2.2.3 Proposed Facilities

The details of the facilities for Northeast and Kafr Saqr Plants are described in Table-2.2.5, and drawings for the major facilities are attached.

Table-2.2.5 PROPOSED TREATMENT FACILITIES

Treatment Plant / Item	Northeast Plant (90,000 m3/d) Description	First* Stage	Second* Stage	Kafr Saqr Plant (60,000 m3/d) Description	First* Stage	Second** Stage
1. Intake facilities	Intake gate W 0.8m x H 1.2m x 2 units Screen, Concrete block, and Intake conduit	2 units LS	-	Intake gate W0.6m x H 1.2m x 2 units Screen, Flash board, Concrete block, and Intake conduit	2 units LS	-
2. Junction well	RC made W 4.0m x L 4.0m x H3.0m x 1 unit	1 unit	-	RC made W 3.3m x L3.3m x H3.0m x 1 unit	1 unit	-
3. Raw water pumping well	RC made W 3.0m x L 30.0m x H 3.0m x 1 unit	1 unit	-	RC made W 3.0m x L 30.0m x H 3.0m x 1 unit	1 unit	-
4. Distribution Well	RC made W 6.0m x L 9.0m x H 4.4m x 1 unit Breadth of weir: 12.8m	1 unit	-	RC made W 5.0m x L 8.0m x H 4.4m x 1 unit Breadth of weir: 9.8m	1 unit	-
5. Mixing well	RC made W 4.5m x L 8.2m x H 3.5m x 2 units Breadth of weir: 9.0m Waterfall mixing Detention time: 3.8 min	1 unit	1 unit	RC made W 3.5m x L 7.4m x H 3.5m x 2 units Breadth of weir: 7.0m Waterfall mixing Detention time: 4.0 min	1 unit	1 unit

(Note): * First Stage: Stage of the first priority phase program
Northeast Plant: 45,000 m3/d, Kafr Saqr Plant: 30,000 m3/d

** Second Stage: Stage of the succeeding programs to meet the demand of the year 2005.

Treatment Plant / Item	Northeast Plant			Kafr Saqr Plant		
	Description	First Stage	Second Stage	Description	First Stage	Second Stage
6. Flocculation basin	RC made Baffled channel type (340 m3, H3.0m) x 4 units Detention time: 20 min	2units	2units	RC made Baffled channel type (230 m3, H3.0m) x 4 units Detention time: 30 min.	2units	2units
7. Sedimentation basin	RC made Rectilinear flow type W16.4m x L72.0m x H3.5m x 4 units Bridge type travelling sludge scraper Detention time: 4 hrs Velocity: 30cm/min Overflow rate: 21 m/d Effluent Trough: 309 m3/d/m	2units	2units	RC made Rectilinear flow type W11.0m x L72.0m x H3.5m x 4 units Bridge type travelling sludge scraper Detention time: 4 hrs Velocity: 30 cm/min Overflow rate: 21 m/d Effluent Trough: 330 m3/d/m	2units	2units
8. Filter	RC made Gravity type Rapid sand filtration 70 m2/unit x 12 units Thickness of sand layer: 60 cm Thickness of gravel layer: 70cm Perforated pipe underdrain system Backwashing and surface washing Constant flow rate control	6units	6units	RC made Gravity type Rapid sand filtration 50 m2/unit x 12 units Thickness of sand layer: 60cm Thickness of gravel layer: 70cm Perforated pipe underdrain system Backwashing and surface washing Constant flow rate control	6units	6units
9. Chlorination chamber	RC made W 4 m x L8.3m x H4.0m x 1 unit	1unit	-	RC made W4.3m x L8.6m x H4.0m x 1 unit	1unit	-

Treatment Plant / Item	Northeast Plant			Kafr Saqr Plant		
	Description	First Stage	Second Stage	Description	First Stage	Second Stage
10. Reservoir	RC made Storage capacity: 15,600m3 (6 hrs of max day demand) W40.9m x L50.1m x H4.0m x 2 units	1unit	1unit	RC made Storage capacity: 11,600m3 (6 hrs of max day demand) W28.0m x L56.5 x H4.0m x 2 units	1unit	1unit
11. Pump station	1,000m2 Raw water pump: Horizontal Sprit-case double suction volute pump ø400mm x 17m3/min x 15m x 75kW x 980rpm x 380V x 6 units	3units	3units	1,000m2 Raw water pump: Horizontal Sprit-case double suction volute pump ø350mm x 11.5m3/min x 15m x 45kW x 980rpm x 380V x 6 units	3units	3units
	Distribution pump: Horizontal Sprit-case double suction volute pump ø400mm x 18m3/min x 60m x 260kW x 980rpm x 3,300V x 5 units	3units	2units	Distribution pump: Horizontal Sprit-case double suction volute pump ø300mm x 12.5m3/min x 60m x 190kW x 980rpm x 3,300V x 5 units	3units	2units
	ø300mm x 9m3/min x 60m x 150kW x 1,450rpm x 3,300V x 2 units	2units	-	ø250mm x 7m3/min x 60m x 132kW x 1,450rpm x 3,300V x 2 units	2units	-
	Backwash pump: Horizontal Sprit-case double suction volute pump ø300mm x 9.8m3/min x 15m x 37kW x 1,450rpm x 380V x 2units	2units	-	Backwash pump: Horizontal Sprit-case double suction volute pump ø300mm x 9.5m3/min x 15m x 37kW x 1,450rpm x 380V x 2 units	2units	-

Treatment Plant / Item	Northeast Plant			Kafr Sagr Plant		
	Description	First Stage	Second Stage	Description	First Stage	Second Stage
	Surface wash pump: Horizontal Sprit-case double suction volute pump ø350mm x 14m3/min x 20m x 75kW x 1,450rpm x 380V x 2 units	2units	-	Surface wash pump: Horizontal Sprit-case double suction volute pump ø300mm x 10m3/min x 20m x 55kW x 1,450rpm x 380V x 2 units	2units	-
12. Distribution pumping well	RC made W3.0m x L50.0m x H4.0m x 1 unit	1 unit	-	RC made W3.0m x L50.0m x H4.0m x 1 unit	1 unit	-
13. Backwash tank	RC made Storage capacity: Backwash amount for 1 filter unit x 1.3 (Allowance): 400m3 W14.2m x L14.2m x H2.0m x 1 unit	1 unit	-	RC made Storage capacity: Backwash amount for 1 filter unit x 1.3 (Allowance): 300m3 W12.2m x L12.2m x H2.0m x 1 unit	1 unit	-
14. Wastewater basin	RC made W8.0m x L16.6m x H3.0m x 2 units	2units	-	RC made W8.0m x L12.5m x H3.0m x 2 units	2units	-
	Vertical agitator Wastewater pump: Sludge pump ø200mm x 7.5m3/min x 7m x 18.5kW x 4 units	4units	-	Vertical agitator Wastewater pump: Sludge pump ø200mm x 5m3/min x 6m x 11kW x 4 units	4units	-
15. Office	2,750m2 Office and Laboractory	LS	-	1,650m2 Office and Laboratory	LS	-

Treatment / Item	Northest Plant			Kafr Saqr Plant		
	Description	First Stage	Second Stage	Description	First Stage	Second Stage
16. Chemical building	1,200m2 Alum building and Chlorine building	LS	-	895m2 Alum building and Chlorine building	LS	-

Drawing List

No.	Title	Plant
2.2.3	General Plan	Northeast Plant
2.2.4	General Plan	Kafr Saqr Plant
2.2.5	Water Level Diagram	Northeast Plant
2.2.6	Water Level Diagram	Kafr Saqr Plant
2.2.7	Intake Facilities	Northeast Plant
2.2.8	Junction Well	"
2.2.9	Pumping Well	"
2.2.10	Distribution Well	"
2.2.11	Mixing Well and Flocculation Basin	"
2.2.12	Plan of Sedimentation Basin	"
2.2.13	Section of Sedimentation Basin	"
2.2.14	Plan of Filter	"
2.2.15	Detail of Filter	"
2.2.16	Section-A of Filter	"
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2.2.18	Reservoir	"
2.2.19	Wastewater Basin	"
2.2.20	Plan of Pumping Station	"
2.2.21	Section of Pump Station	"
2.2.22	Alum Feed System Flow Diagram	"
2.2.23	Plan of Alum Building	"
2.2.24	Section of Alum Building	"
2.2.25	Chlorination System Flow Diagram	"
2.2.26	Neutralization System Flow Diagram	"
2.2.27	Chlorine Building	"
2.2.28	Intake Facilities	Kafr Saqr Plant
2.2.29	Junction Well	"
2.2.30	Pumping Well	"
2.2.31	Dividing Well	"

No.	Title	Plant
2.2.32	Flocculation Basin	Kafr Saqr Plant
2.2.33	Plan of Sedimentation Basin	"
2.2.34	Section of Sedimentation Basin	"
2.2.35	Plan of Filter	"
2.2.36	Details of Filter	"
2.2.37	Section-A of Filter	"
2.2.38	Section-B of Filter	"
2.2.39	Reservoir	"
2.2.40	Wastewater Basin	"
2.2.41	Plan of Pump Station	"
2.2.42	Section of Pump Station	"
2.2.43	Alum Feed System Flow Diagram	"
2.2.44	Plan of Alum Building	"
2.2.45	Section of Alum Building	"
2.2.46	Chlorination System Flow Diagram	"
2.2.47	Neutralization System Flow Diagram	"
2.2.48	Chlorine Building	"

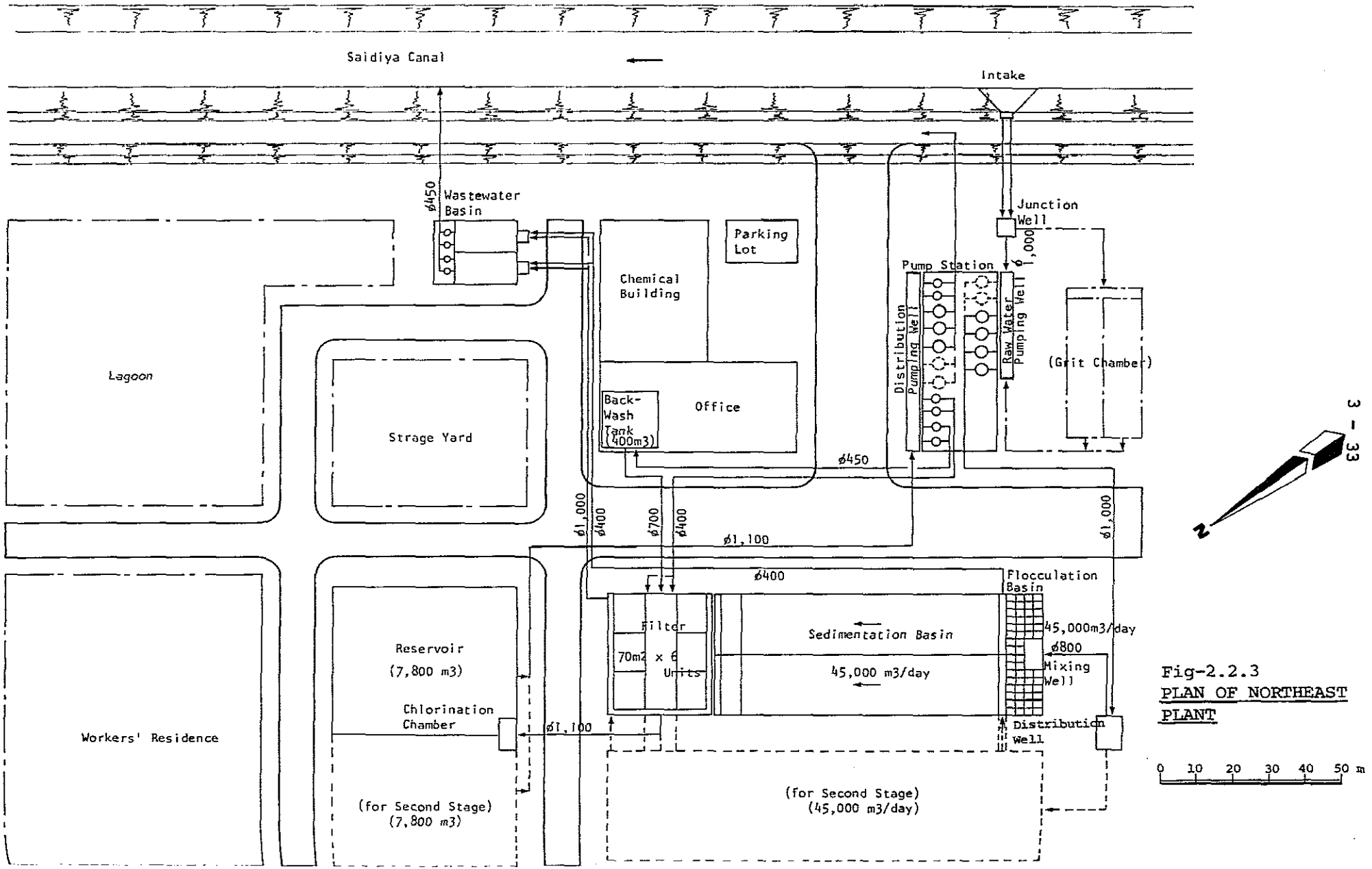


Fig-2.2.3
PLAN OF NORTHEAST PLANT

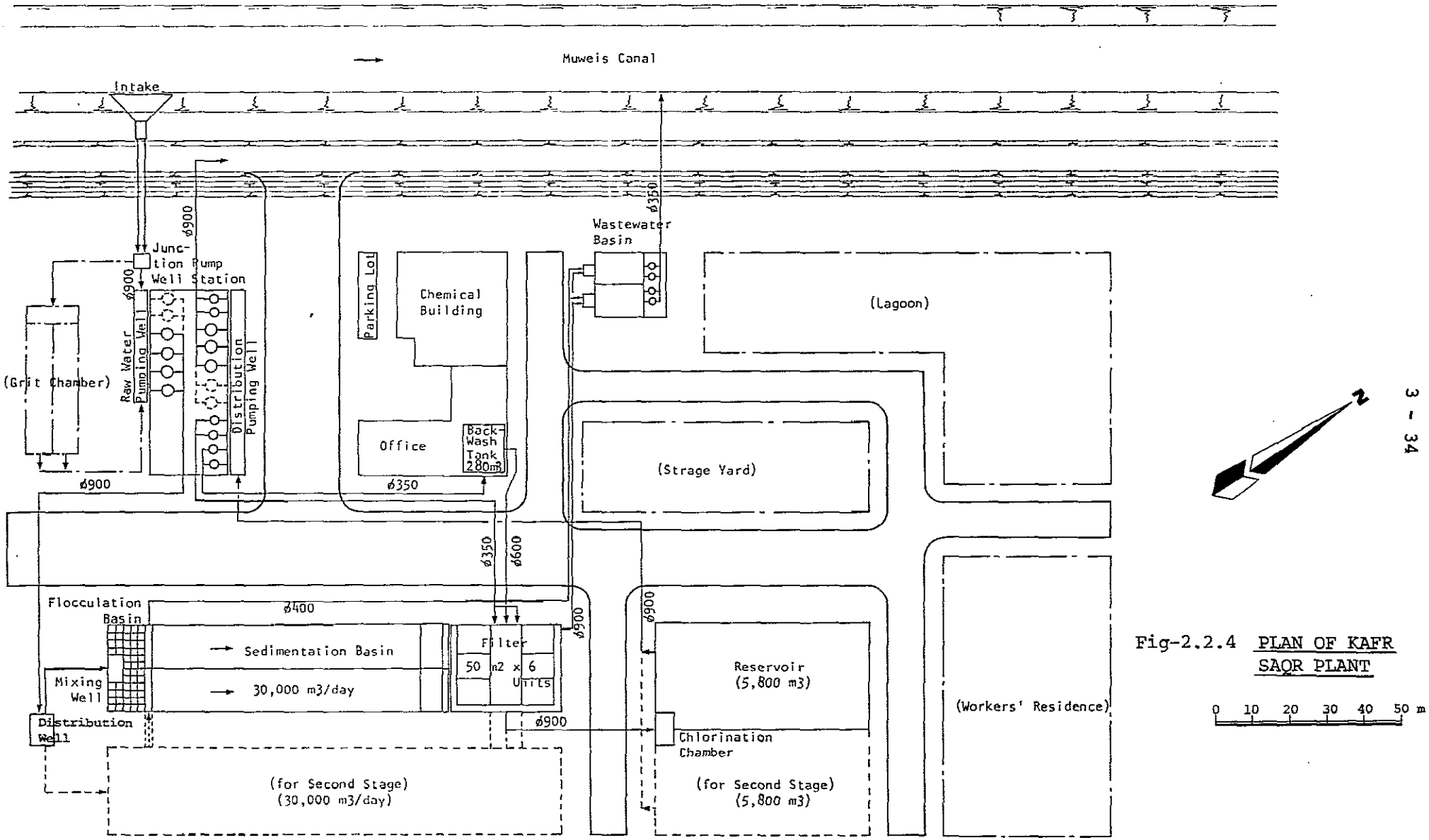


Fig-2.2.4 PLAN OF KAFR SAQR PLANT

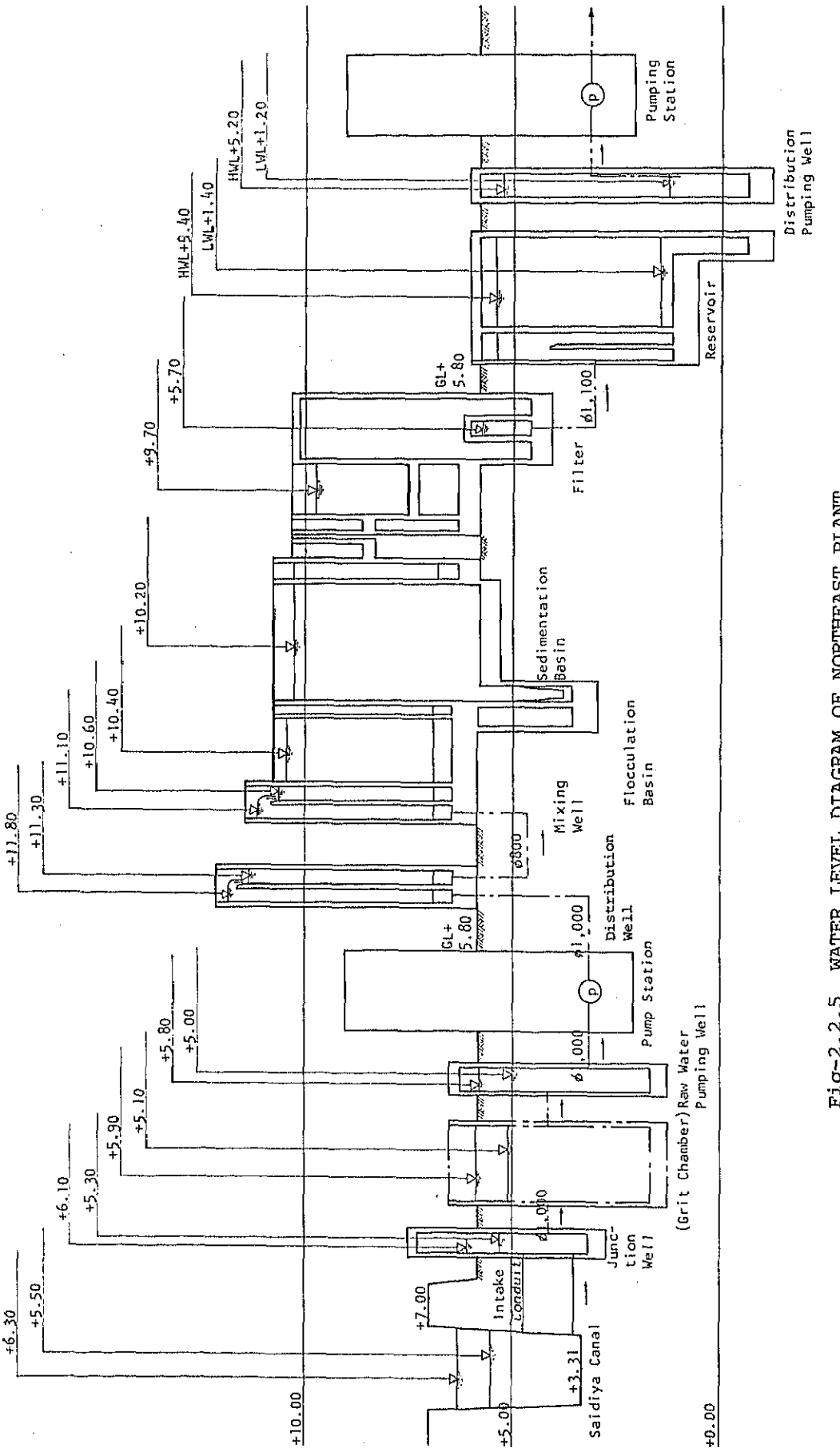


Fig-2.2.5 WATER LEVEL DIAGRAM OF NORTHEAST PLANT

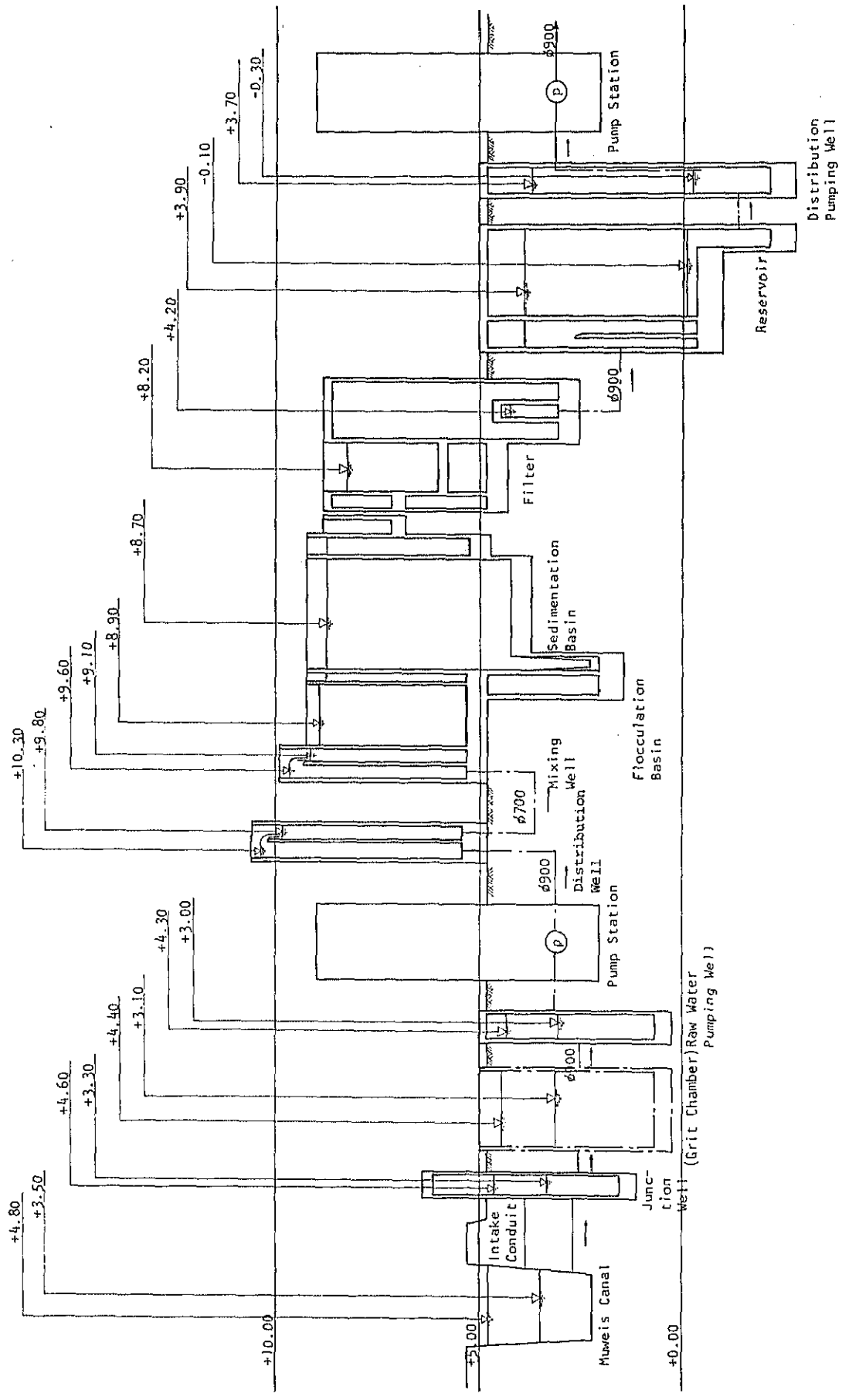


Fig-2.2.6 WATER LEVEL DIAGRAM OF KAFR SAQR PLANT

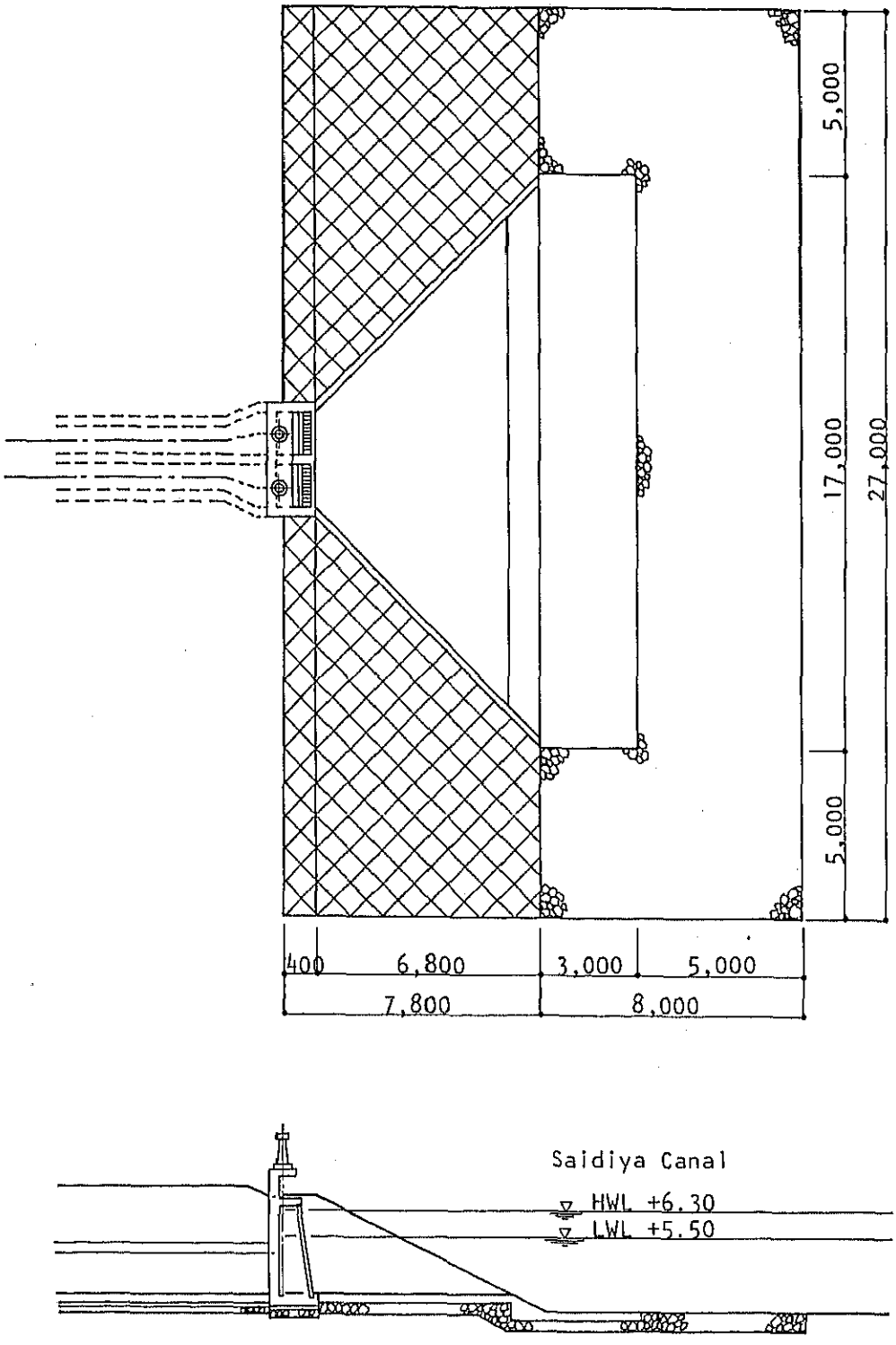


Fig-2.2.7 INTAKE FACILITIES
(Northesst Plant)

