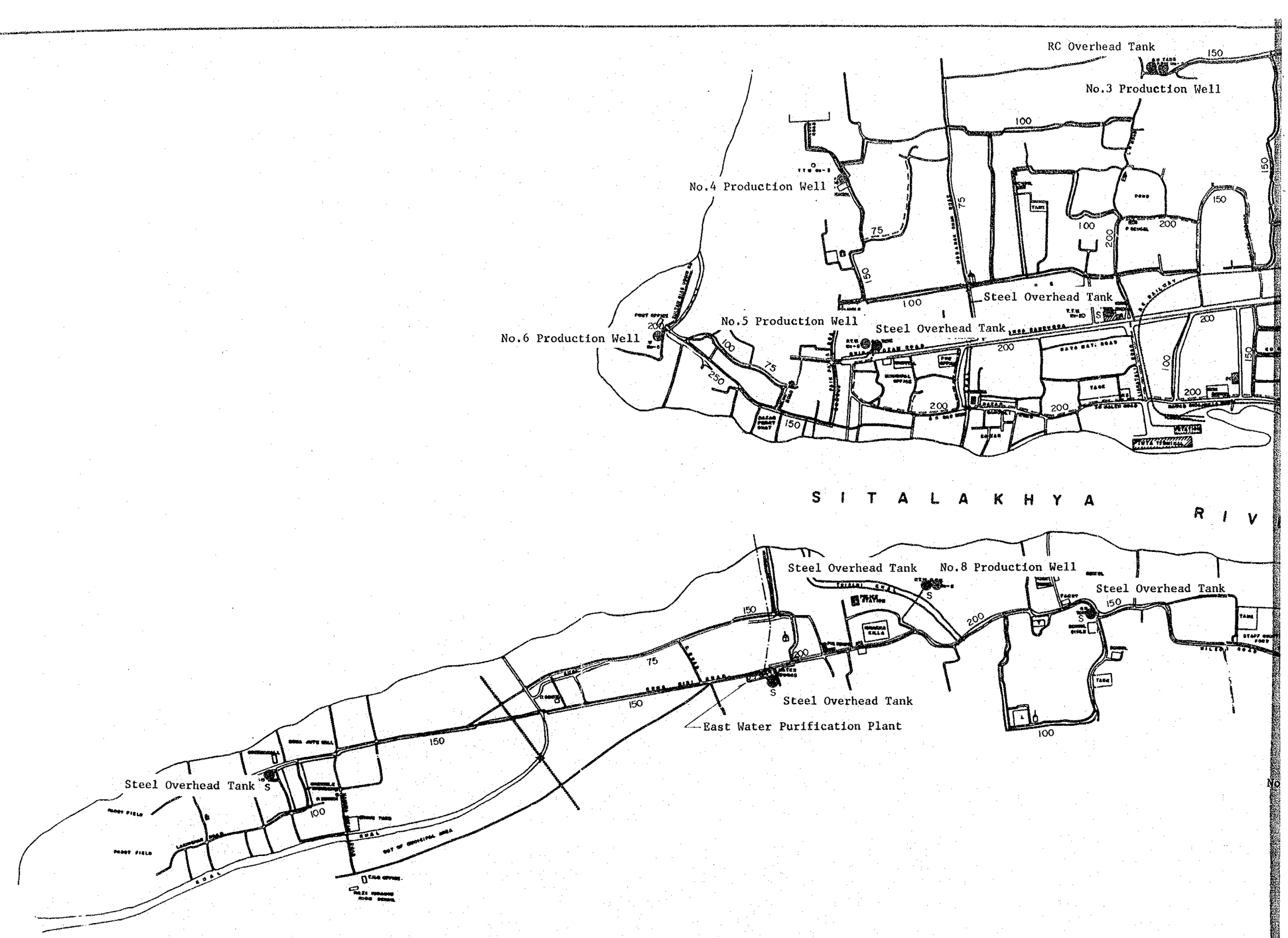
Total: 10,992 m^3/day

Overhead Tank	(Godnail)	(Bandar)	(Modanganj)	(Sanakand)
1. Capacity	15,000 gal.	8,000 gal.	12,000 gal.	15,000 gal.
2. Height	40'	40'	40'	40'
3. Date of Construction	?	1936	?	?
4. Structure	Steel	Steel	Steel	Steel