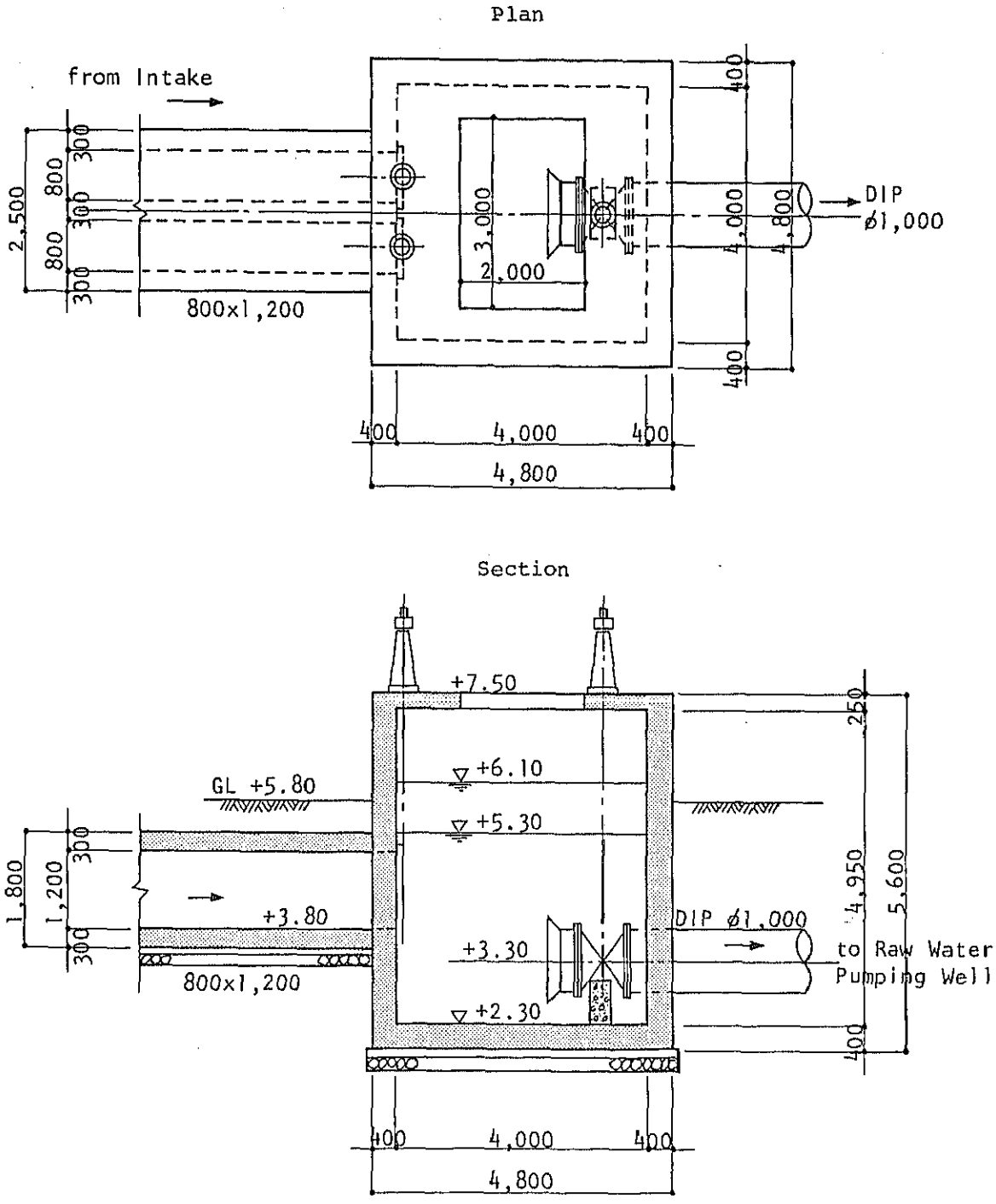
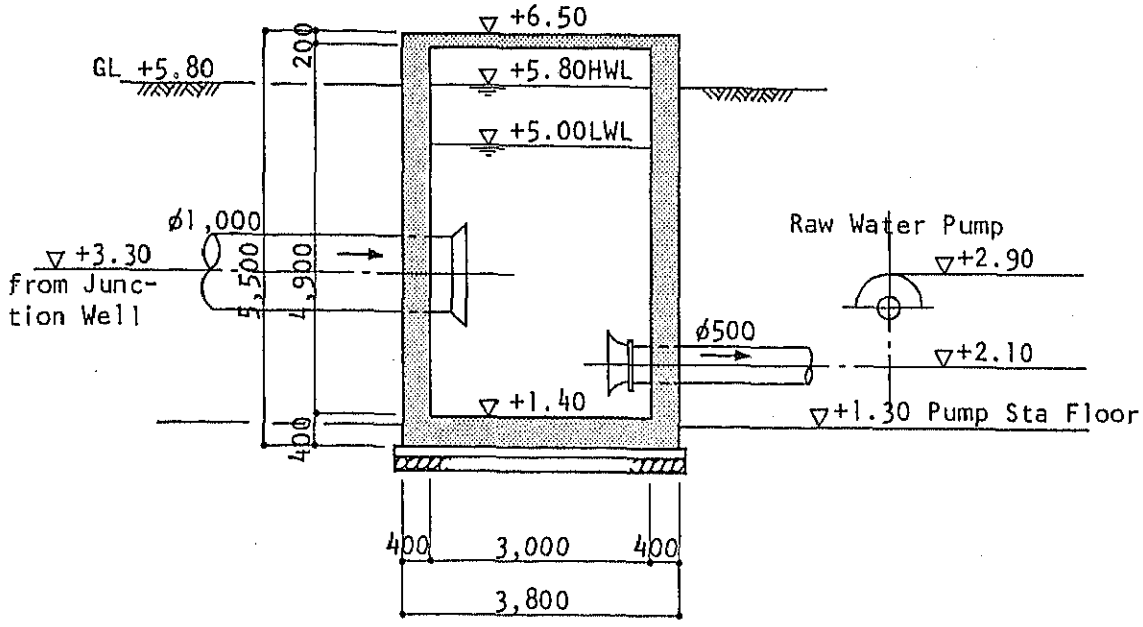


Fig-2.2.8 JUNCTION WELL
(Northeast Plant)

Raw Water Pumping Well



Distribution Pumping Well

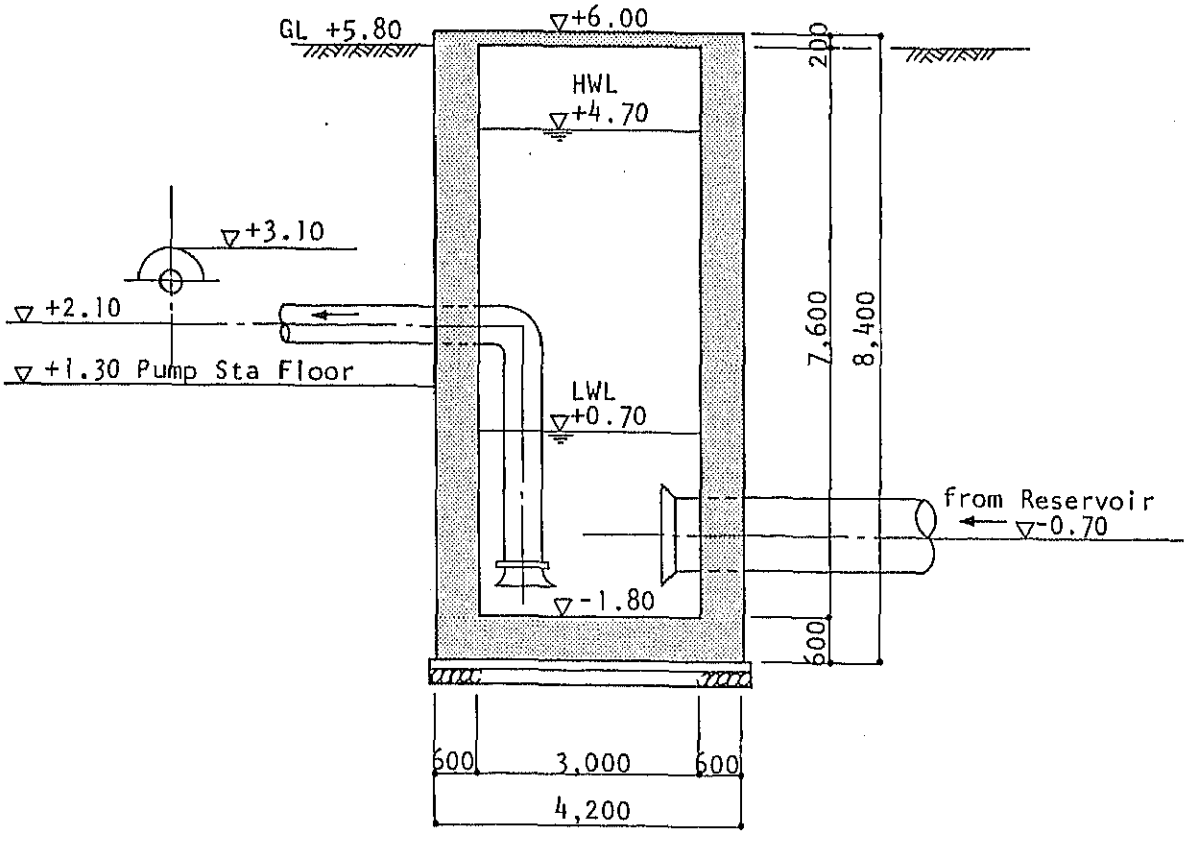


Fig-2.2.9 PUMPING WELLS
(Northeast Plant)

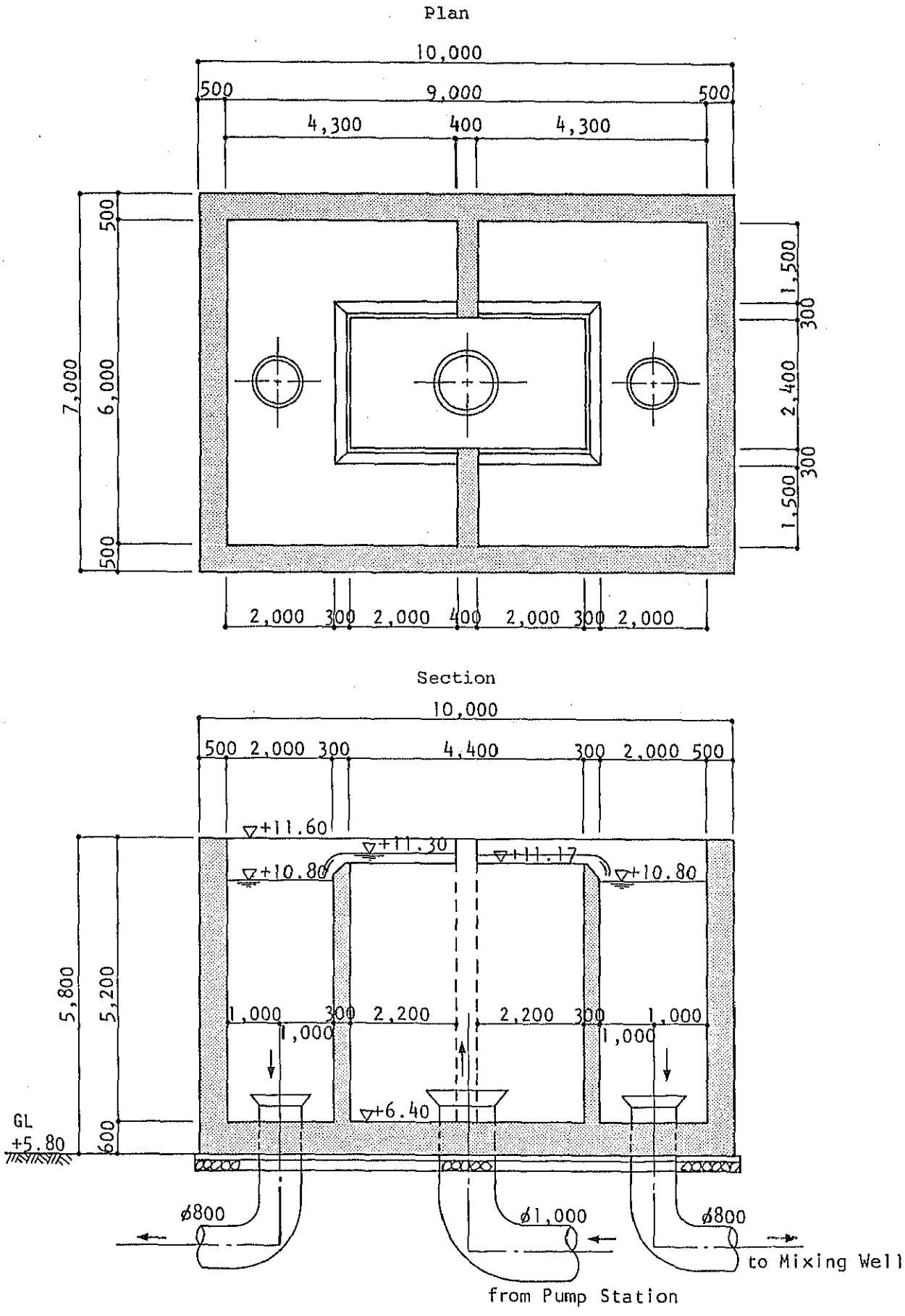


Fig-2.2.10 DISTRIBUTION WELL
(Northeast Plant)

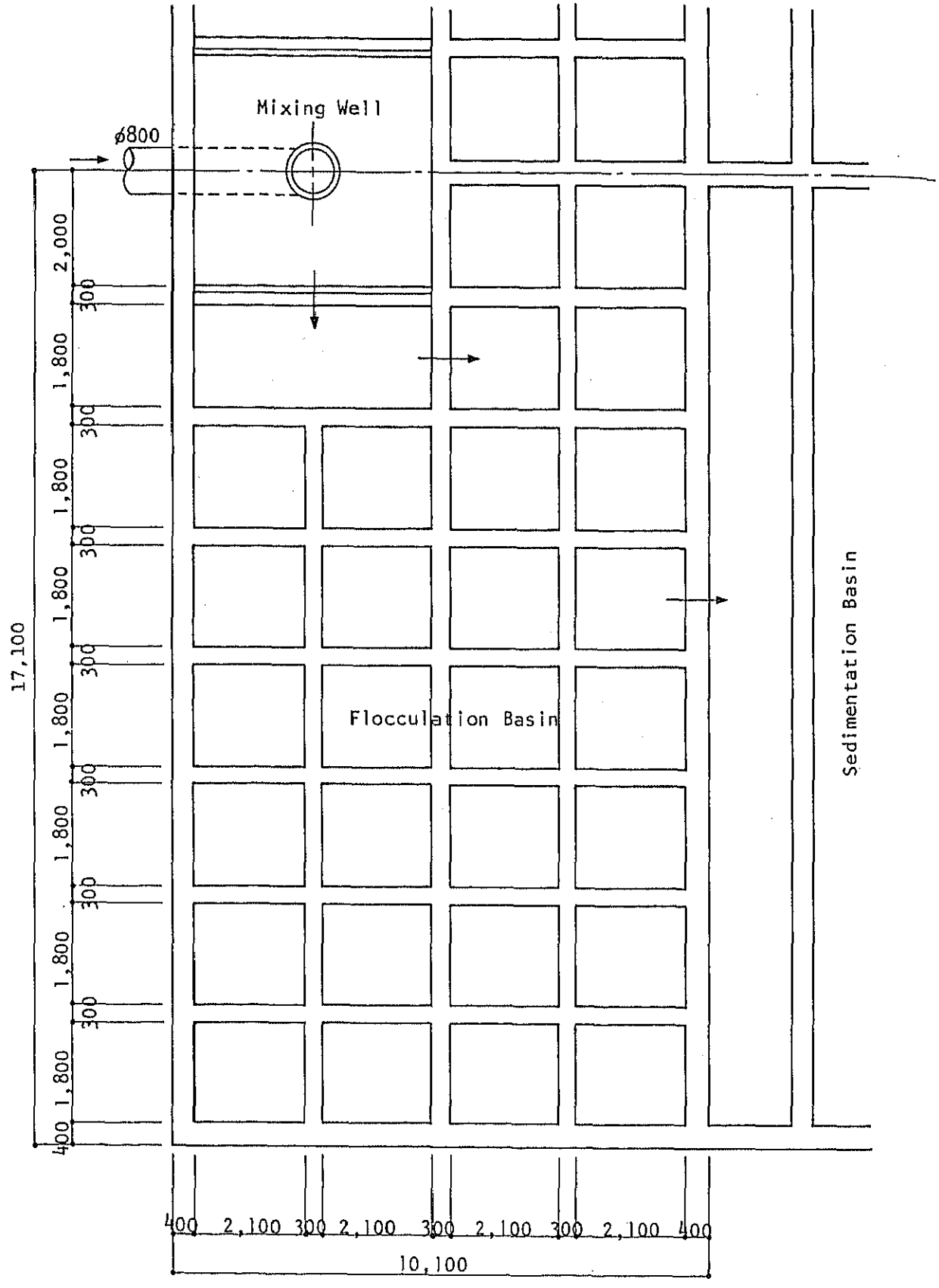


Fig-2.2.11 MIXING WELL AND FLOCCULATION BASIN
(Northeast Plant)

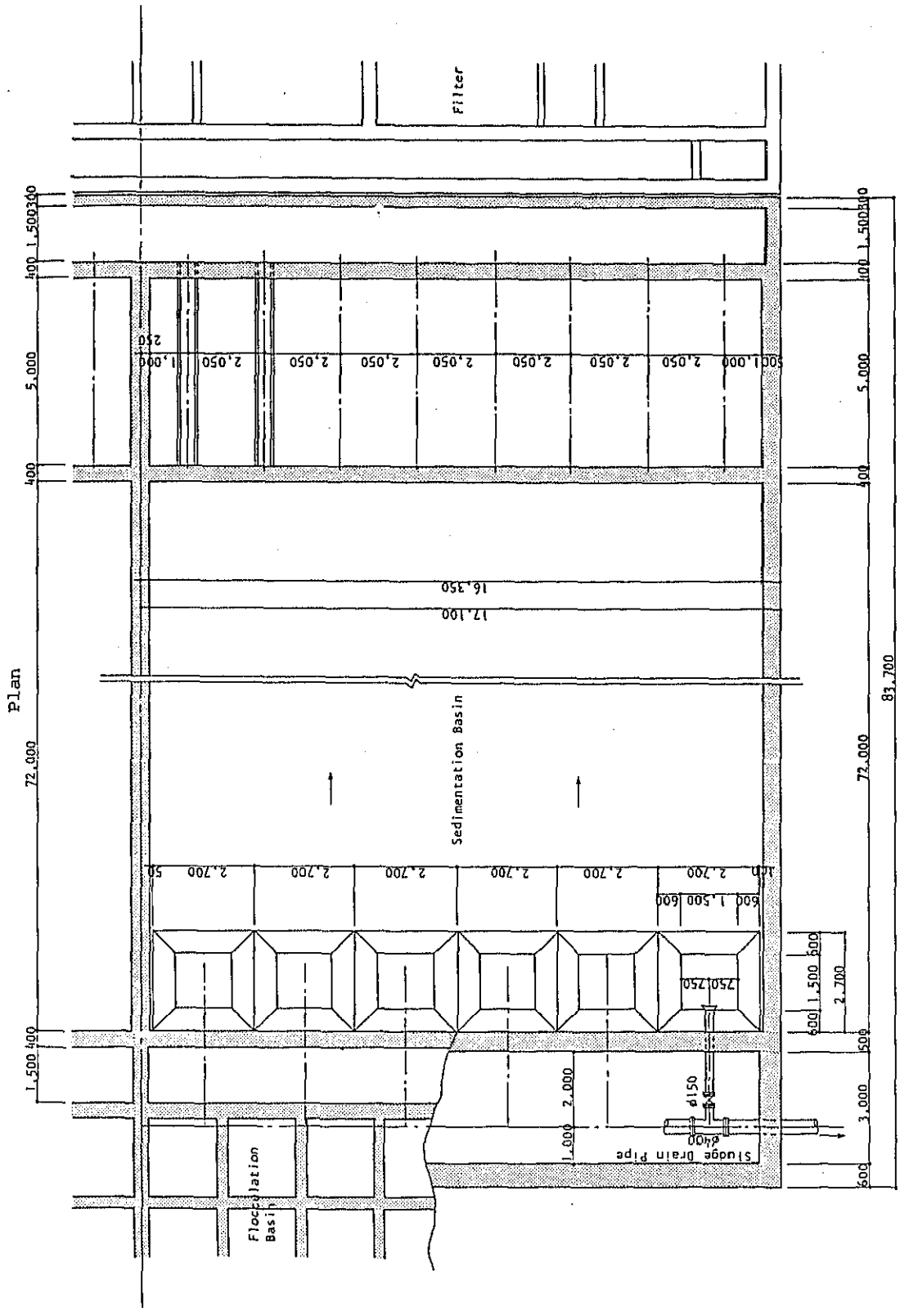


Fig-2.2.12 SEDIMENTATION BASIN
(Northeast Plant)

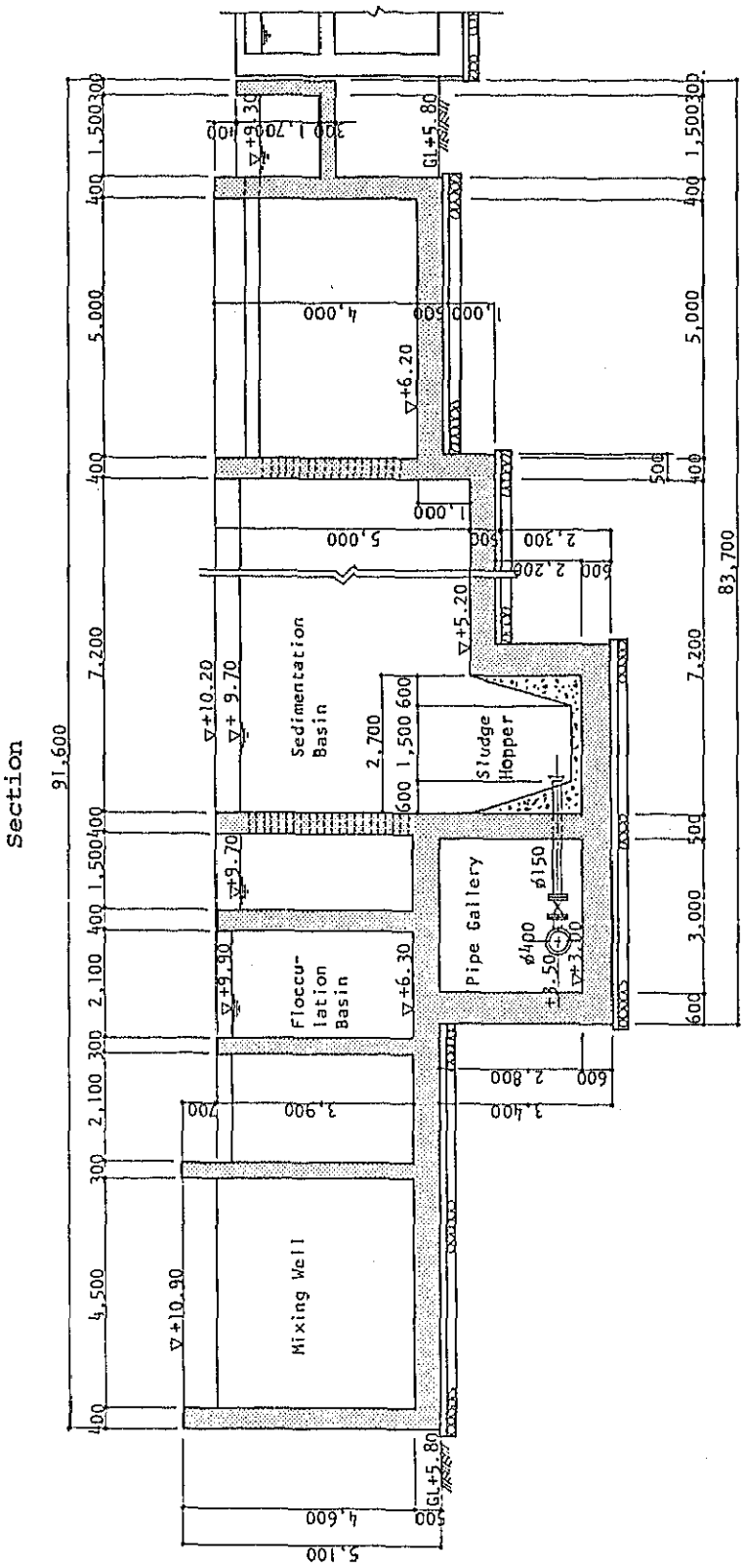


Fig-2.2.13 SEDIMENTATION BASIN
(Northeast Plant)

Plan

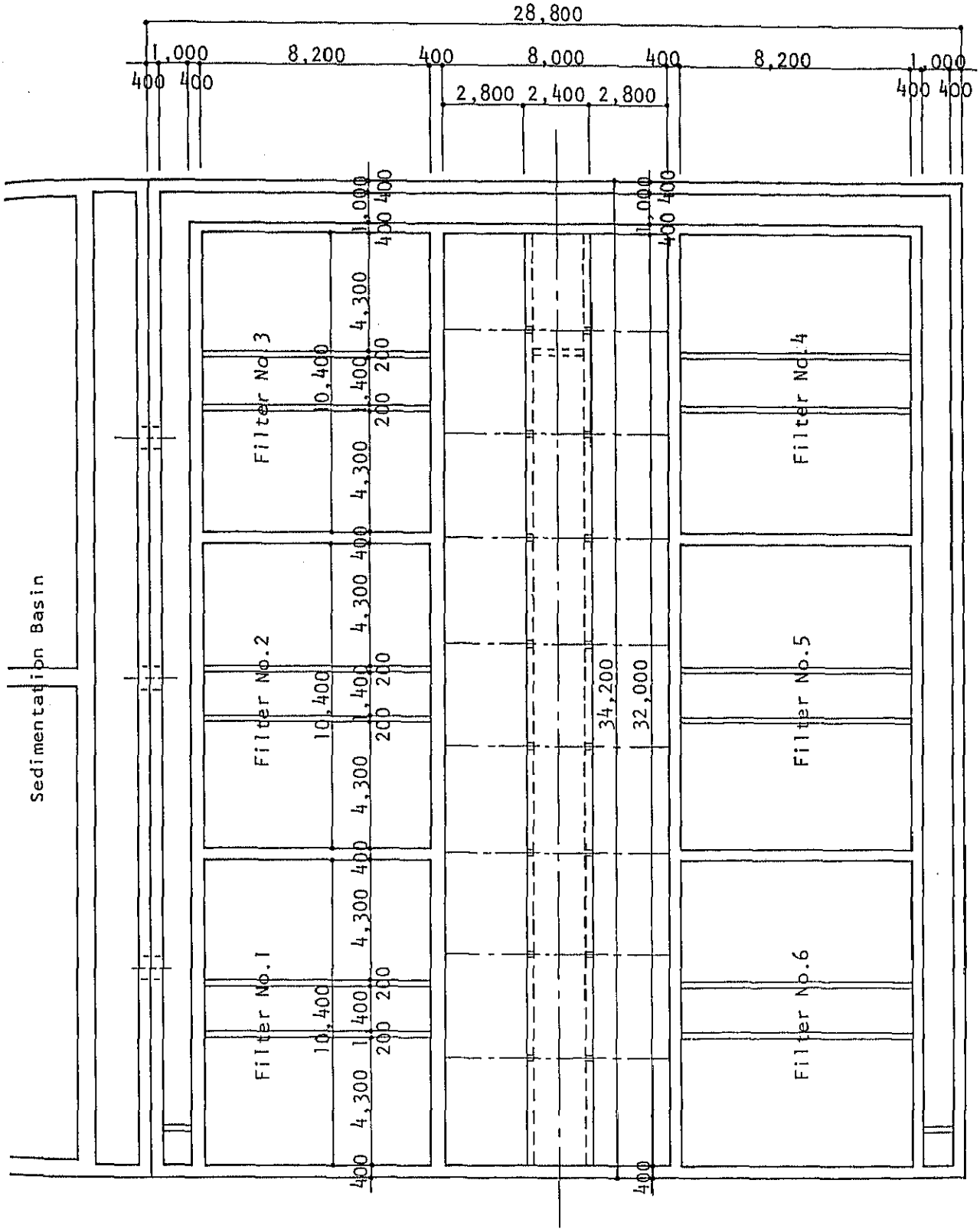


Fig-2.2.14 FILTER
(Northeast Plant)

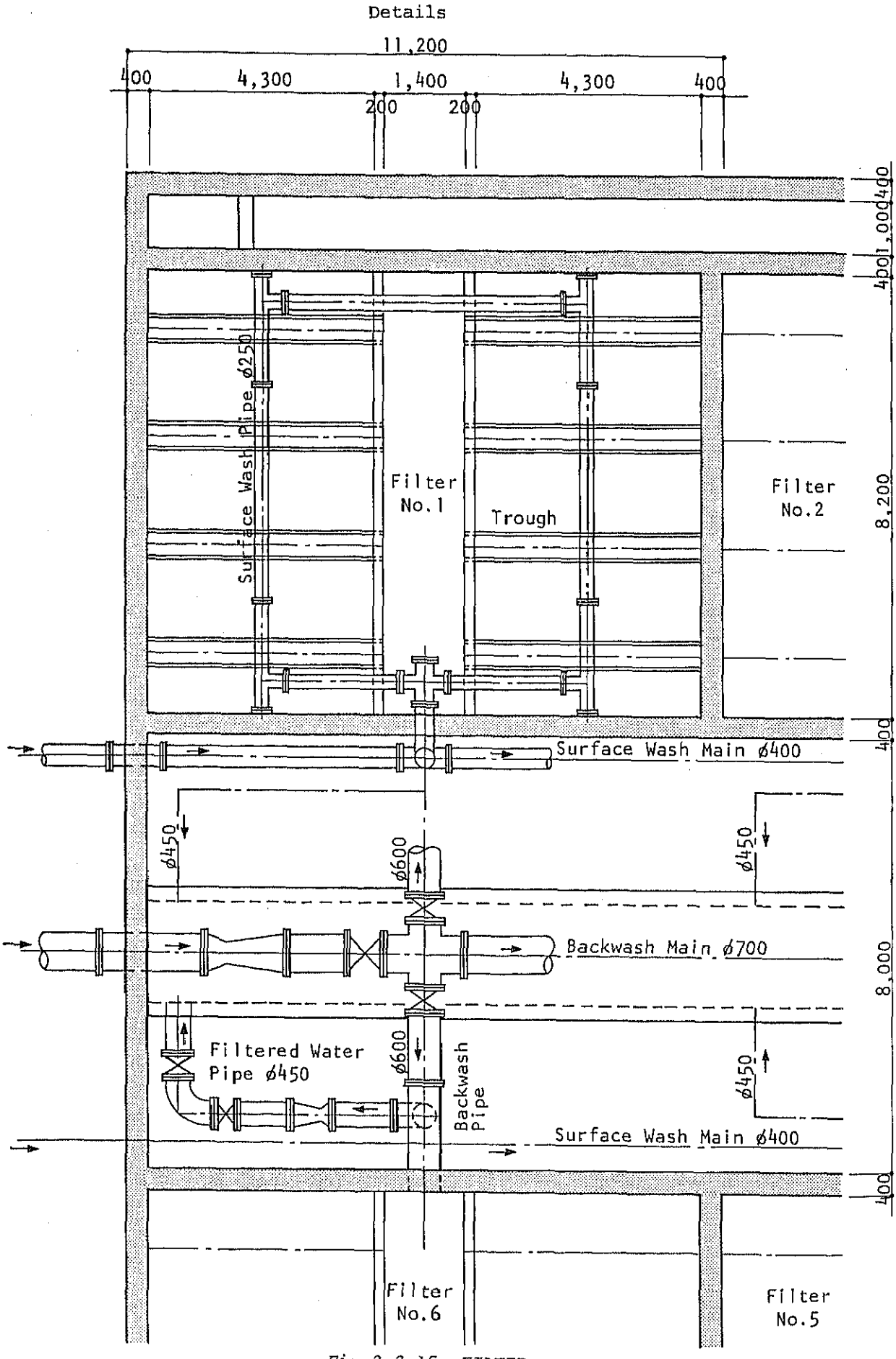


Fig-2.2.15 FILTER
(Northeast Plant)

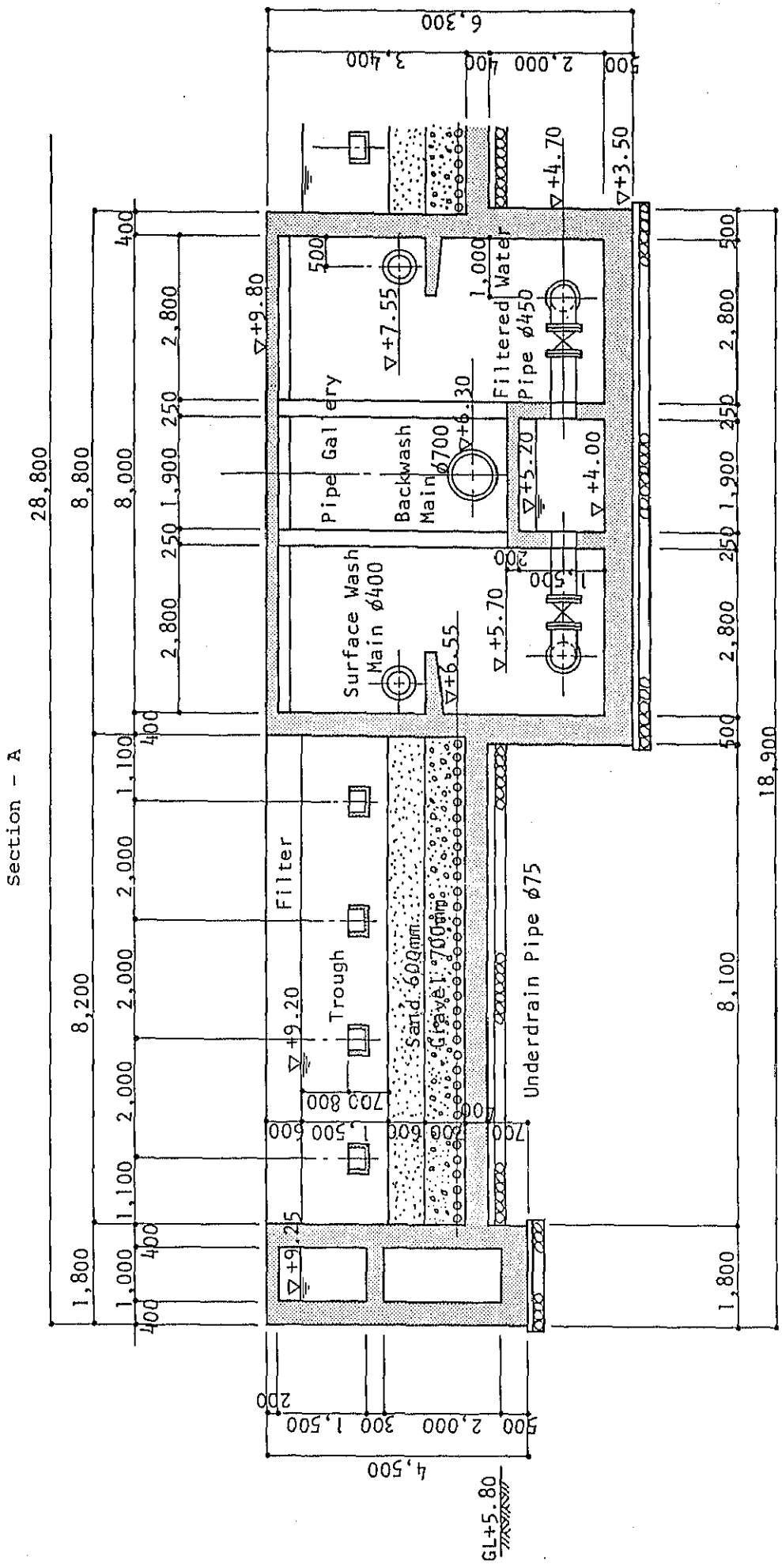


Fig-2.2.16 FILTER
(Northeast Plant)

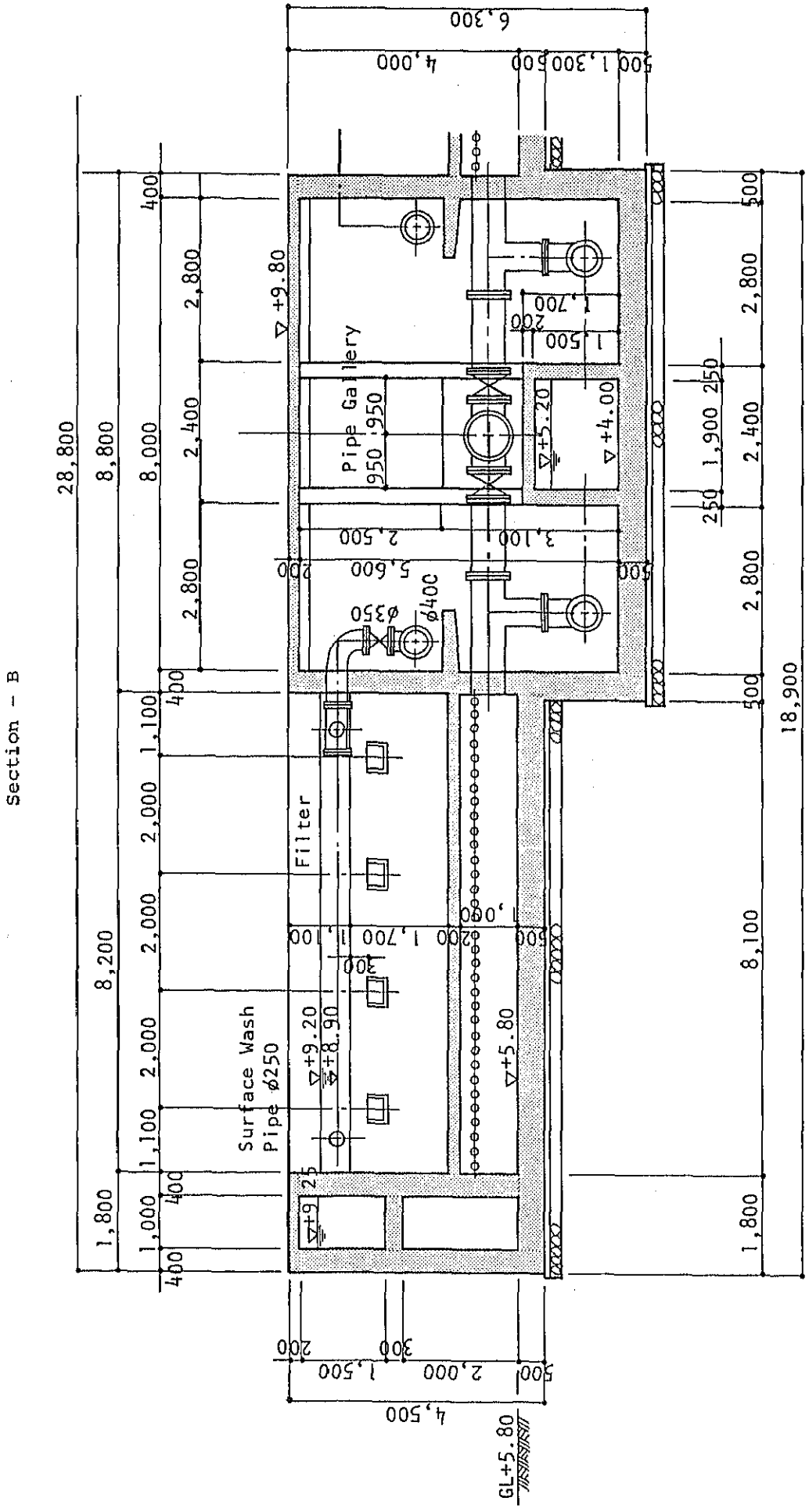


Fig-2.2.17 FILTER
(Northeast Plant)

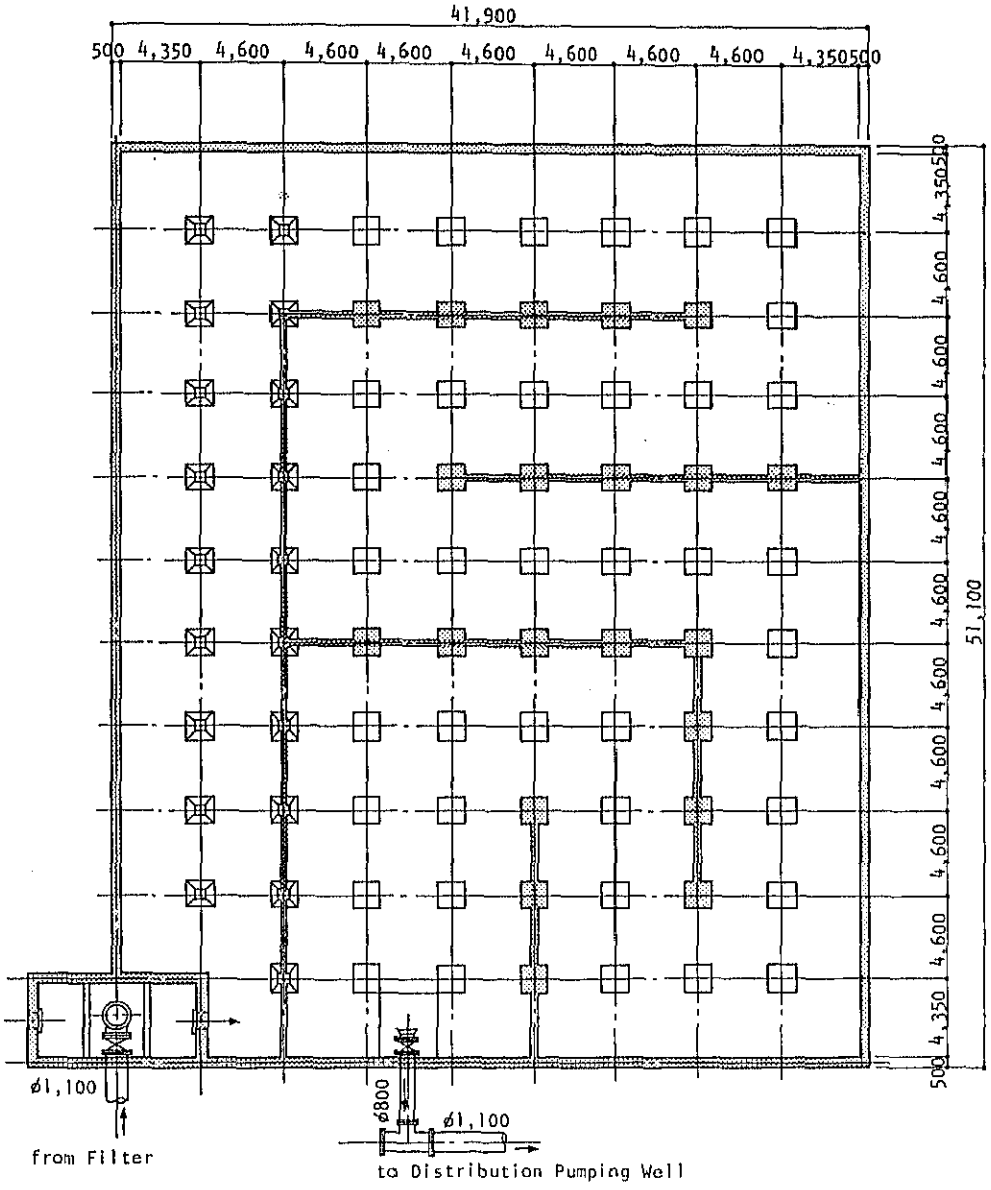
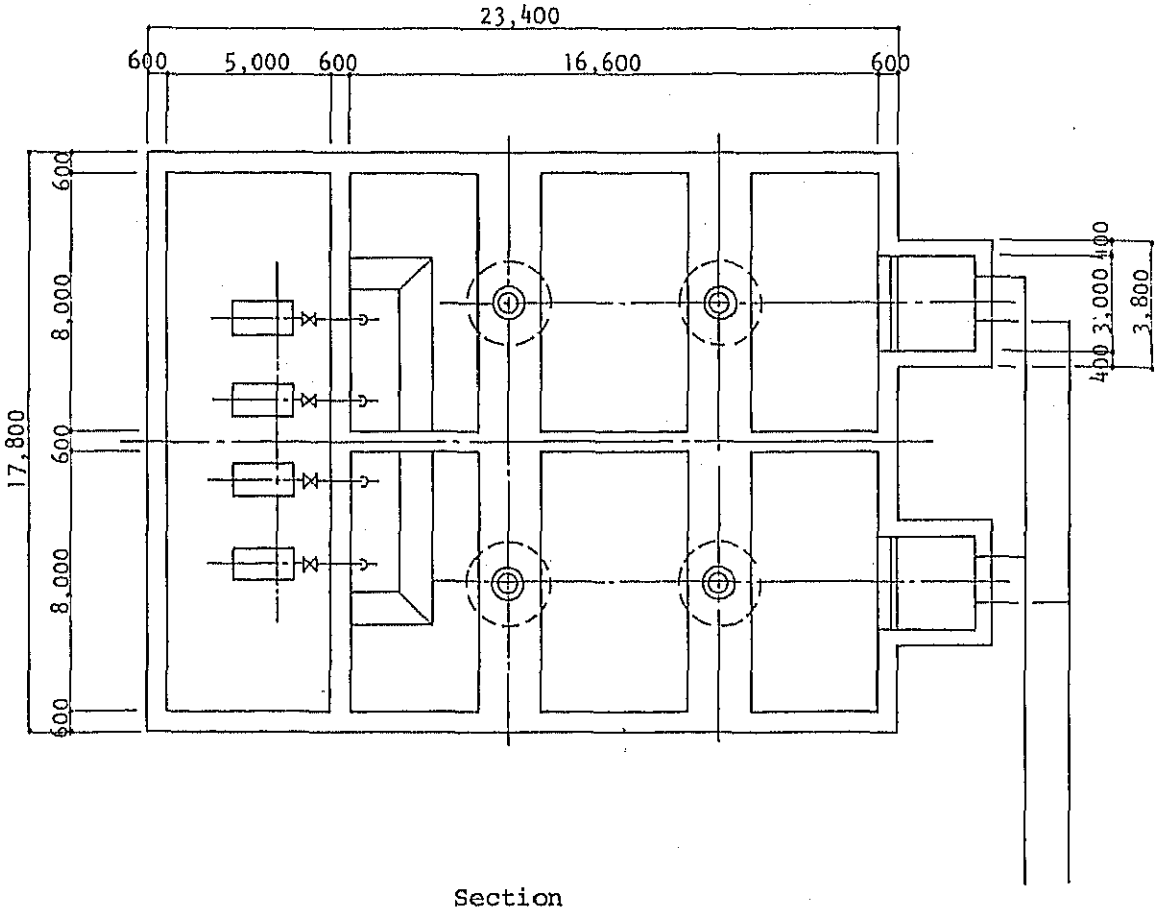


Fig-2.2.18 RESERVOIR
(Northeast Plant)