Related Structions

1. Sluice Valve	?
2. Air Valve	-
3. Wash-out	10 Nos

House Connection	3,205 Nos
Public Post	528 Nos


RC Overhead Tank
No.3 Production Well
No.4 Production Well
Steel Overhead Tank
No.5 Production Well
Steel Overhead Tank
No.6 Production Well
S I T A L A K H Y A
R I V
Steel Overhead Tank
No.8 Production Well
Steel Overhead Tank
Steel Overhead Tank
East Water Purification Plant
Steel Overhead Tank

d Tank

Production Well

No.1 Production Well

No.2 Production Well

No.7 Production Well

RC Overhead Tank

RIVER

Steel Overhead Tank

Steel Overhead Tank

Steel Overhead Tank

RC Overhead Tank

No.9 Production Well

No.10 Production Well

Steel Overhead Tank

West Water Purification Plant

L E G E N D

; WATER PURIFICATION PLANT(WPP)

: PRODUCTION WELL

; OVERHEAD TANK

; OVERHEAD TANK UNDERCONSTRUCTION

; TRANSMISSION PIPE Ø400 mm,from WPP

; DISTRIBUTION PIPE Ø300 mm

; do. Ø250 mm

; do. Ø200 mm

; do. Ø150 mm

; do. Ø100 mm

; do. Ø 75 mm

; TRANSMISSION PIPE,from Intake to WPP

; DAMAGED PART OF DISTRIBUTION PIPE

GRAPHIC SCALE

DIRECTORATE OF PUBLIC HEALTH ENGINEERING
GOVERNMENT OF BANGLADESH

NARAYANGANJ

GENERAL PLAN OF EXISTING WATER SUPPLY FACILITIES

Date: Dec. 1984 | Drawing No:

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 2-1

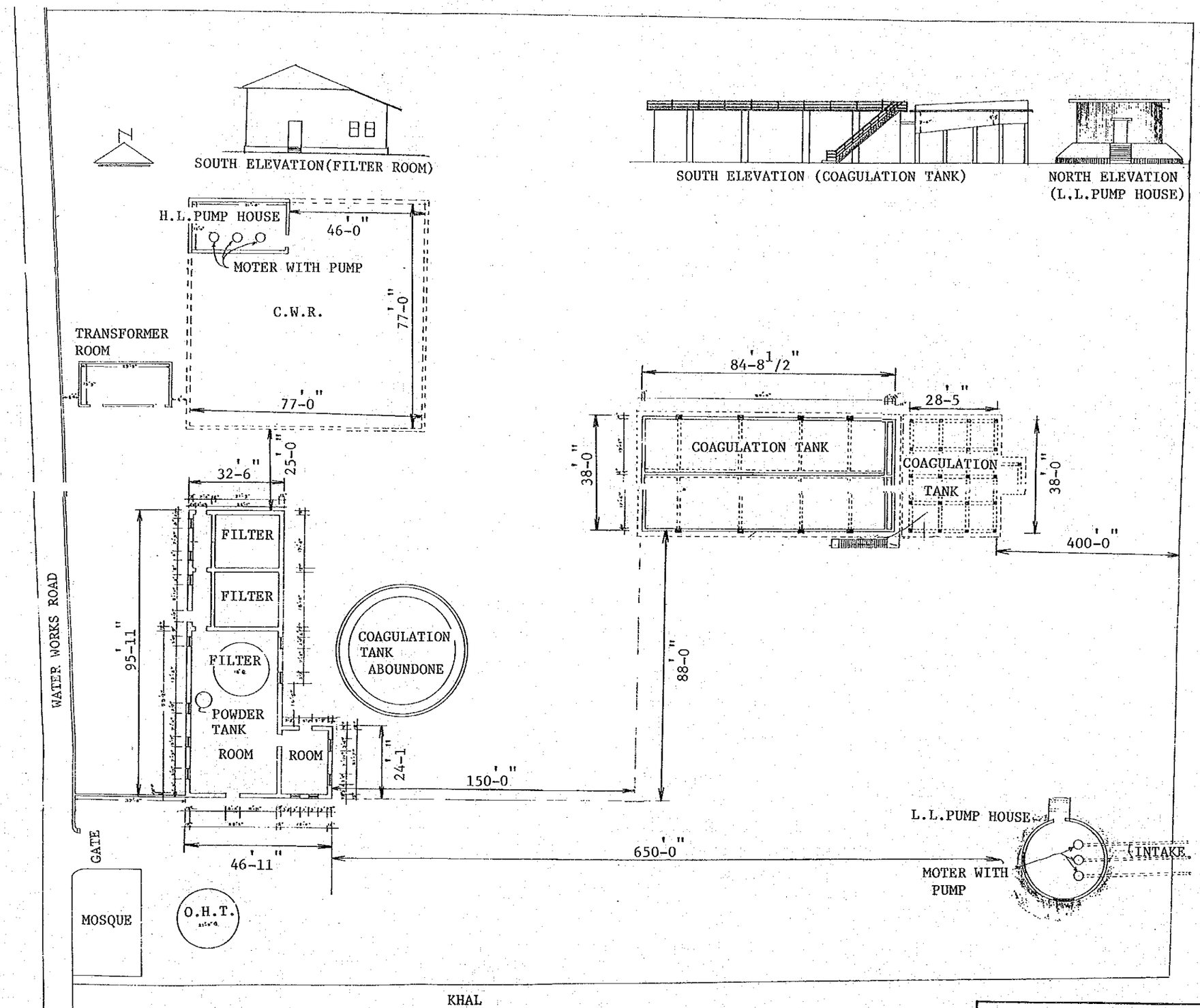
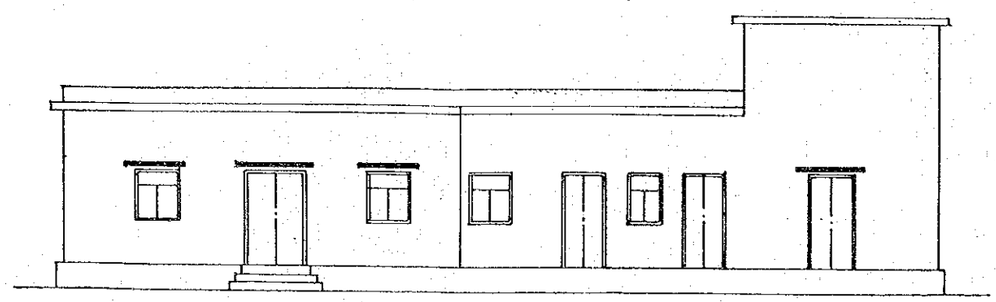
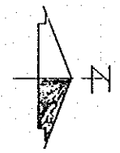