Plan



Section

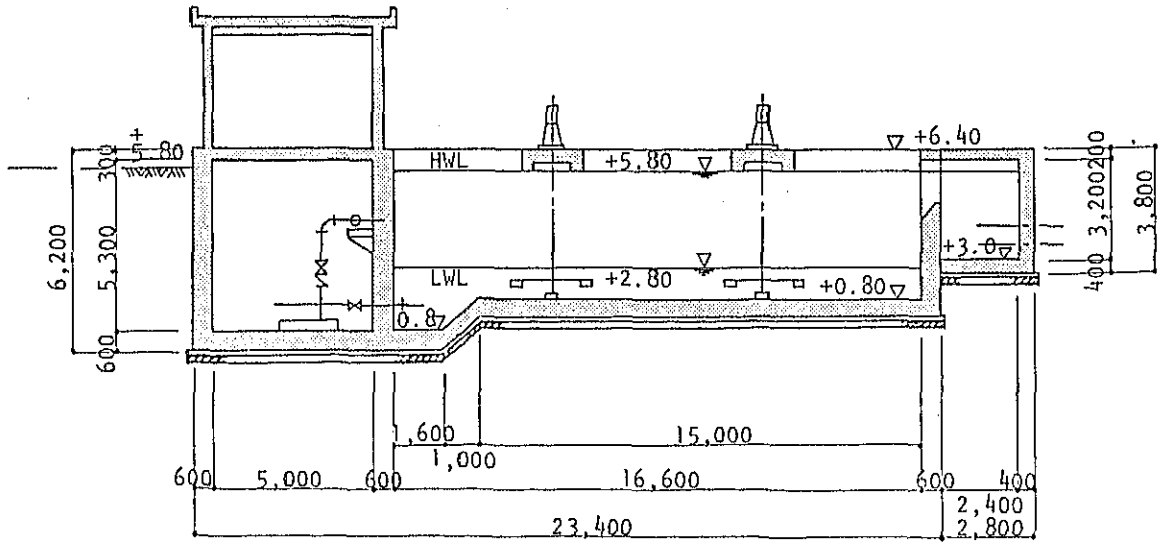


Fig-2.2.19 WASTEWATER BASIN
(Northeast Plant)

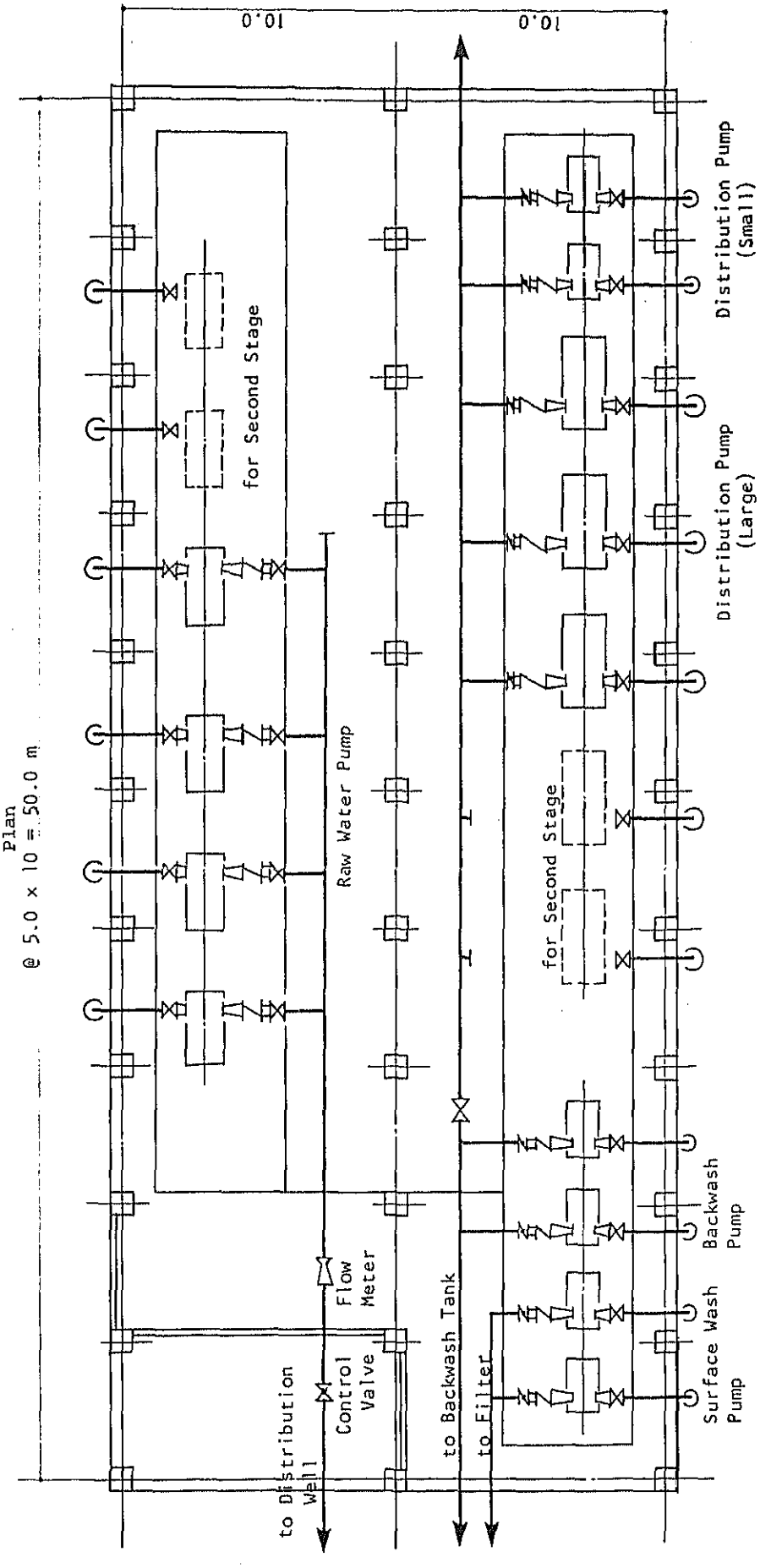


Fig-2.2.20 PUMP STATION
(Northeast Plant)

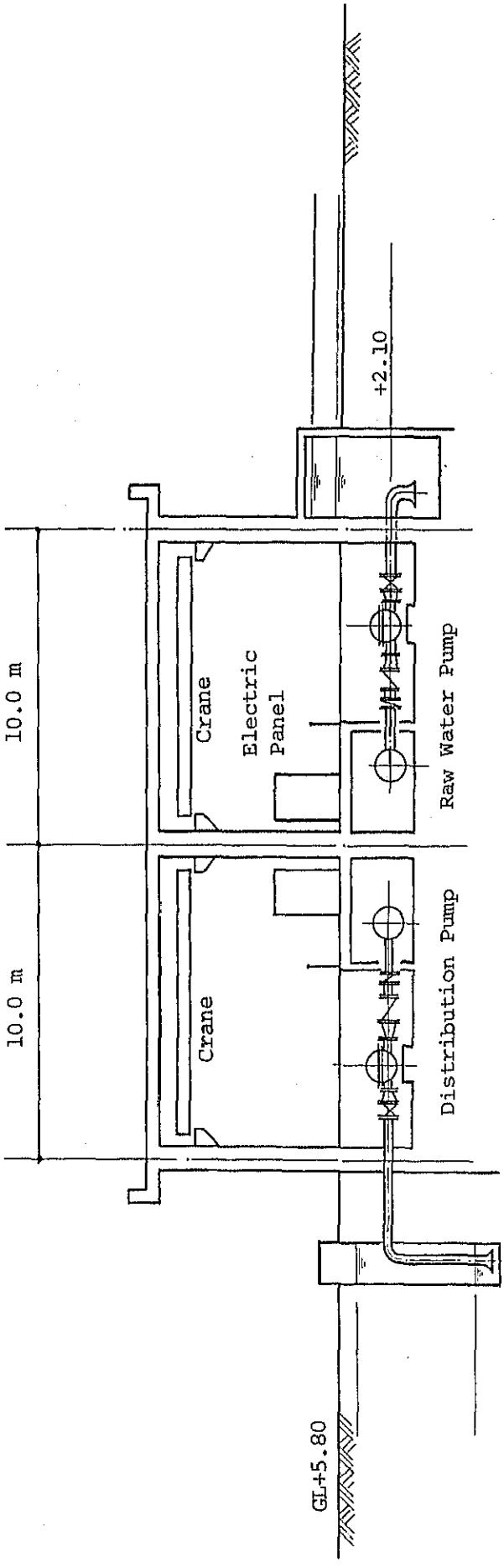


Fig-2.2.21 PUMP STATION
(Northeast Plant)

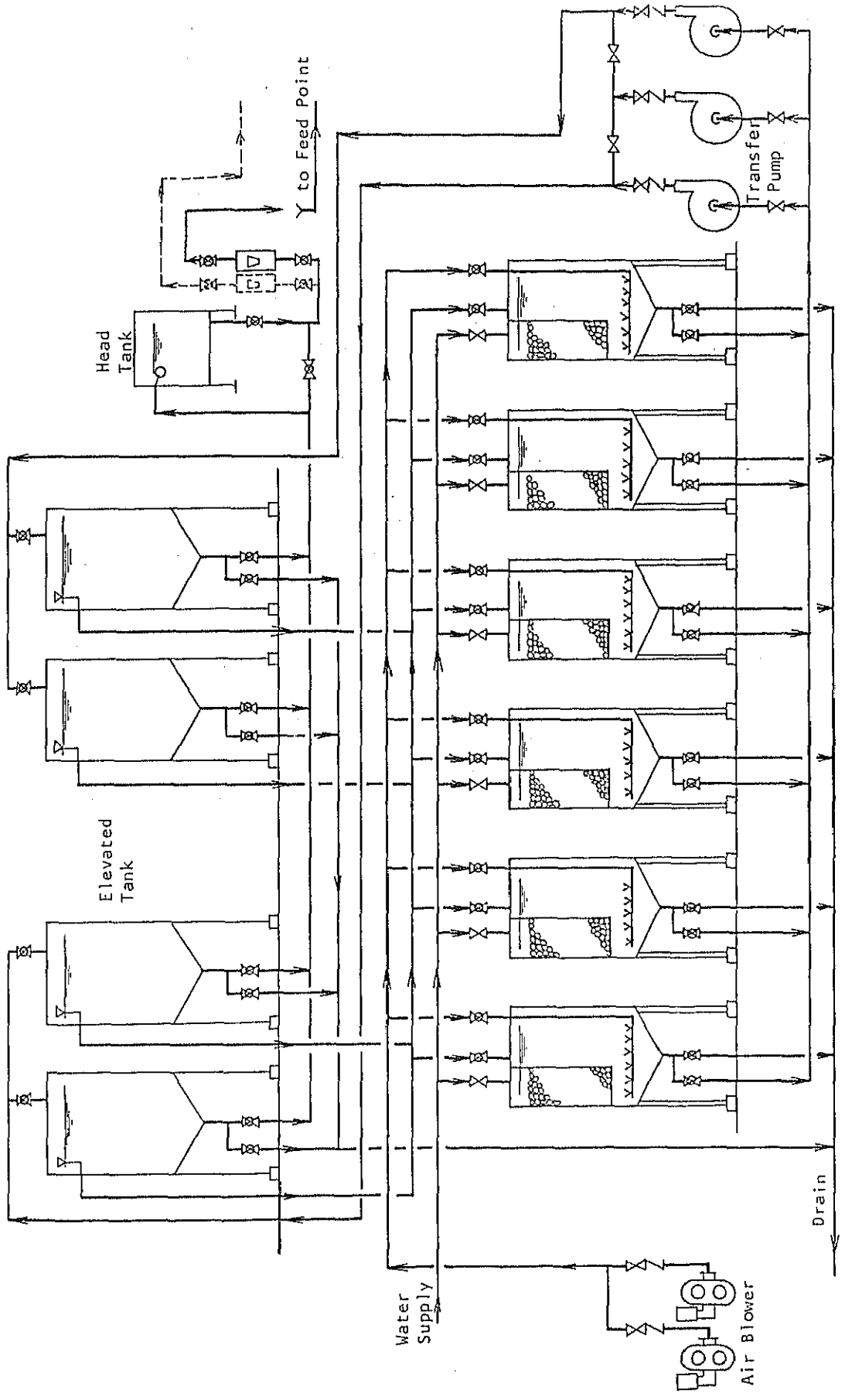


Fig-2.2.22 ALUM FEED SYSTEM FLOW DIAGRAM (Northeast Plant)

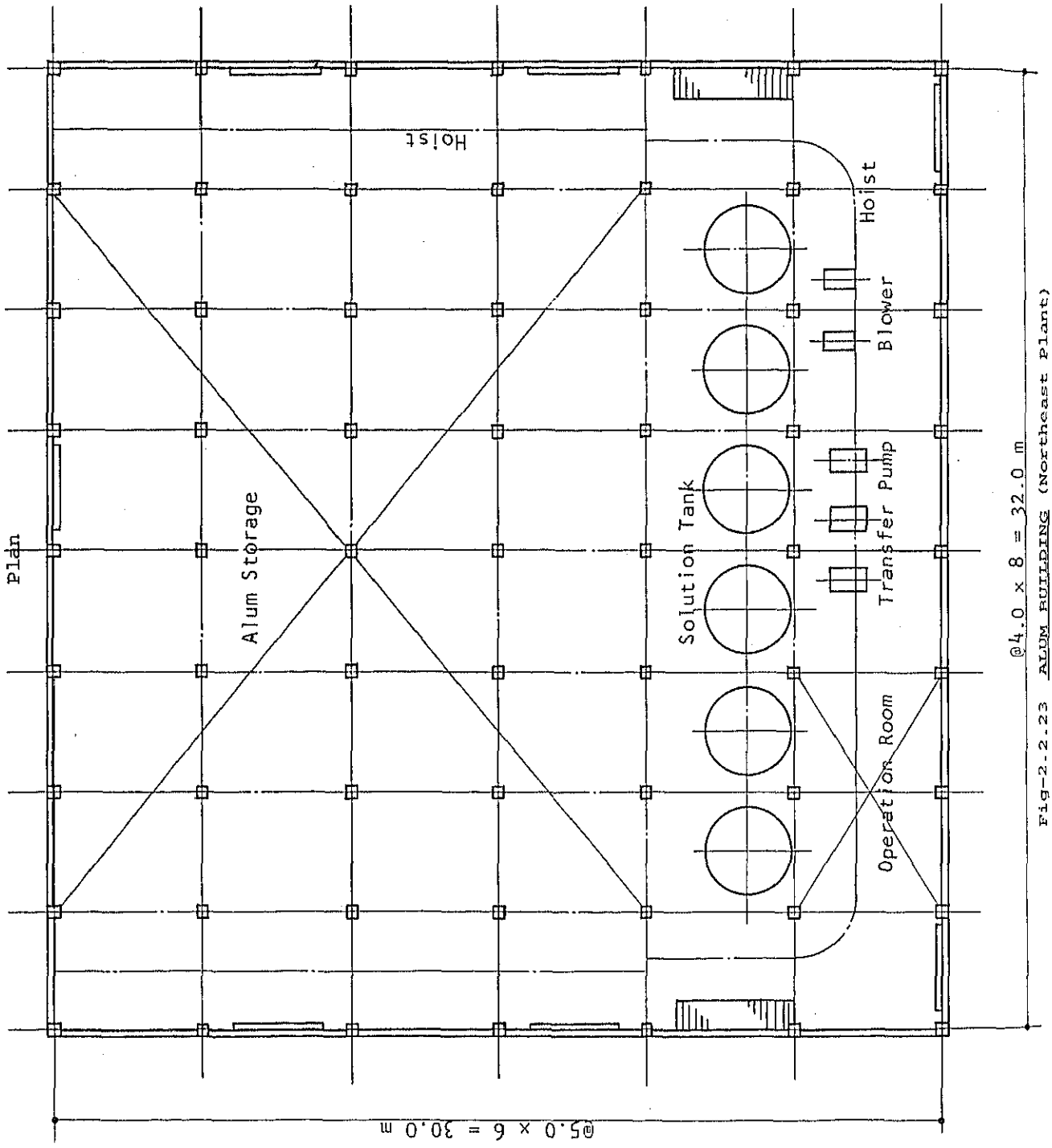


Fig-2.2.23 ALUM BUILDING (Northeast Plant)

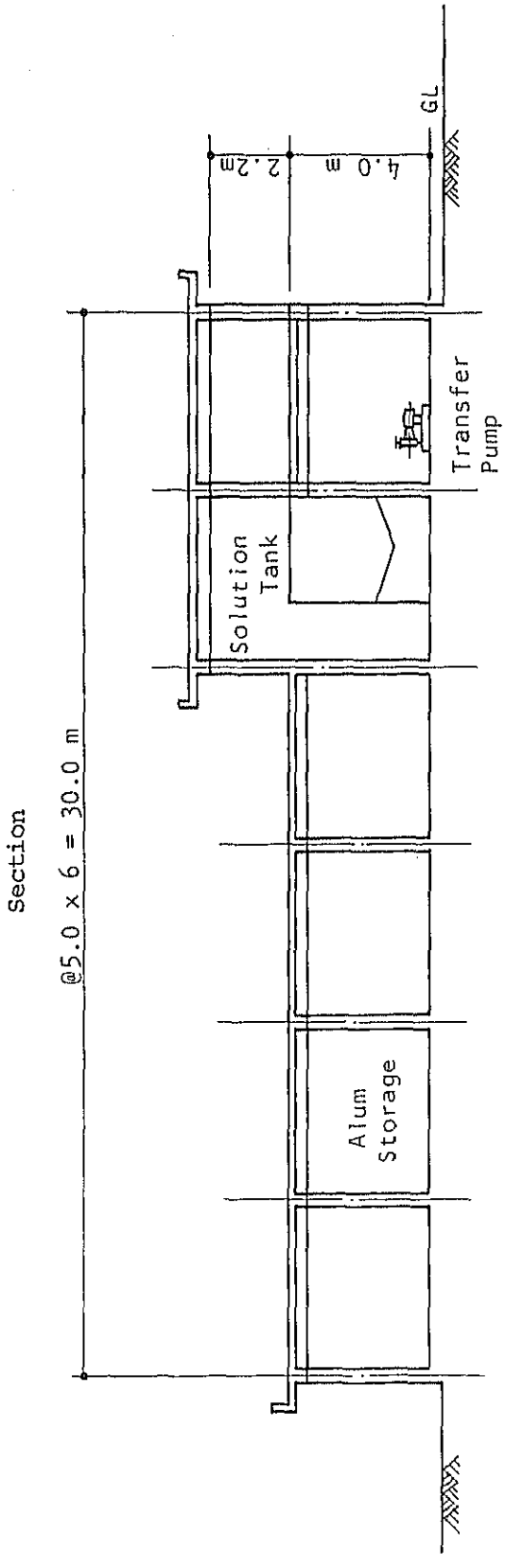


Fig-2.2.24 ALUM BUILDING
(Northeast Plant)

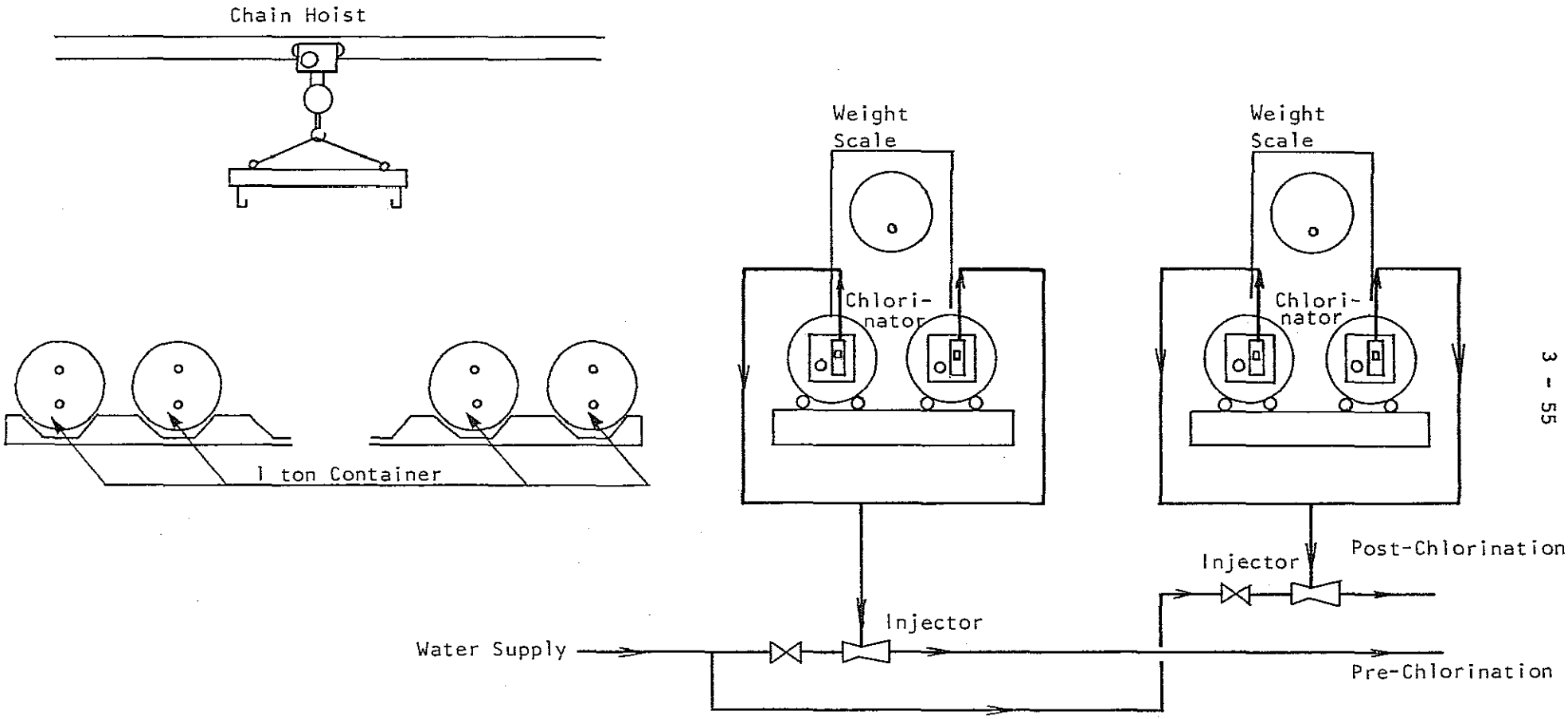


Fig-2.2.25 CHLORINATION SYSTEM FLOW DIAGRAM
(Northeast Plant)

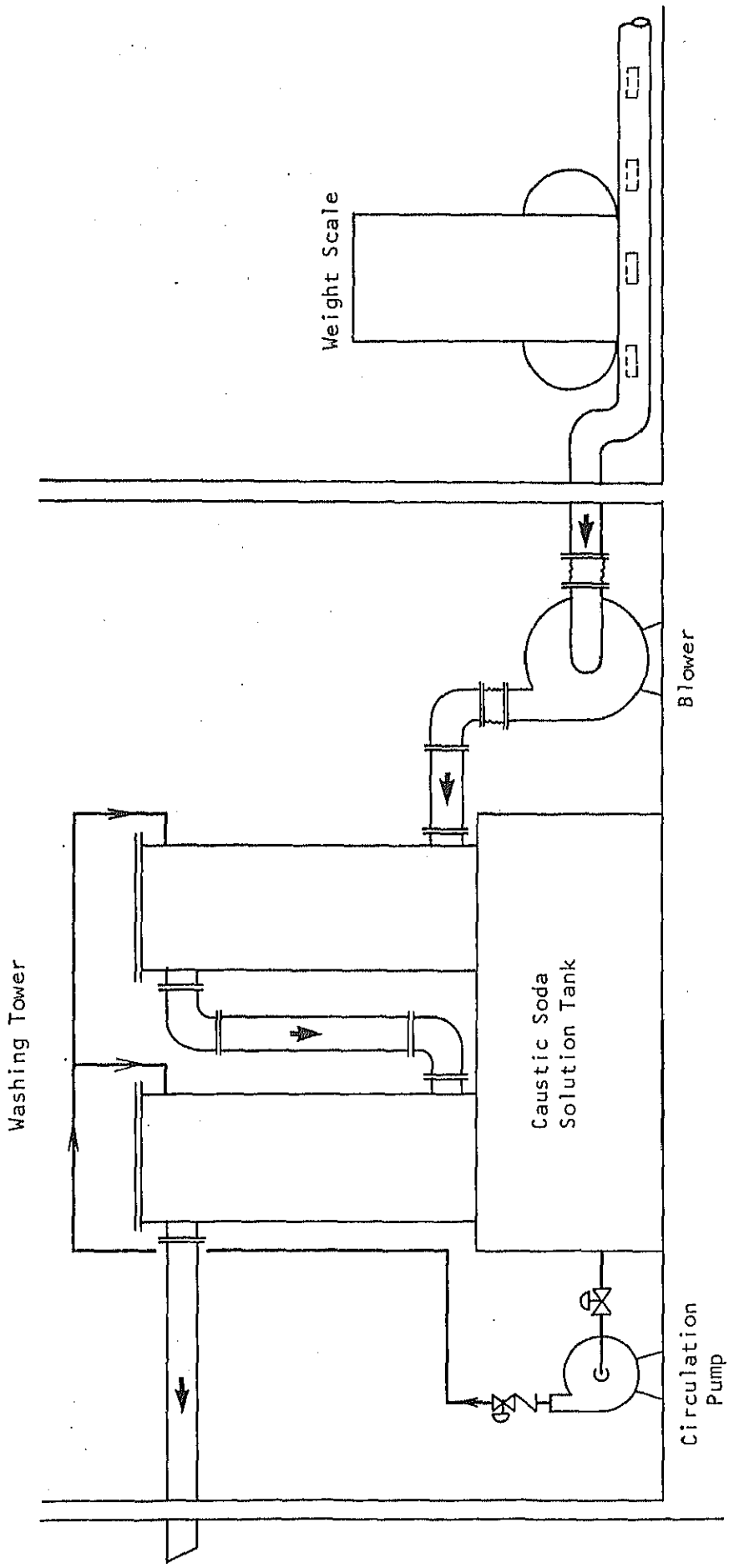


Fig-2.2.26 NEUTRALIZATION SYSTEM FLOW DIAGLAM
(Northeast Plant)

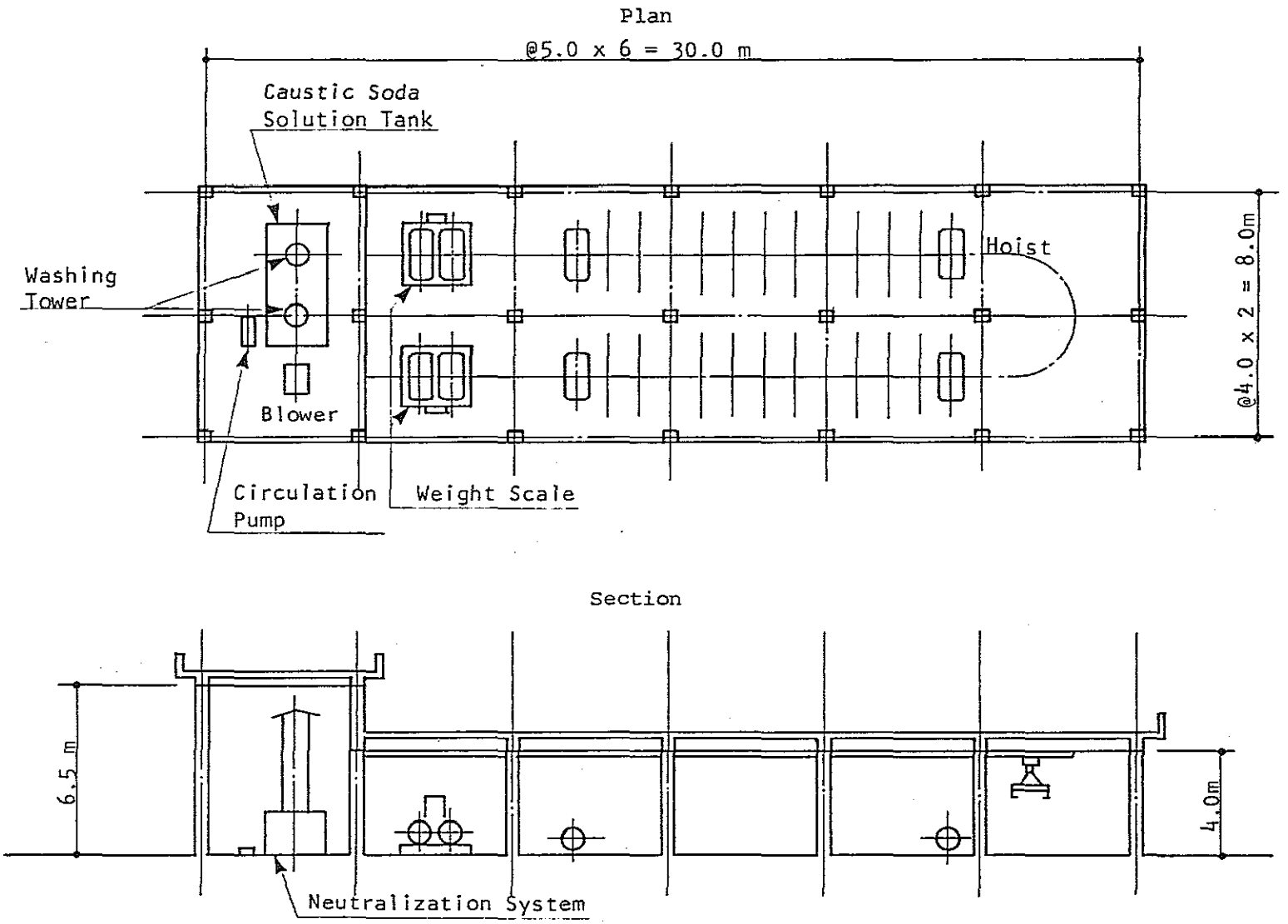
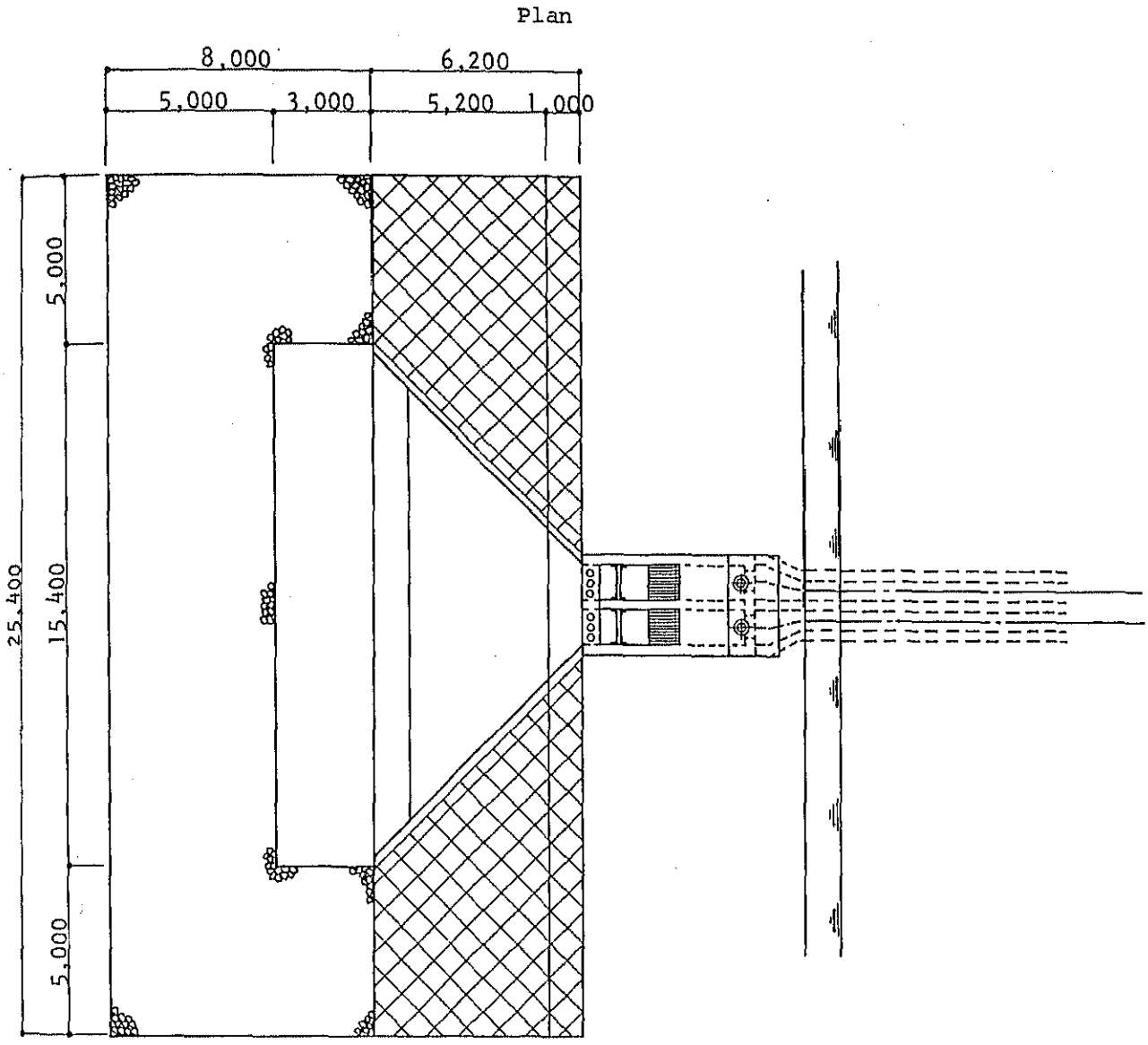


Fig-2.2.27 CHLORINE BUILDING
(Northeast Plant)



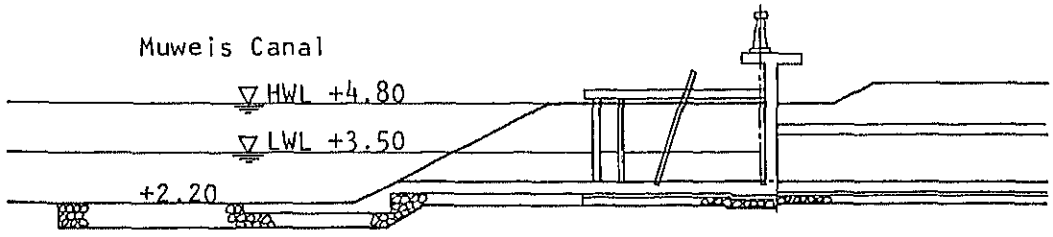


Fig-2.2.28 INTAKE FACILITIES
(Kafr Saqr Plant)

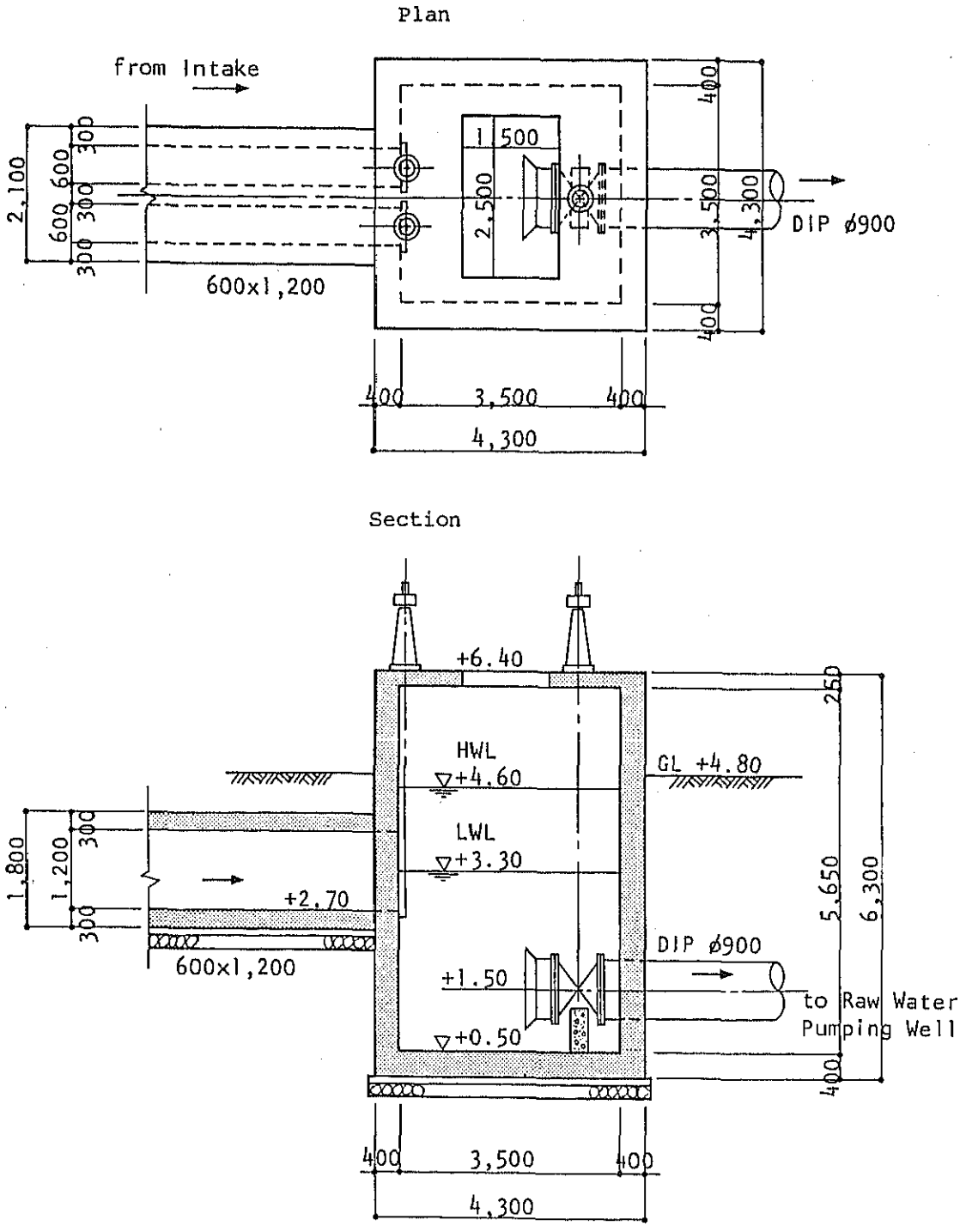


Fig-2.2.29 JUNCTION WELL
(Kafr Saqr Plant)

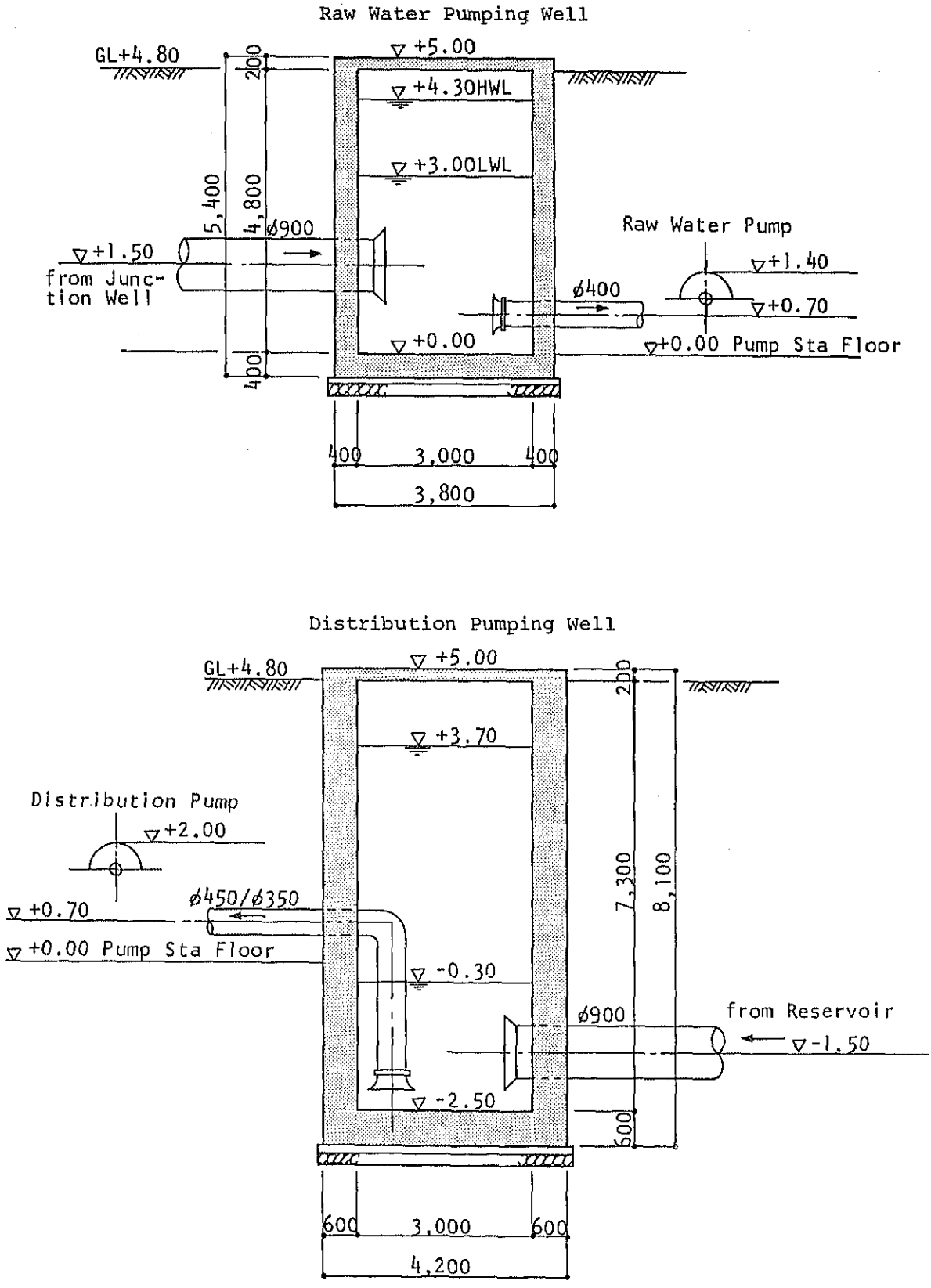


Fig-2.2.30 PUMPING WELLS
(Kafr Saqr Plant)

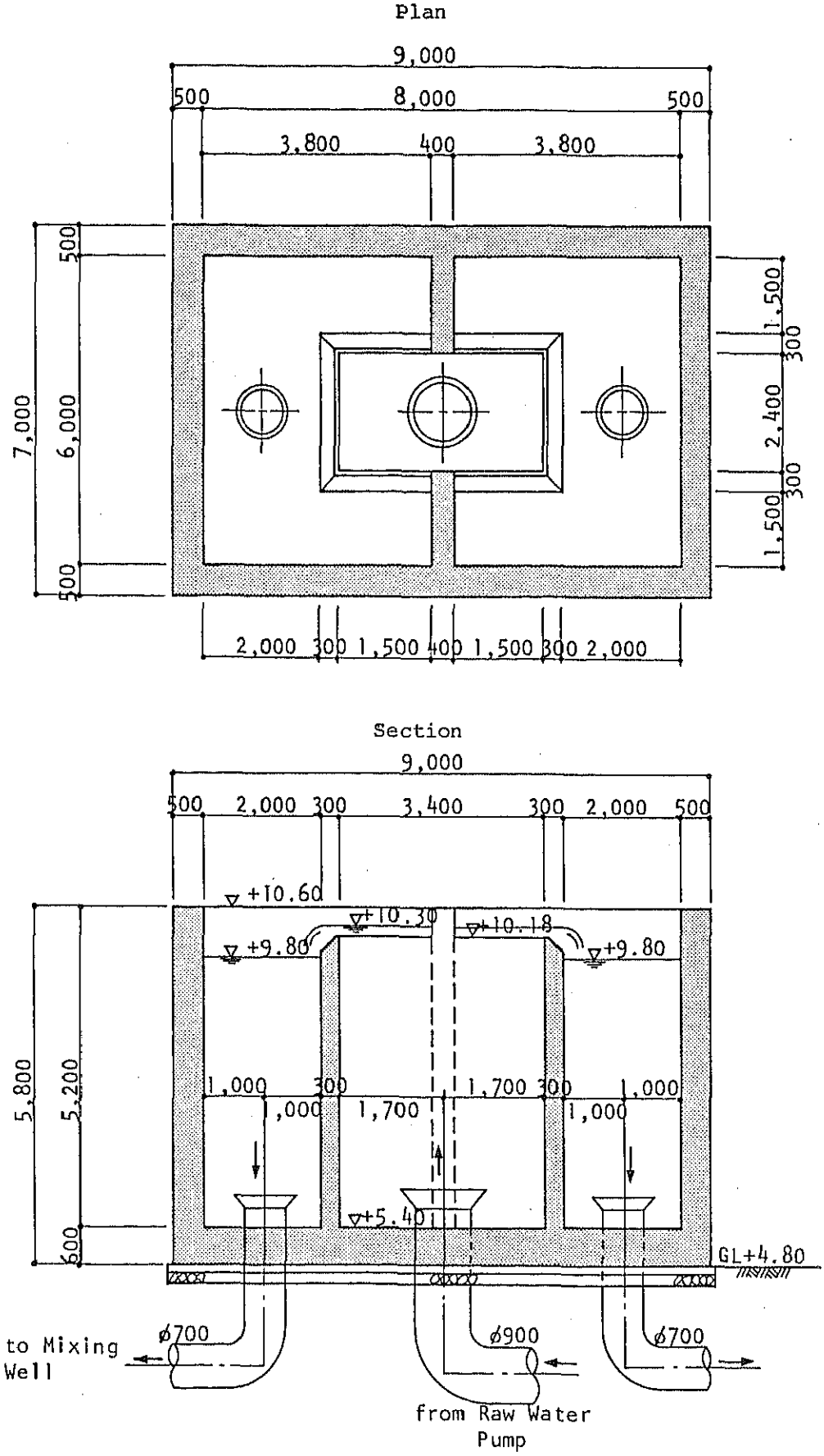


Fig-2.2.31 DISTRIBUTION WELL
(Kafr Saqr Plant)

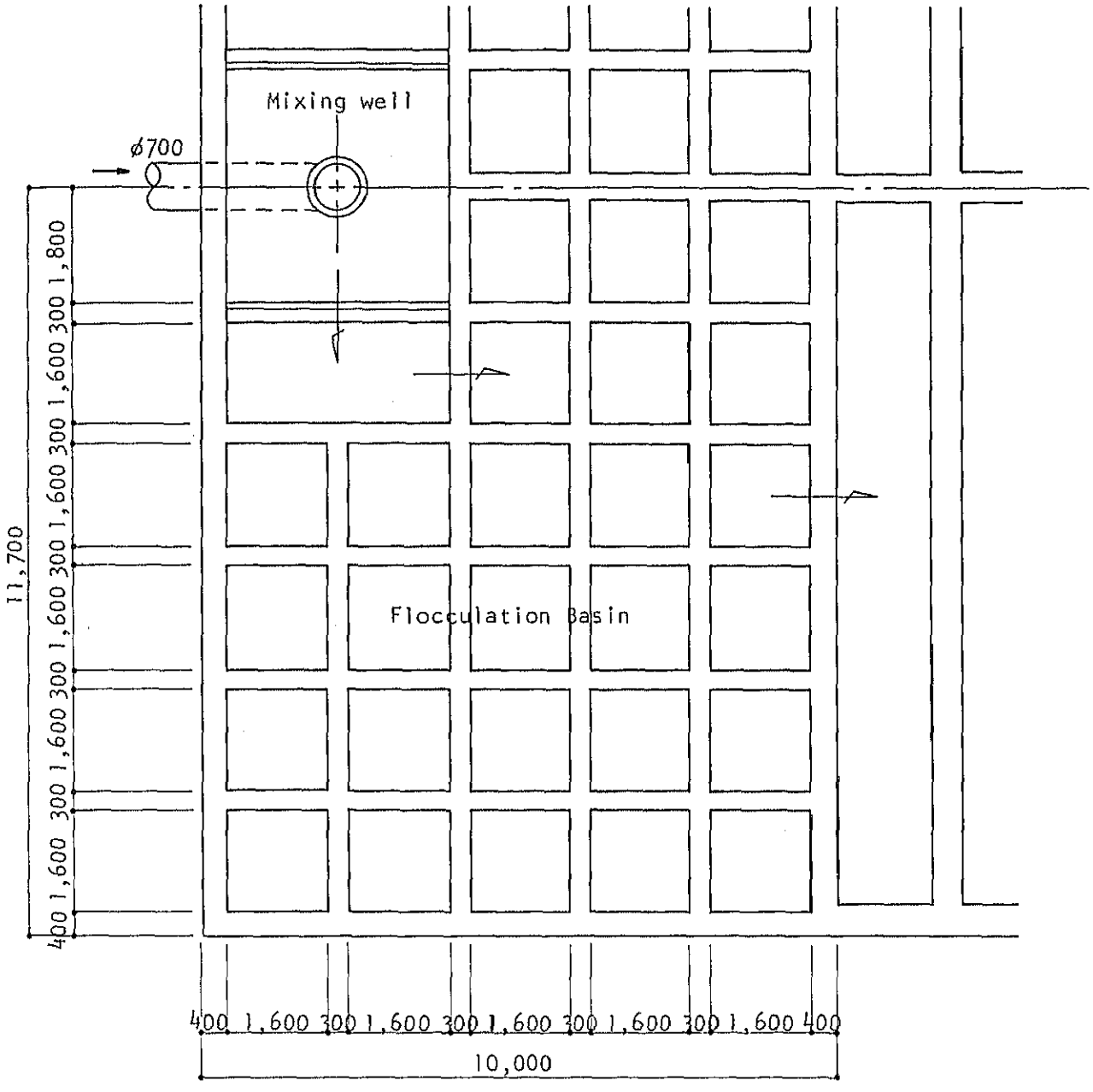
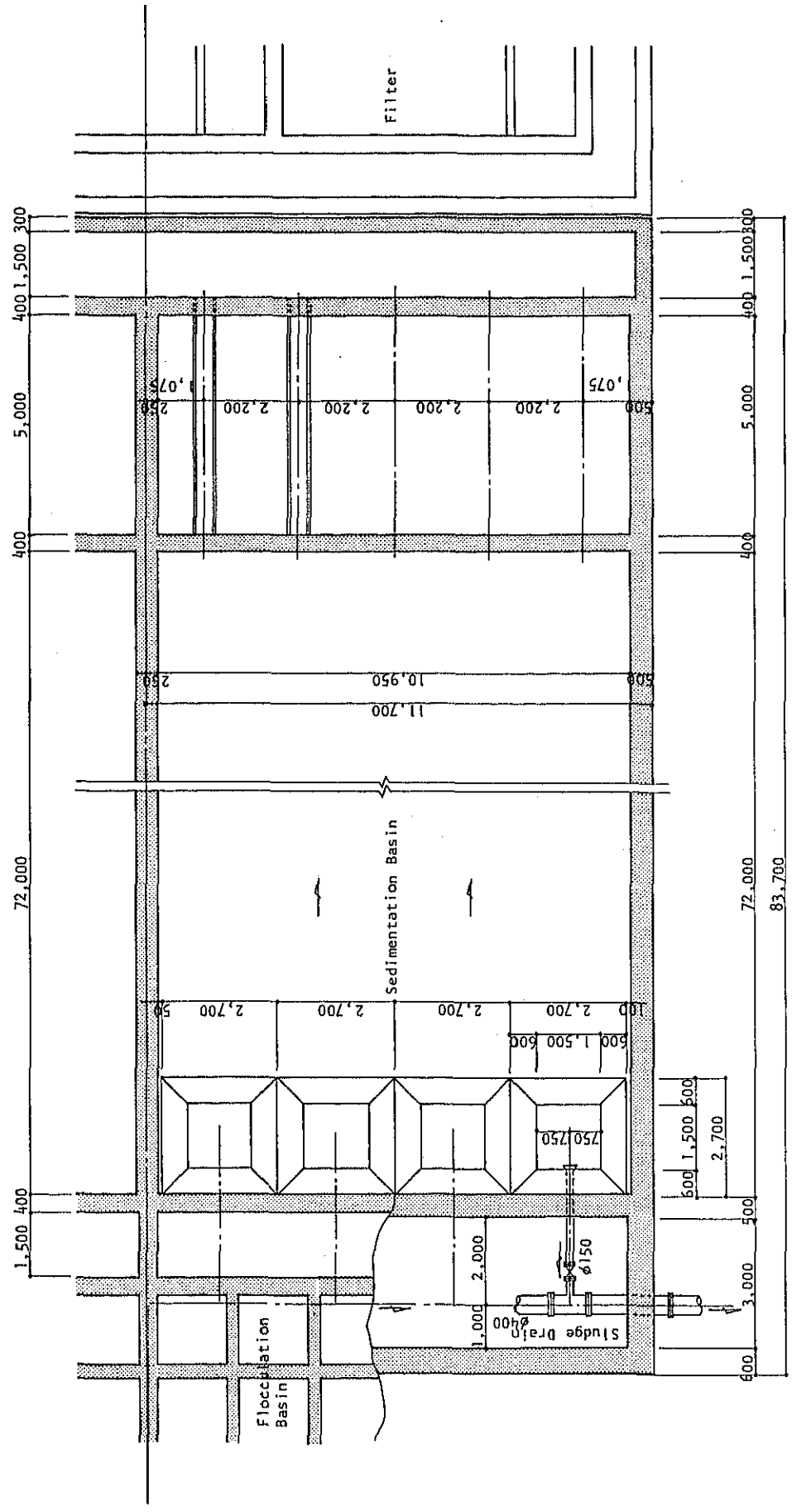