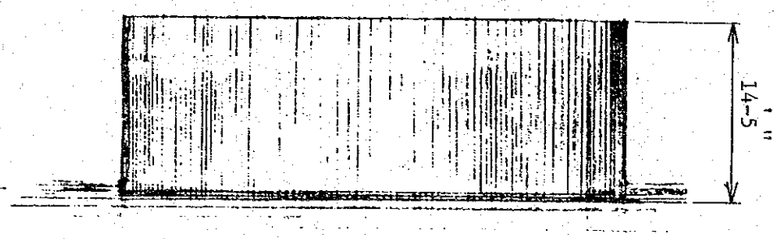
Fig. 2-2

Existing Water Purification Plant
of Narayanganj West Town

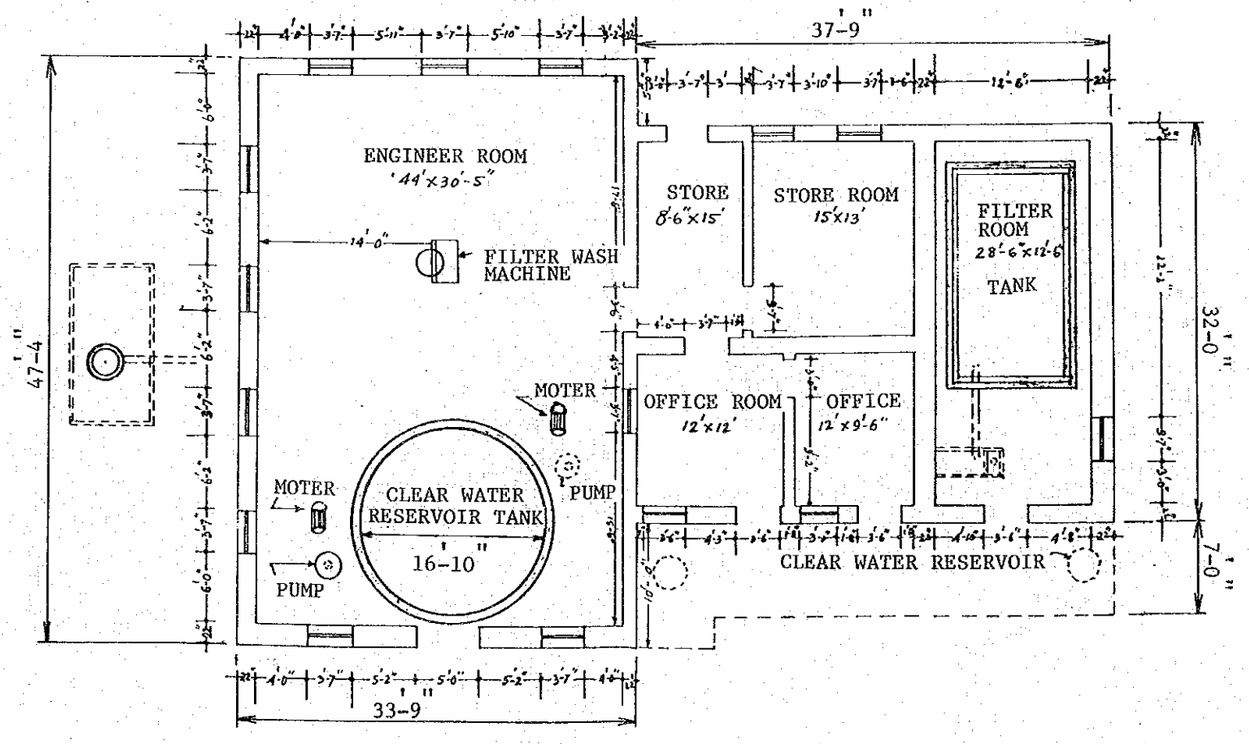


EAST ELEVATION





ELEVATION



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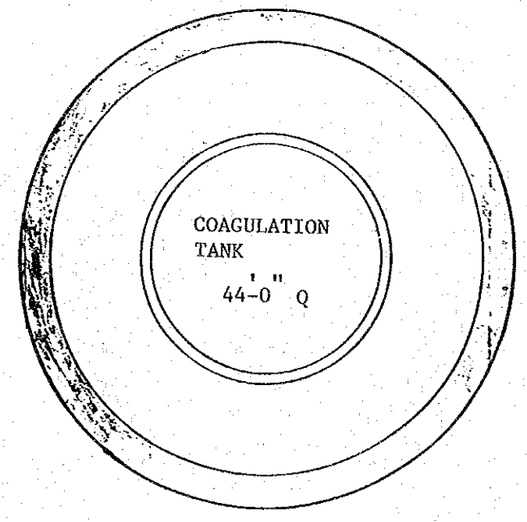

Fig. 2-3

Existing Water Purification Plant
of Narayanganj East Town

2-2 Contents of the Project Currently under Way

DPHE has planned and is constructing for Narayanganj Town six production wells, a pump house and pump equipment at six locations, distributing line extension work of 14.4 km (9 miles) and one overhead tank (1,000 m^3) aiming for completion in the 1980-85. When these are completed, 12,600 m^3/day of water supply including the quantity by the existing facilities will be secured. The project cost is 15 million TK. If the construction of this project should progress and be finished on schedule, the potable water supply system is expected to be able to cover almost 40% of current population.

Narayanganj Town's population today is 350,000 and the quantity of water supply is 10,992 m^3/day with a coverage of 32.7%.

The construction work being implemented at the present time by the DPHE aims to improve the water supply pervasion rate slightly (about 5%) by replacing the timeworn pipes and other minor works.