Fig-2.2.32 FLOCCULATION BASIN
(Kafr Saqr Plant)



Plan

Fig-2.2.33 SEDIMENTATION BASIN
(Kafr Saqr Plant)

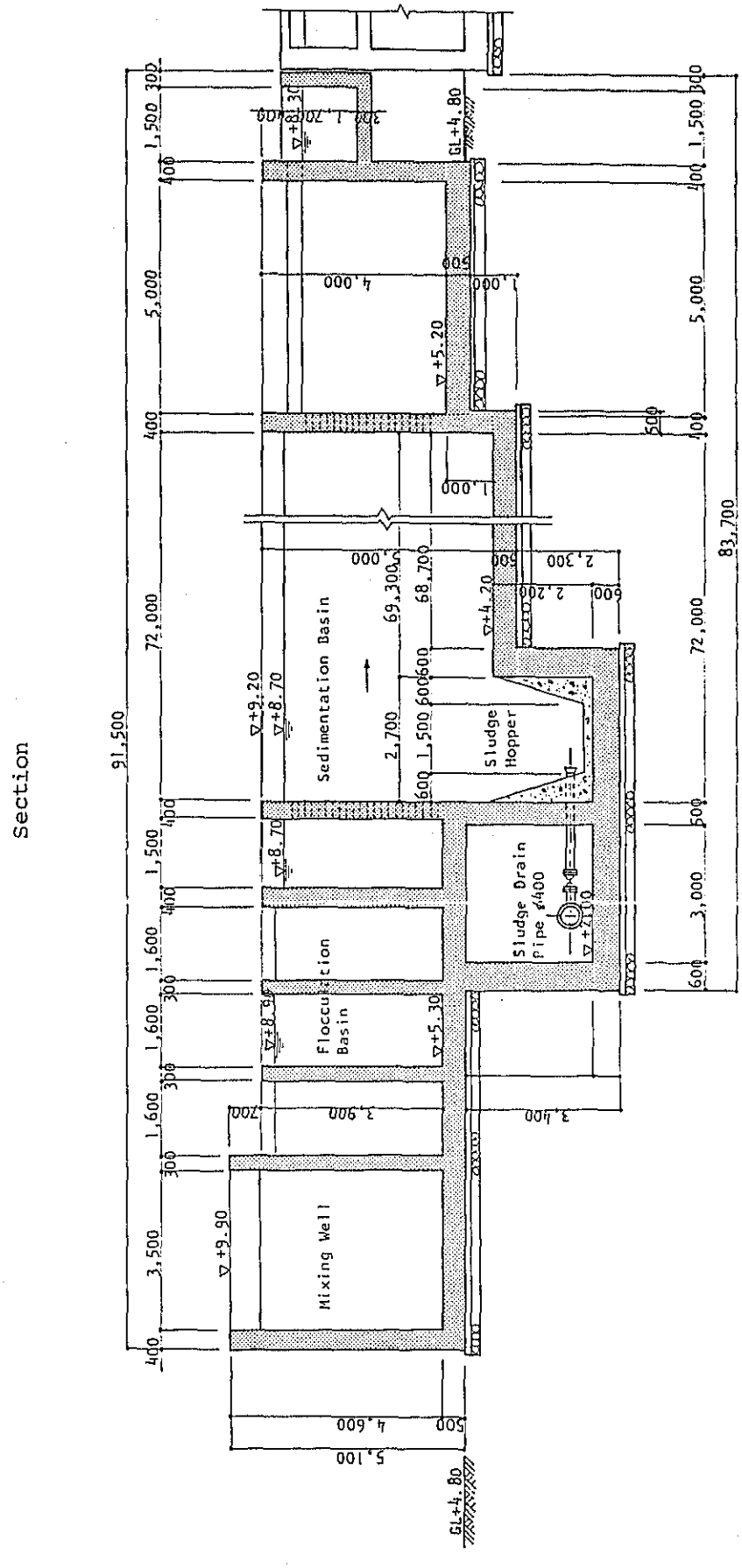


Fig-2.2.34 SEDIMENTATION BASIN
(Kafr Saqr Plant)

Plan

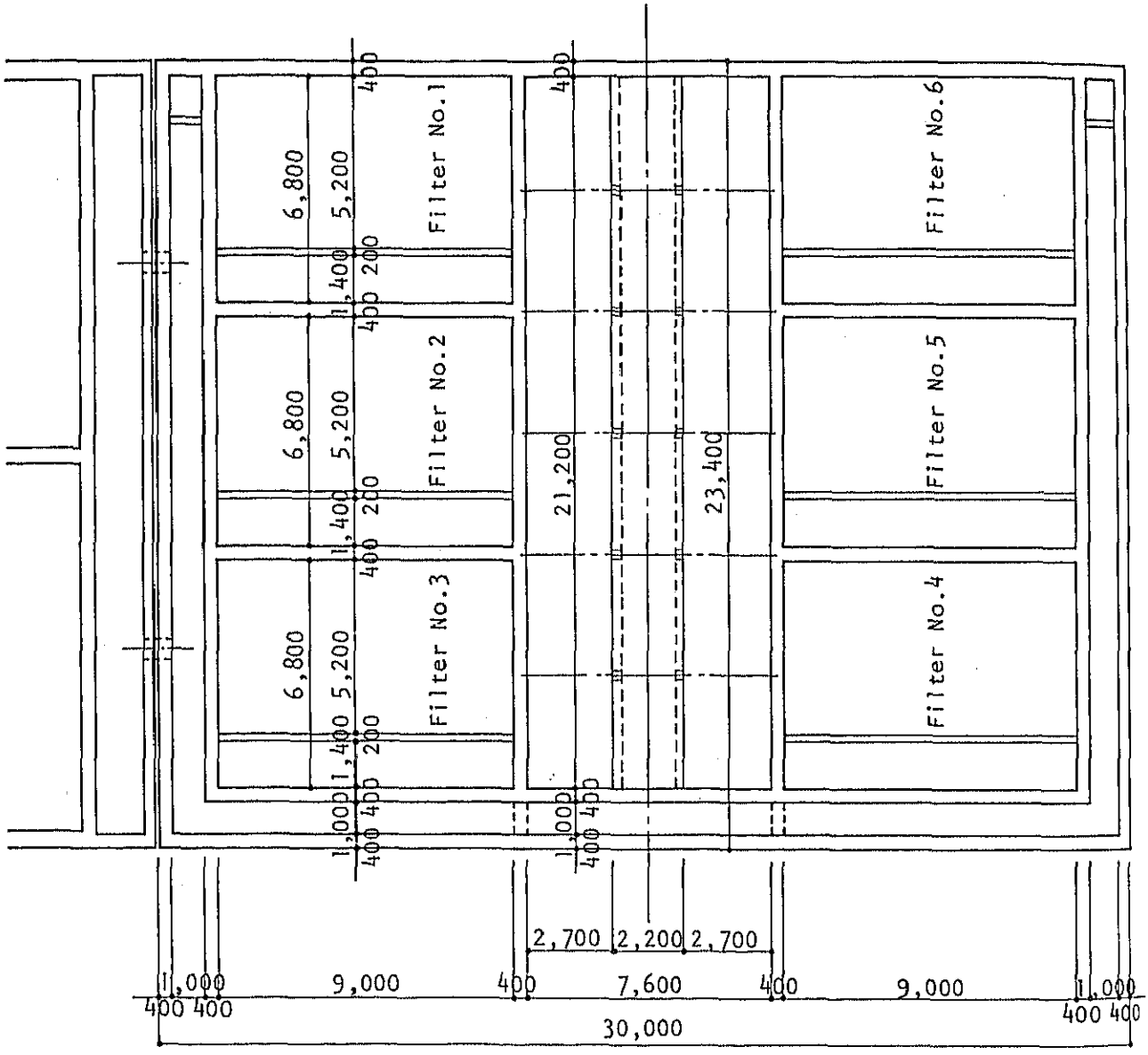


Fig-2.2.35 FILTER
(Kafr Saqr Plant)

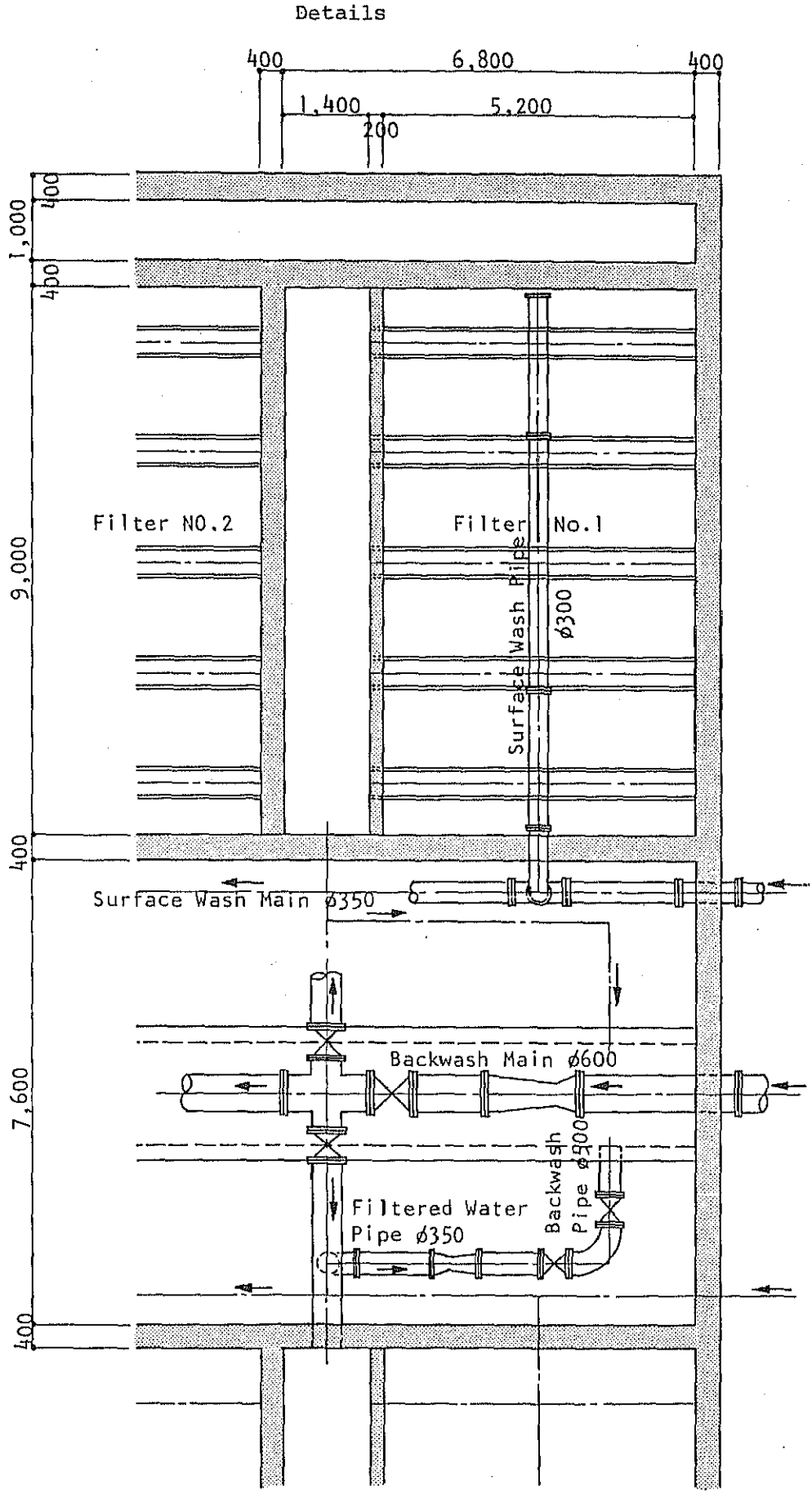


Fig-2.2.36 FILTER
(Kafr Saqr Plant)

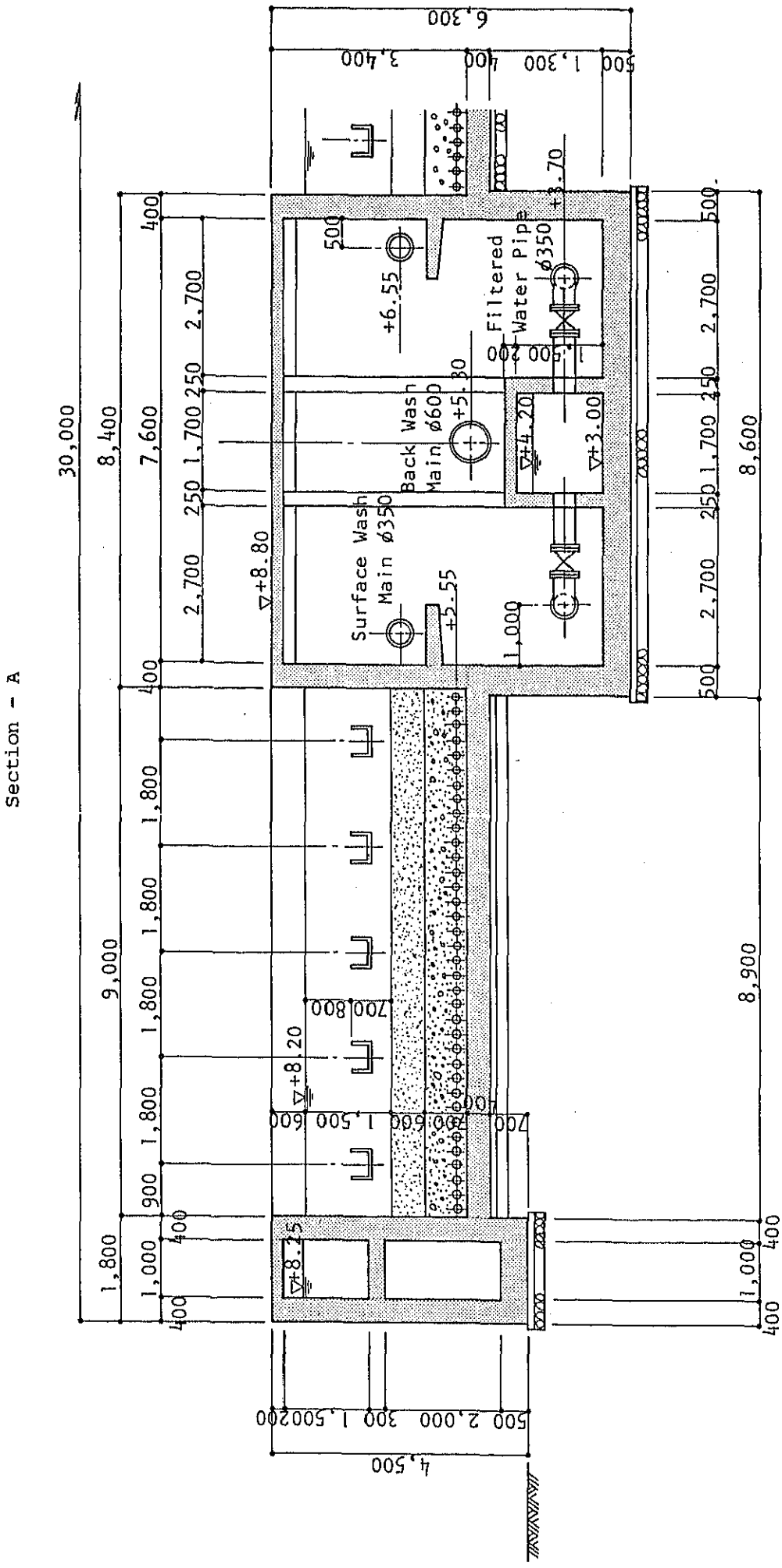


Fig-2.2.37 FILTER
(Kafr Saqr Plant)

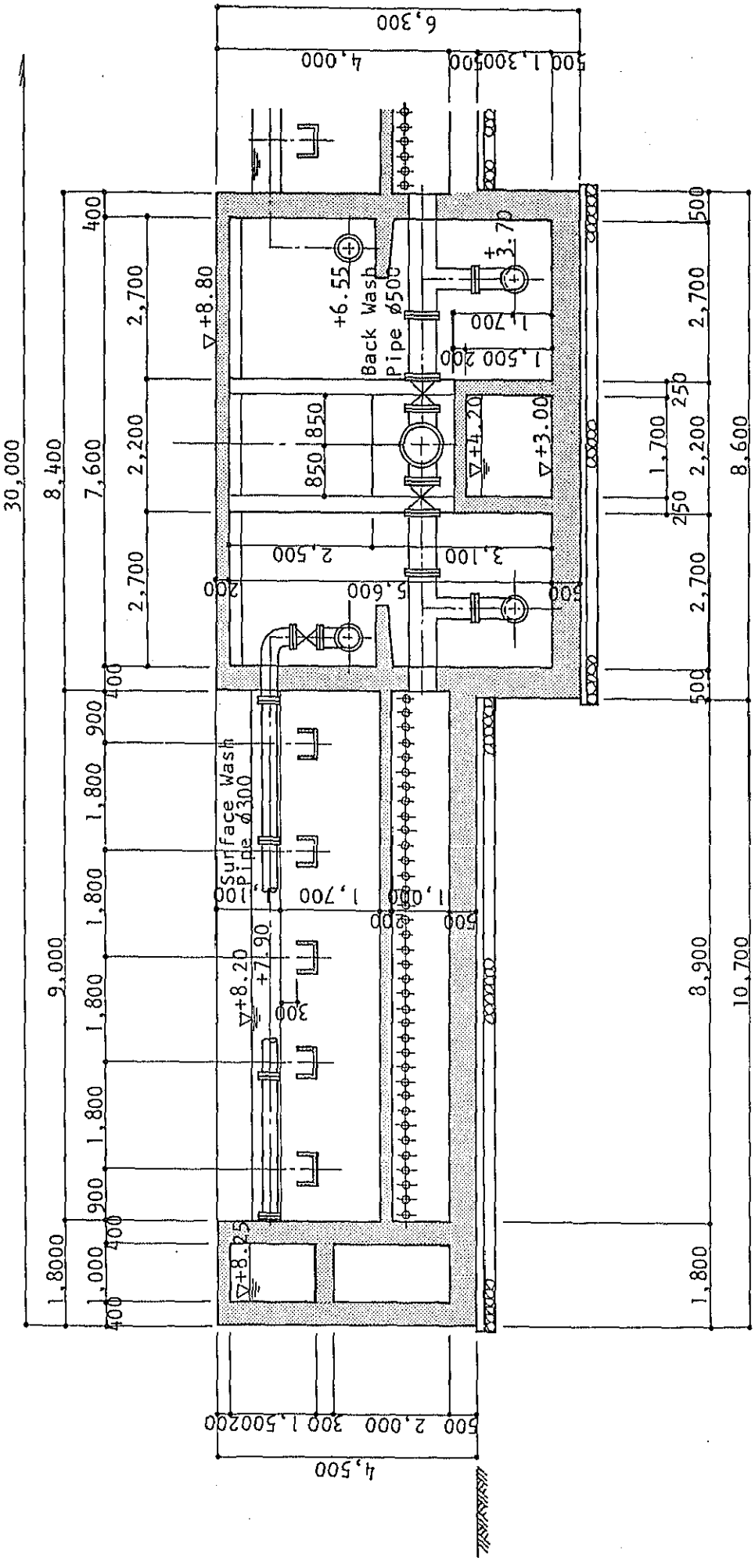


Fig-2.2.38 FILTER
(Kafr Saqr Plant)

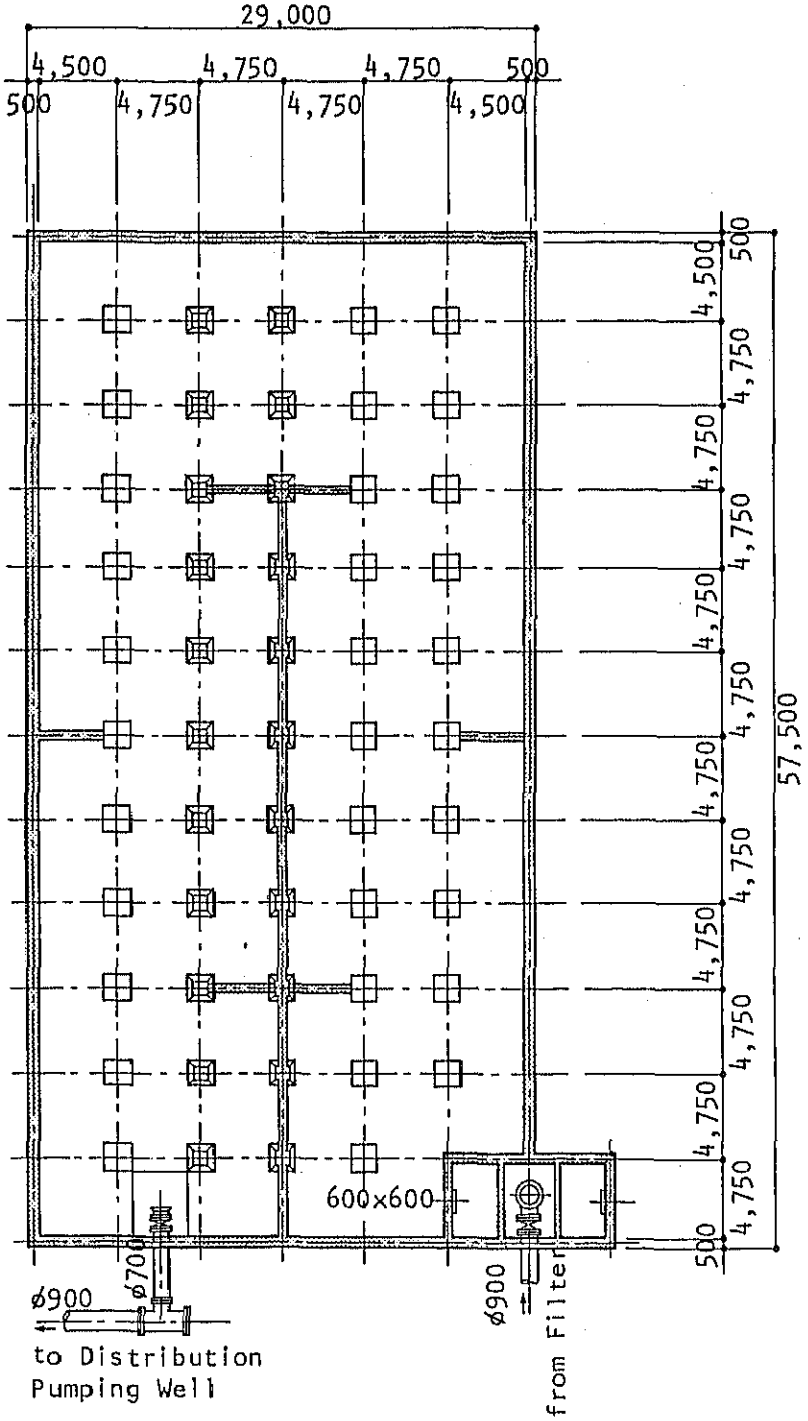
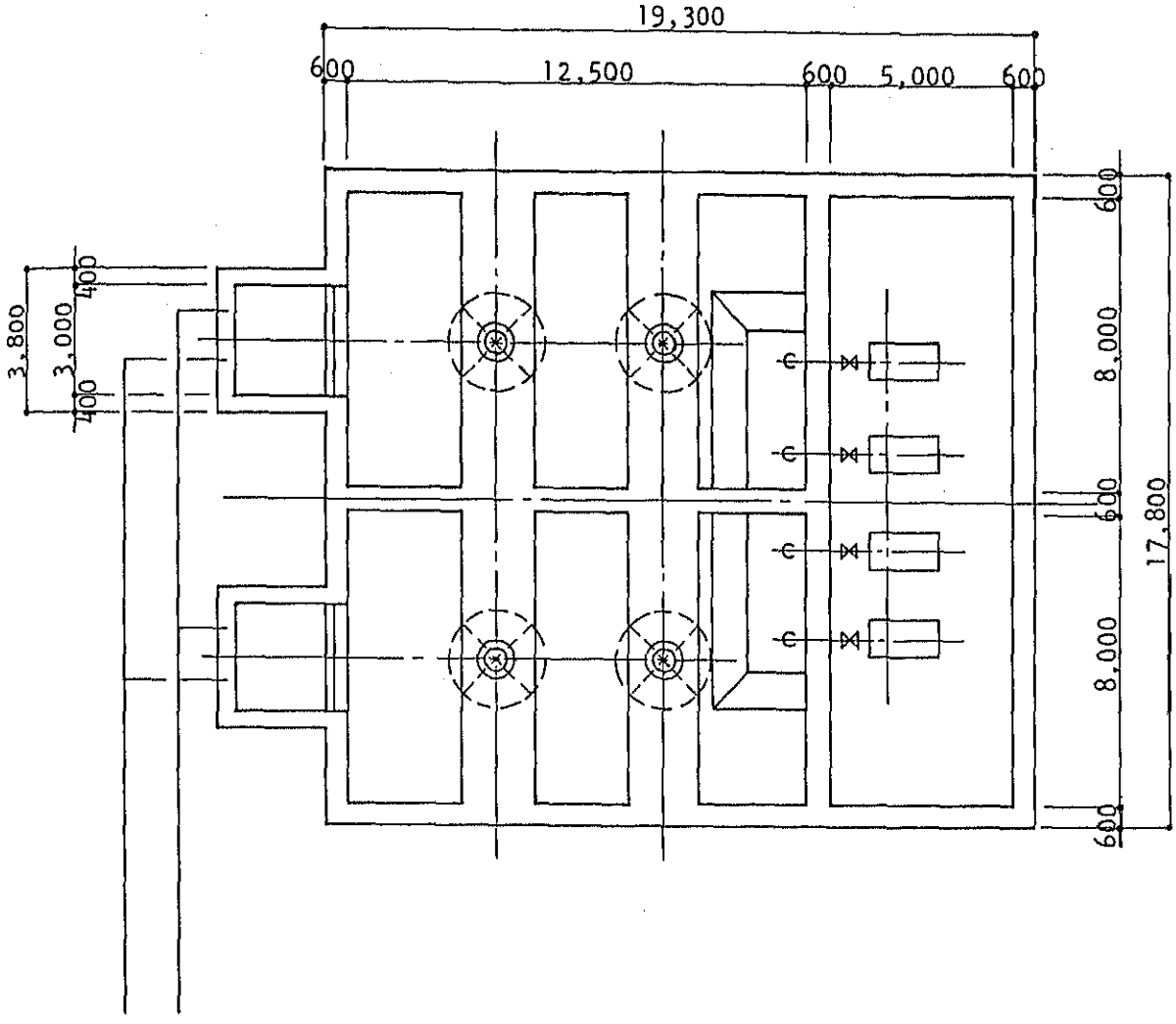