2-3 Needs for This Project

As stated above, the construction work now under way is not based on any plan that envisages the future population growth or trend of demand for water. Under the circumstances, many problems such as insufficient pressure, insufficient pipe diameter, impossibility of executing appropriate expansion and rehabilitation work, etc., are taking place in connection with the implementation of the water supply service.

The primordial role the running water service is assigned is the permanent and stable supply of potable water, and in this connection it is necessary to carry out the expansion and repair works always based on well planned schemes taking into consideration the changes in the future demand of water, because if not an efficient and economical operation of the system will be impossible.

Narayanganj Town is a municipality that boasts having the fourth largest population in Bangladesh. Being near Dhaka, the capital city, it has many industries including light industry and shipbuilding, warehousing, etc., and occupies a strategic position in the inland water transportation network. Because of socially and economically important position of the town, it has been considered desirable to implement a systematic construction program by developing a potable water supply master plan based on a forecast of future demand, and preparing a rehabilitation program including the reorganization and consolidation of distributing pipeline networks which had been laid since the time of British rule and when the country was still a part of East Pakistan.

It was against such a backdrop that the cooperation in the form of grants to the water supply scheme of Narayanganj Town was additionally requested locally during the preliminary study for which the basic design study was conducted.

Results of the investigations carried out in connection with the existing water supply facilities of Narayanganj Town during the basic design study reveal that the facilities are conspicuously timeworn and that the scale of the existing facilities is too small compared with the future plan. Thus, it is concluded that a mere improvement of the system by rehabilitation of the facilities is insufficient, being therefore necessary to consider a plan for full-scale improvement of the facilities to cope with the water-supply needs of the town.

CHAPTER 3 OUTLINE OF THE PROJECT AREA

3-1 Location and General Conditions

Narayanganj Town is located about 20 km southeast of Dhaka, the capital of Bangladesh, and belongs to Narayanganj District of Dhaka Division. Narayanganj District consists of five Upazillas, one of which is Narayanganj Sadar Upazilla which consists of ten Unions and one Poroushoava, and this Poroushoava is Narayanganj Town. (Refer to Annex I for local administration units.)

At the time of the 1974 census, the town's population was 196,879, which grew to 298,359 in 1981 at an annual rate of 6.1%. The population in 1983 is estimated to have reached 350,000.

The town has an area of 19.4 km^2 (7.5 $miles^2$) which is divided into east and west by the Sitalakhya River. The western side of the town is comprised of major government offices and the commercial district with a well developed transport network of railways and bus services. Thus comprising the principal part of town, the population is about 263,000 or 75% of the town's total population. On the eastern side of the town are such major industries as shipbuilding and light industries developed along the Sitalakhya River and a scattering of small scale commercial and residential areas and farm houses here and there. The population on this side is about 87,000. Narayanganj is also an important port of inland water transportation.

3-2 Natural Condition

(1) Topography

The territory of Bangladesh presents a typical deltaic topography formed by sediments carried by three major rivers, Ganges, Jamuna and Megna.

Narayanganj Town, the project area, having topographical peculiarities typically representing Bangladesh, is located in the delta formed by the Jamuna River and the Megna River, it has a flat topography with practically no differences in altitude which averages approximately 6 m.

Narayanganj is located at the southern extremity of the Central Plateau leading to Mymensingh and Dhaka, and is 20 km southeast of Dhaka. Being located on the right bank of the Sitalakya River, tributary of the Megna River, the central area of Narayanganj has developed since old times as a strategic part of the inland fluvial transportation network, and its street areas and villages are distributed from the shore of the Sitalakhya River to the outskirts of the town. They are located on localities with relatively high elevation, such as natural embankments, terraces on the banks of the river, plateaus, etc., that do not become flooded even in the rainy season (June to October).

The project area is divided in two parts by the Sitalakhya River that flows between them, the western district located at the right bank and the eastern district located at the left bank. The arterial road and railway leading to Dhaka and the fluvial navigation network leading to the main localities are located in the western district, which is an area provided with the essential urban infrastructure. On the other hand, the eastern district is generally being in terms of development, with exception of