Fig-2.2.39 RESERVOIR
(Kafr Saqr Plant)

Plan



Section

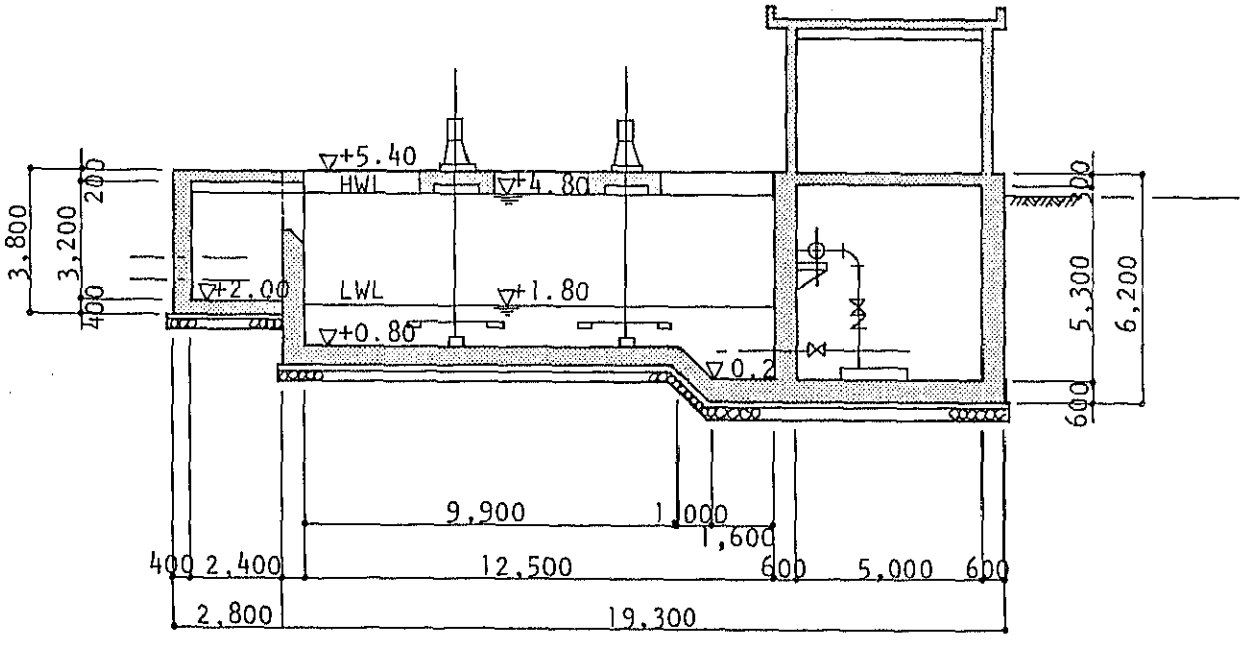


Fig-2.2.40 WASTEWATER BASIN
(Kafr Saqr Plant)

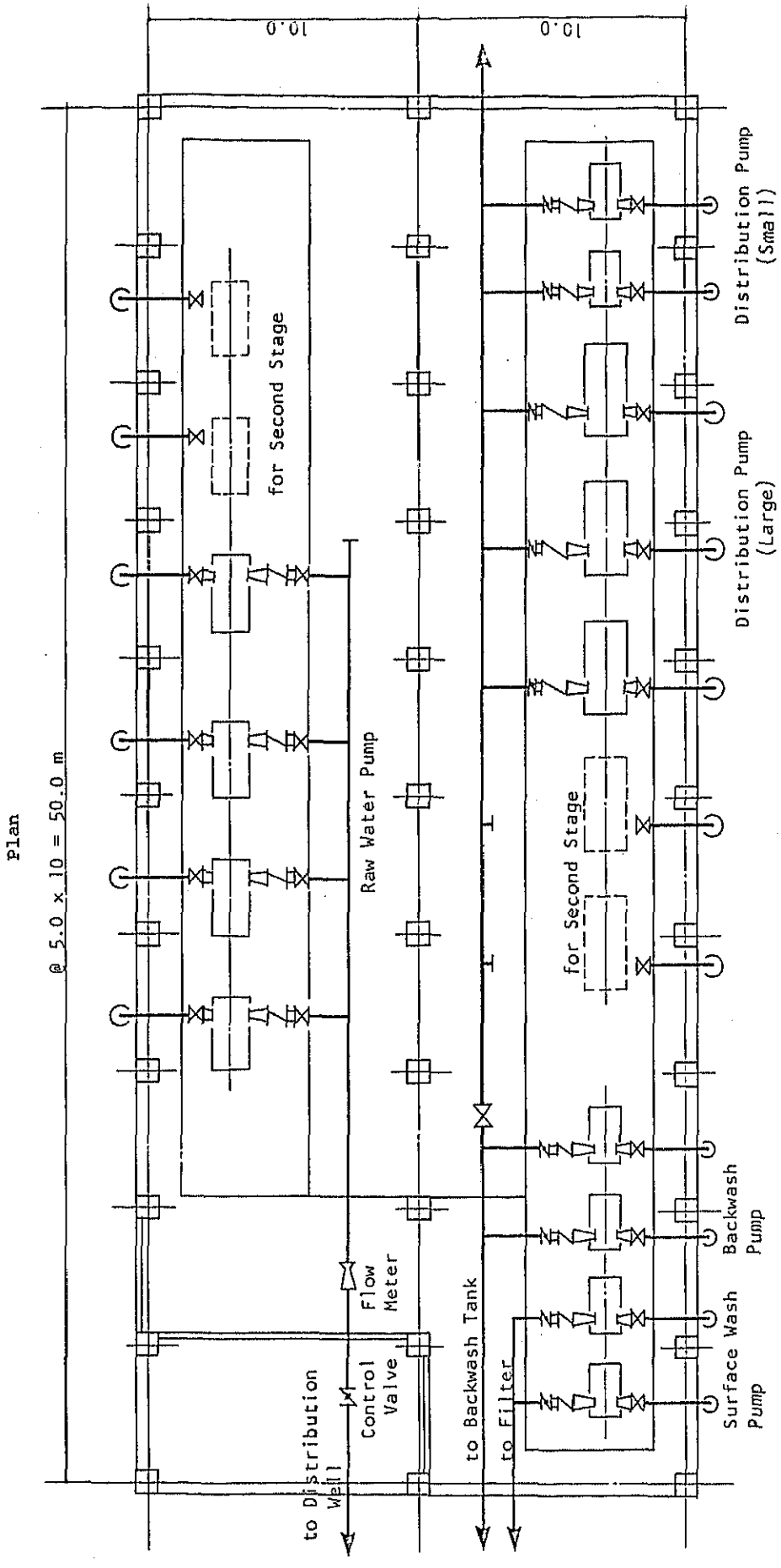


Fig-2.2.41 PUMP STATION
(Kafr Saqr Plant)

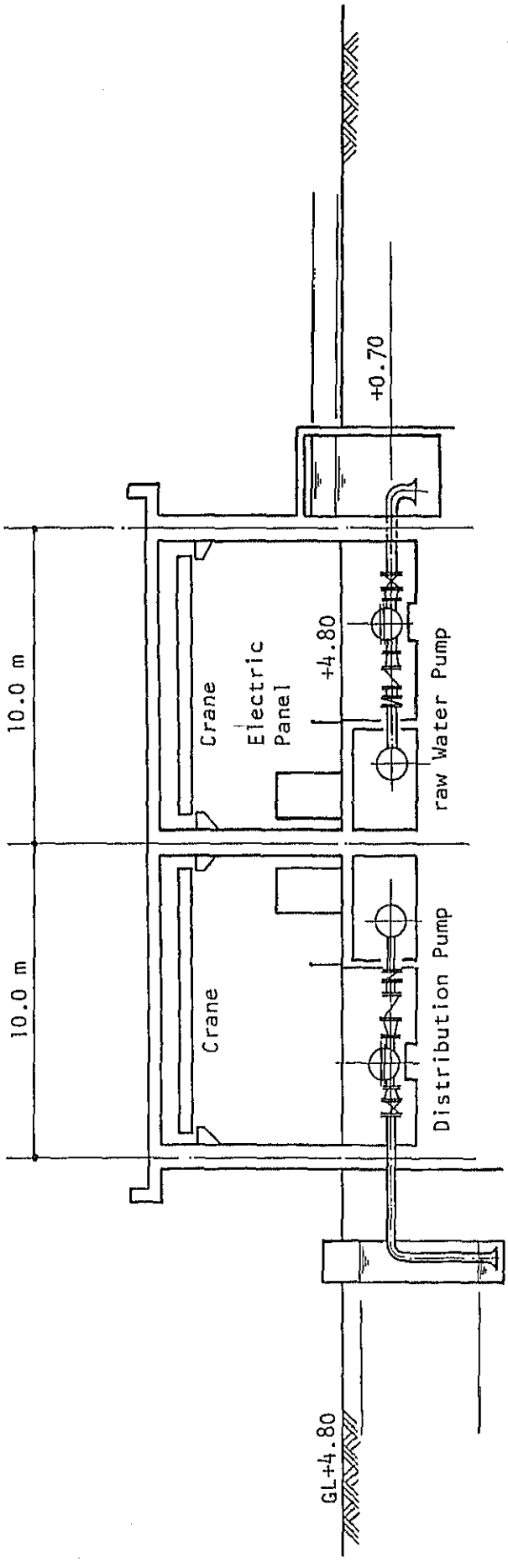
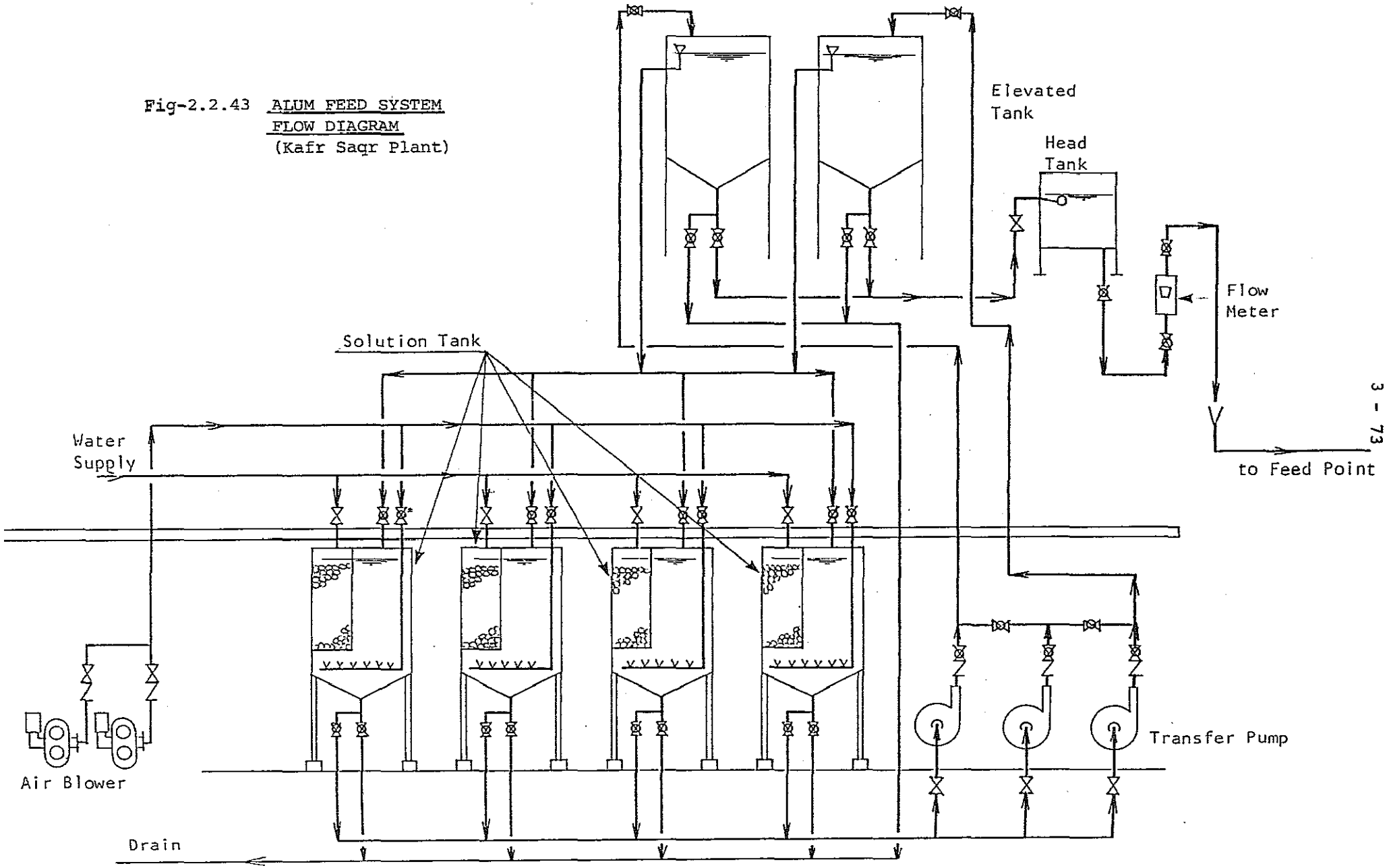


Fig-2.2.42 PUMP STATION
(Kafr Saqr Plant)

Fig-2.2.43 ALUM FEED SYSTEM FLOW DIAGRAM (Kafr Saqr Plant)



Plan

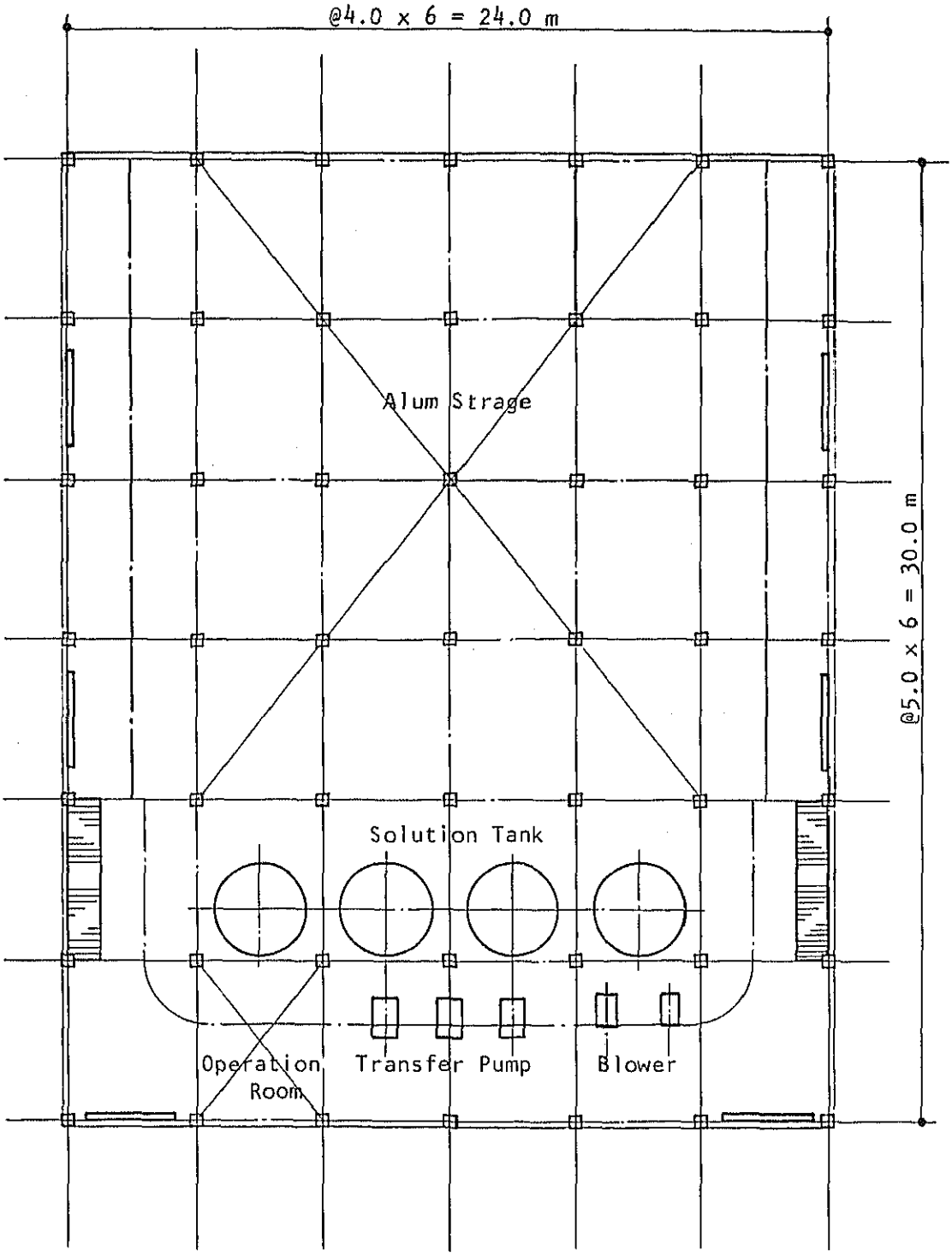


Fig-2.2.44 ALUM BUILDING
(Kafr Saqr Plant)

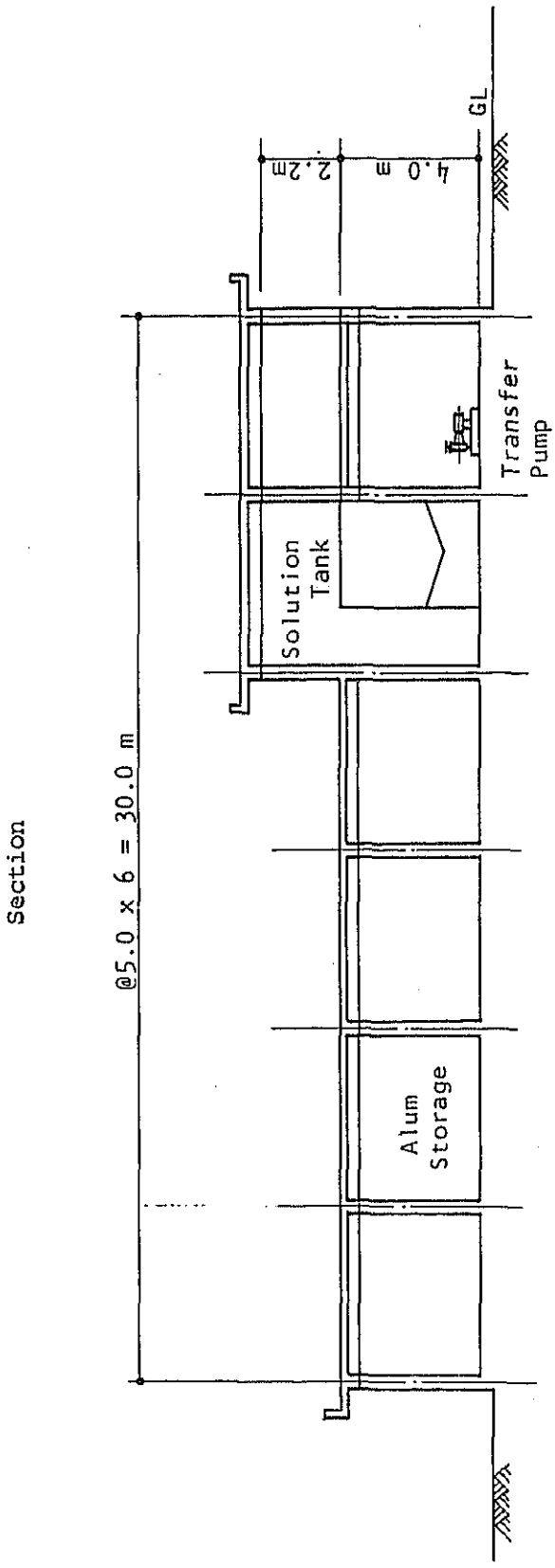


Fig-2.2.45 ALUM BUILDING (Kafr Saqr Plant)

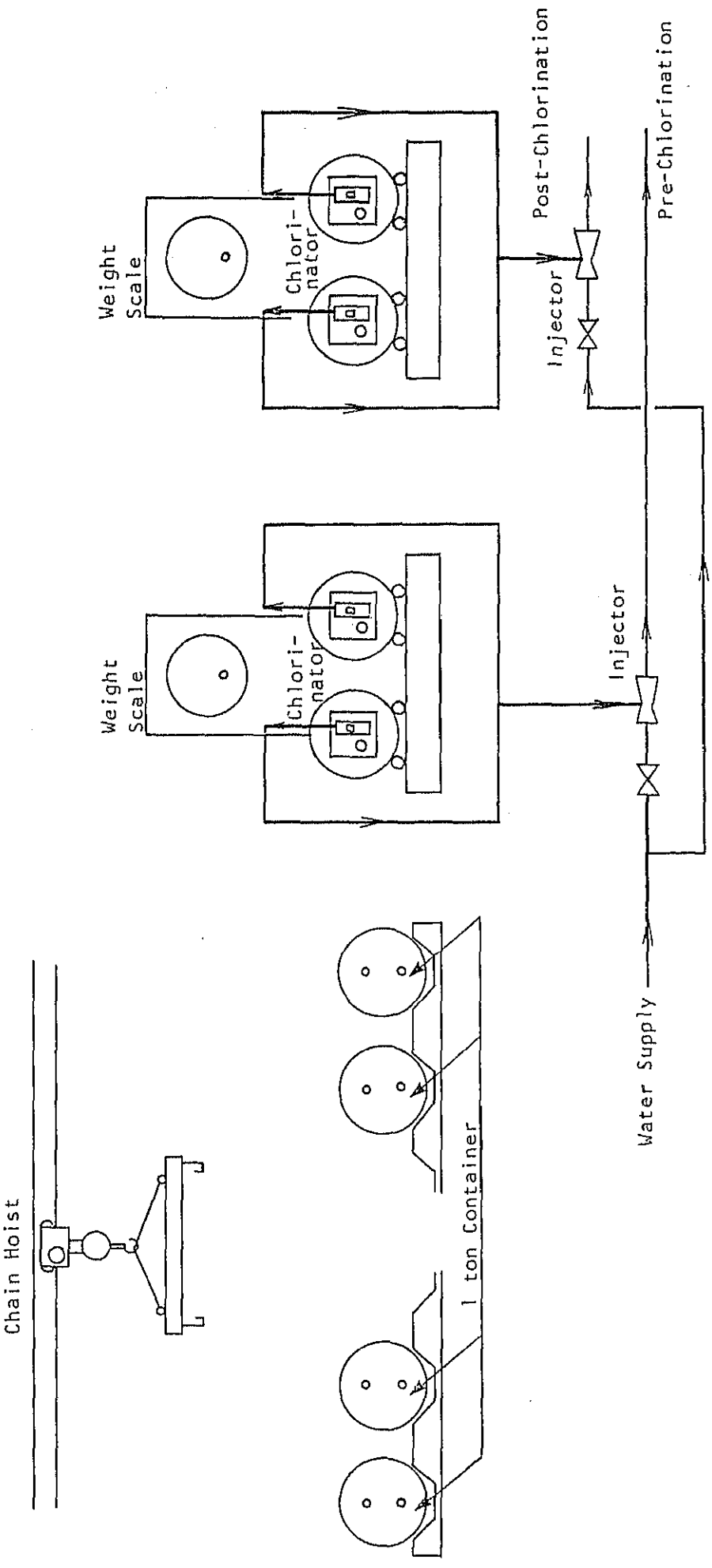


Fig-2.2.46 CHLORINATION SYSTEM FLOW DIAGRAM
(Kafr Saqr Plant)

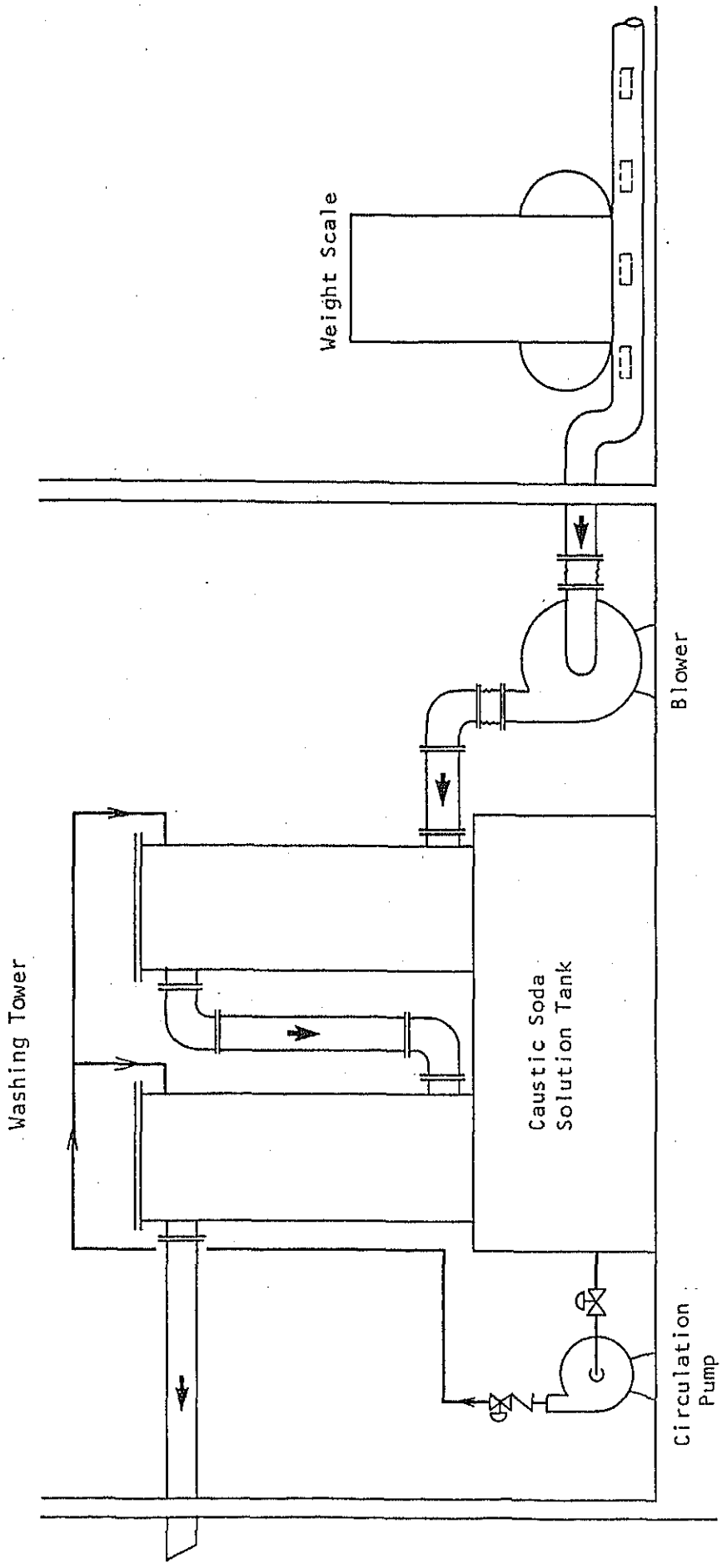


Fig-2.2.47 NEUTRALIZATION SYSTEM FLOW DIAGRAM
(Kafr Saqr Plant)

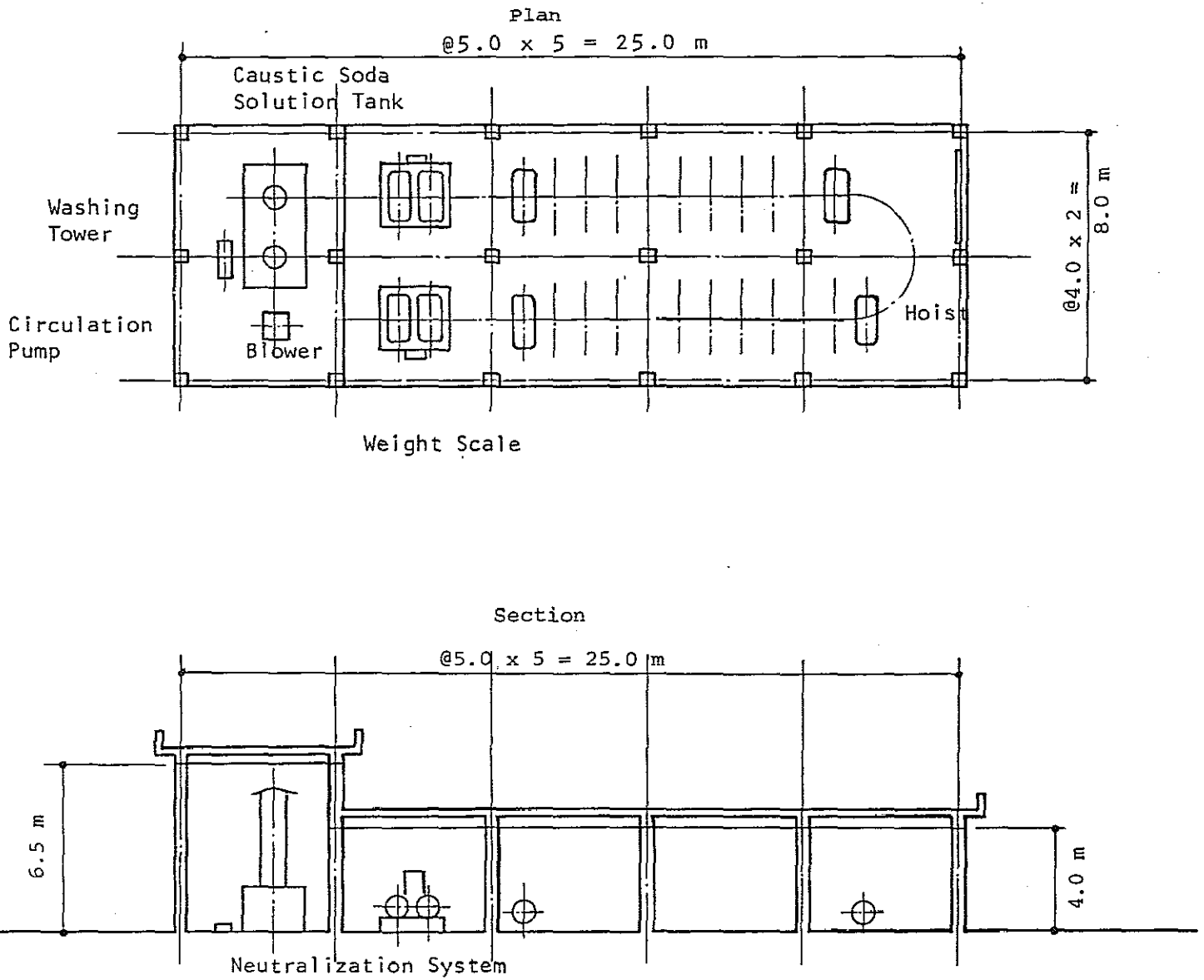


Fig-2.2.48 CHLORINE BUILDING
(Kafr Saqr Plant)

2.3 Emergency Works

The Emergency Works are planned to relieve the present poor condition of water supply to a certain extent, and consist of strengthening works for densely populated Zagazig city and for the southern area of the Governorate, rehabilitation of existing plants and procurement of machines/vehicles for maintenance.

2.3.1 Production Increase of Zagazig Treatment Plant

As a result of the technical study with regard to a possibility of an expansion of the existing plant capacity, it was proved that additional 120 l/s could be increased by additional construction work, within the existing land area of the Zagazig Plant, making total capacity of 320 l/s. This construction work was considered useful to great extent, in order to contribute to urgent improvement of present water supply condition of Zagazig city. The work is proposed as one of the emergency works to be implemented urgently.

The outline of the prodution increase work is as follows:

Water Source : Muweis Canal water (As the Existing)
Treatment Method : Rapid Sand Filtration (As the Existing)
Proposed Facilitites to be constructed a new :

a) Flocculation/Sedimentation Basins
   40 l/s x 3 basins = 120 l/s
b) Filters 40 l/s 4 beds (one standby) = 120 l/s
c) Mixing Well 1 well for 120 l/s
d) Reservoir 2 reservoirs
e) Chlorination Chamber 1 chamber for 210 l/s
f) Intake Facility 1 unit for 320 l/s
g) Raw Water Pumps/Room For 320 l/s
h) Distribution Pumps/Room For 320 l/s
i) Distribution Pumps/Room For 320 l/s
   100 l/sec x 3 units (1 standby)
   60 l/sec x 3 units (2 standby)
j) Distribution pumps
   100 l/sec x 5 units
   50 l/sec x 2 units

k) Surface wash pumps

96 l/sec x 2 units (1 standby)

l) Power receiving and supply system

The brief explanation of the aforementioned facilities is as follows:

Flocculation/sedimentation basins are to be completed by some modification work of the existing old sedimentation basins which were constructed in 1909 and have been left unused.

Chlorination chamber, intake facility, raw water pumps and distribution pumps are to be installed with capacity of 320 l/s which combines the existing (200 l/s) with the additional (120 l/s), since existing pumps have been deteriorated and need replacement.

Chemicals of aluminum sulphate and chlorine are proposed to be fed by the existing facilities with rehabilitation works.

Surface wash system of the filters is proposed for the additional filters. To this end, surface wash pumps are proposed to be installed in the distribution pump room. As for backwash for the filters, the existing elevated tank in the plant for distribution is utilizable.

The filtrated water of the existing facility (200 l/s) is to be conveyed to the new reservoir through the existing reservoir for post-chlorination and for distribution together with the additional 120 l/s water.

Distribution pipe is to be connected to the existing 24" diameter distribution pipeline which is enough for 320 l/s distribution.

Preliminary design drawings for the production increase of Zgazig Treatment Plant are shown in the following sheets.

Drawing List

No.	Title	Plant
2.3.1	General Plan	Zagazig Plant Increase
2.3.2	Intake Facilities	"
2.3.3	Plan of Raw Water Pump Station	"
2.3.4	Section of Raw Water Pump Station	"
2.3.5	Treatment Facilities	"
2.3.6	Plan of Mixing Well	"
2.3.7	Section of Mixing Well	"
2.3.8	Plan of Flocculation Basin and Sedimentation Basin	"
2.3.9	Section of Flocculation Basin and Sedimentation Basin	"
2.3.10	Details of Filters	"
2.3.11	Section-A of Filters	"
2.3.12	Section-B of Filters	"
2.3.13	Reservoir and Distribution Pump Room	"
2.3.14	Section of Reservoir	"
2.3.15	Section of Distribution Pum Room	"
2.3.16	General Plan	"
2.3.17	Old existing Sedimentation Basin	"
2.3.18	Existing Wall of Sedimentation Basin	"

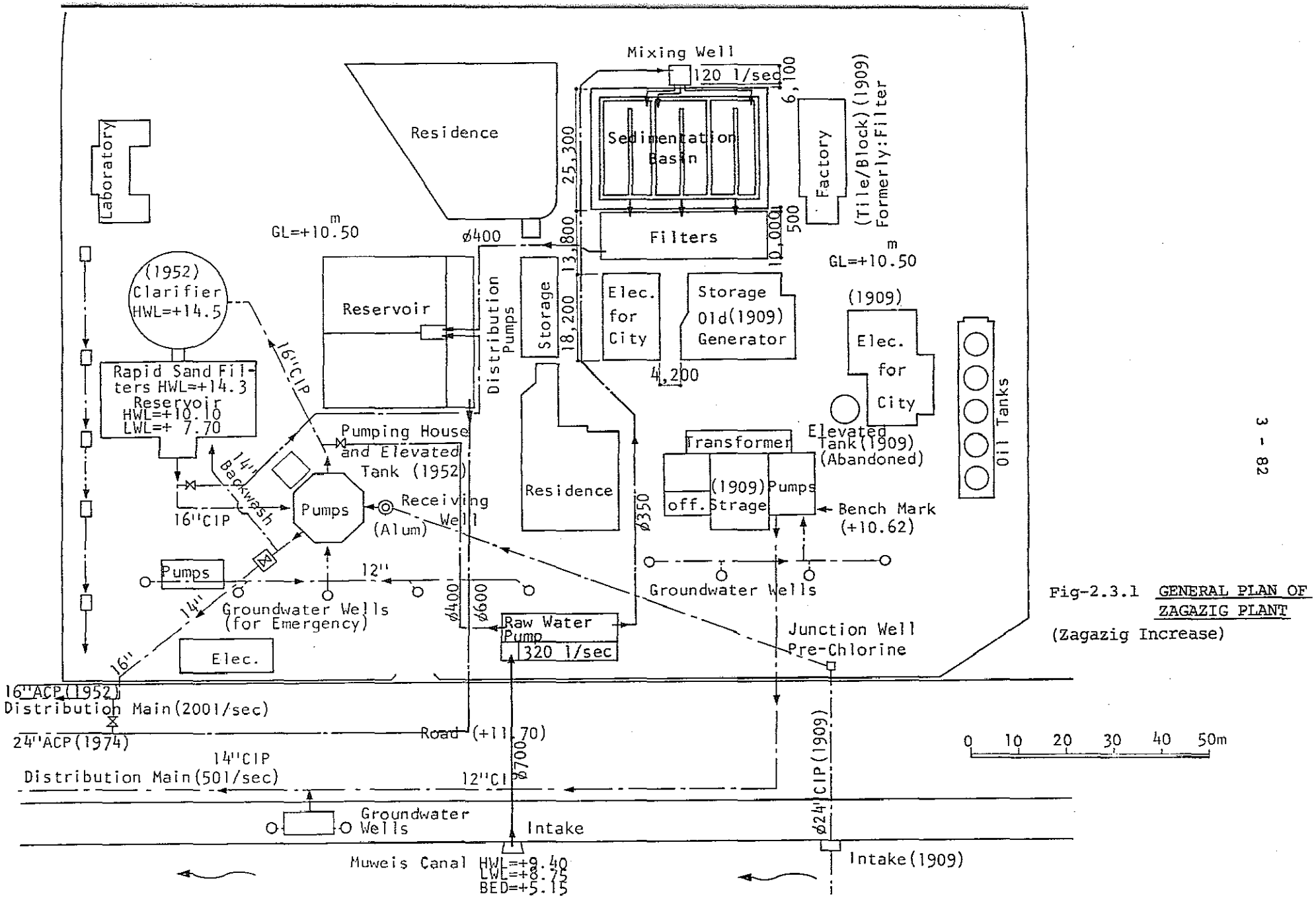


Fig-2.3.1 GENERAL PLAN OF ZAGAZIG PLANT

(Zagazig Increase)

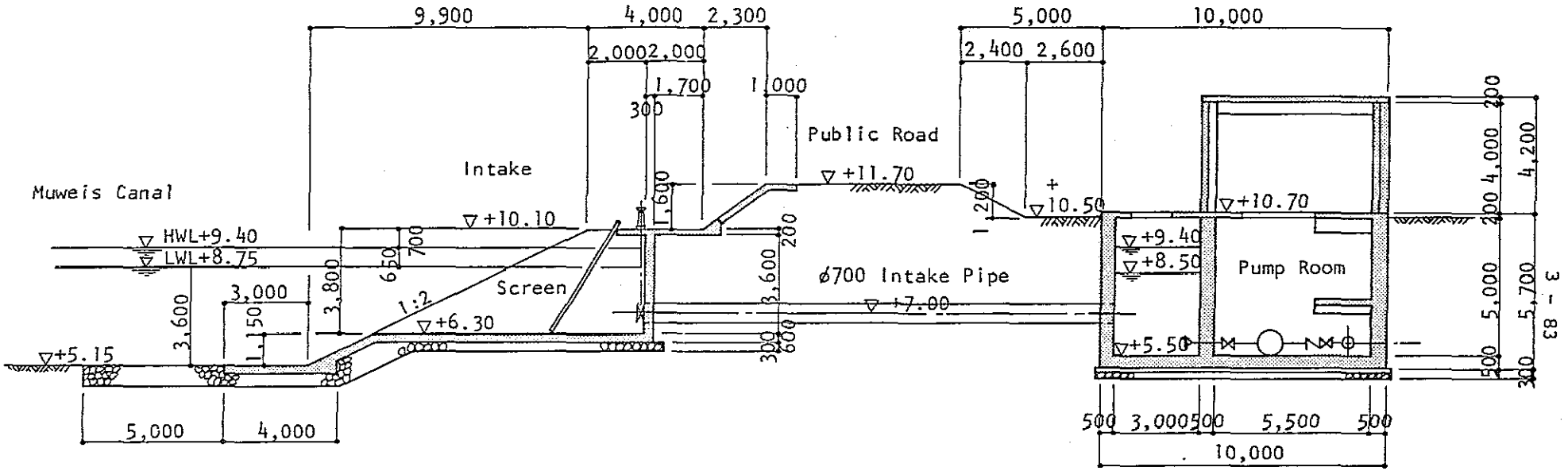


Fig-2.3.2 INTAKE FACILITIES
(Zagazig Increase)

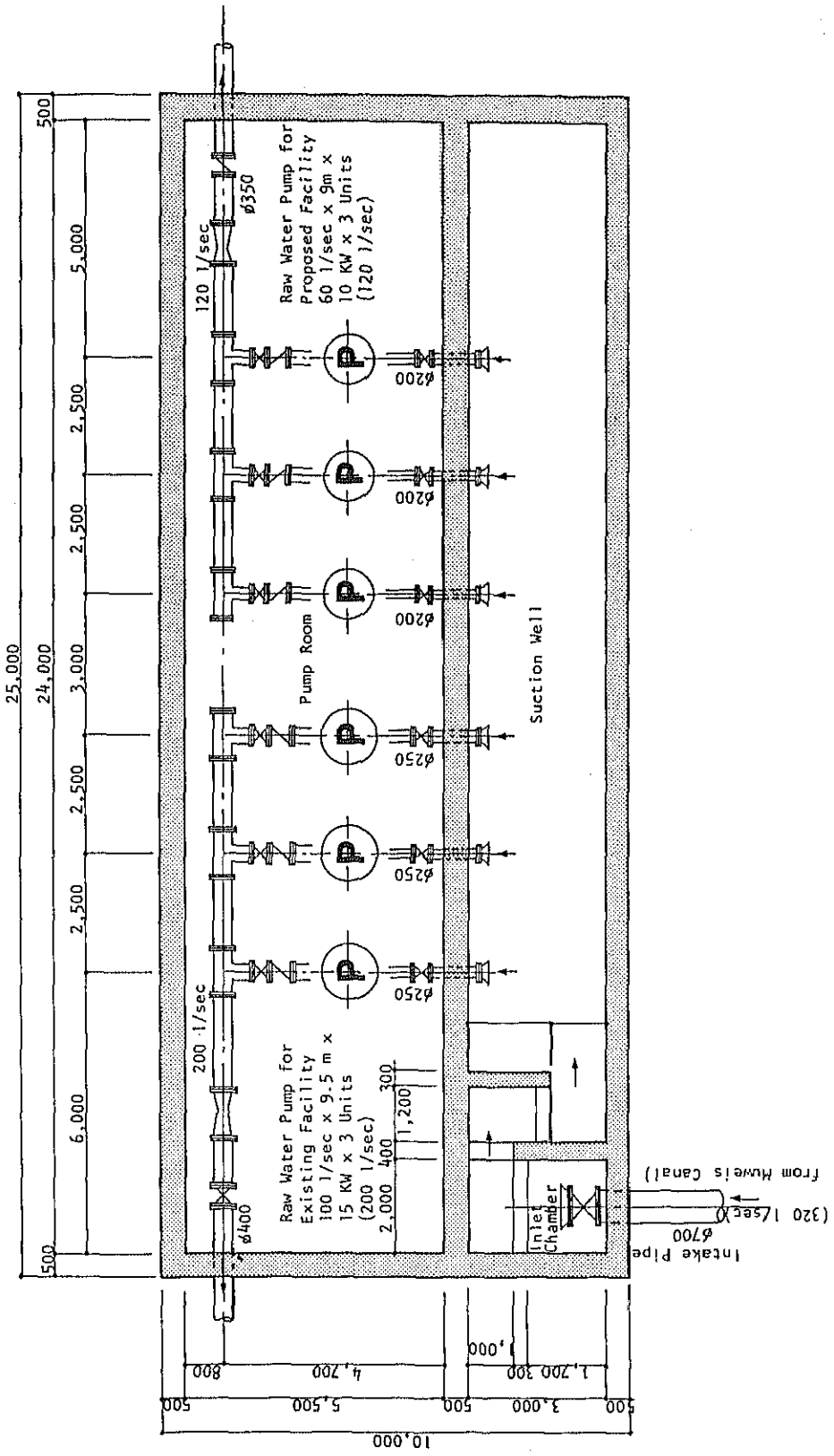


Fig-2.3.3 RAW WATER PUMP STATION

(Zagazig Increase)

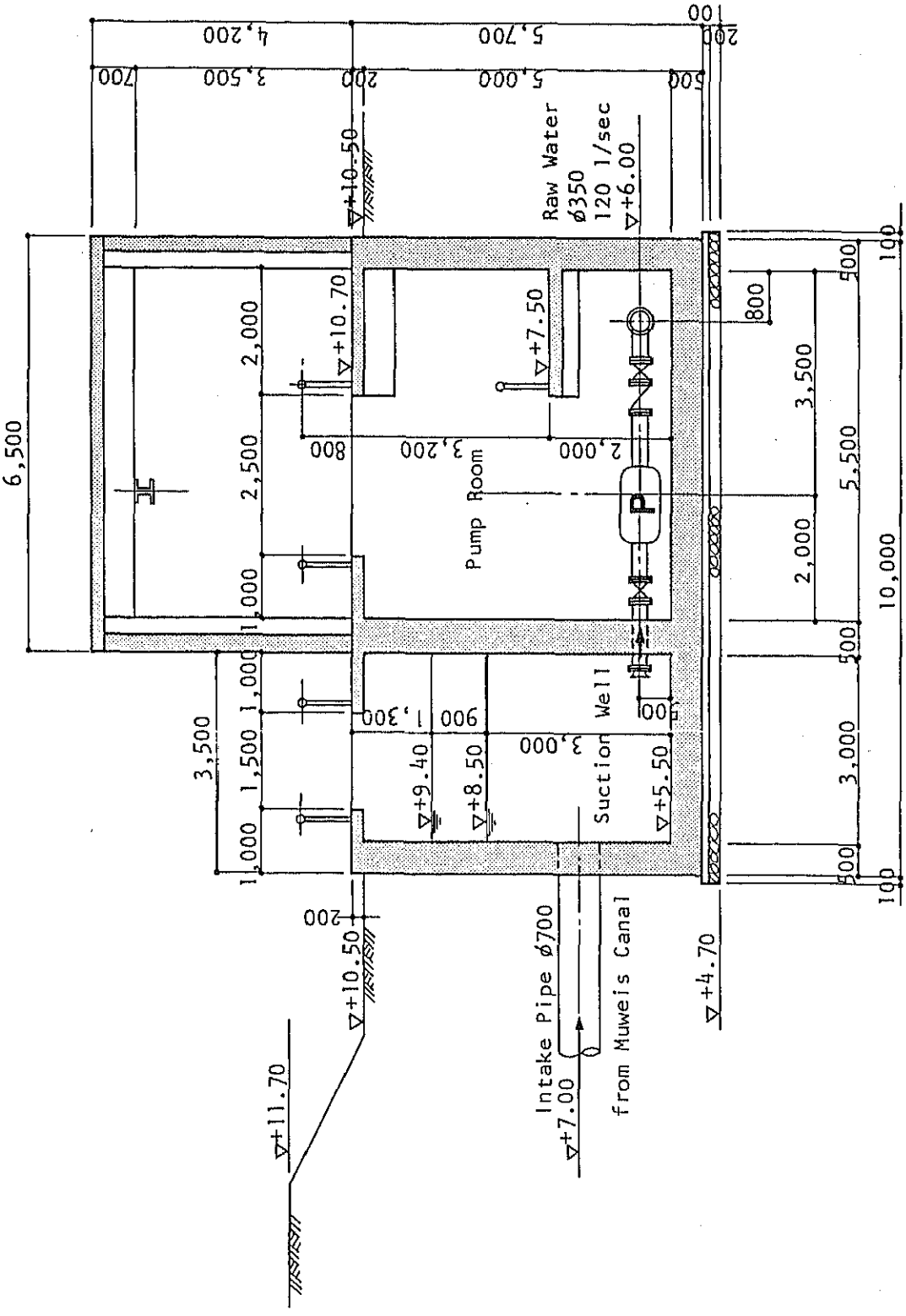


Fig-2.3.4 RAW WATER PUMP STATION
(Zagazig Increase)

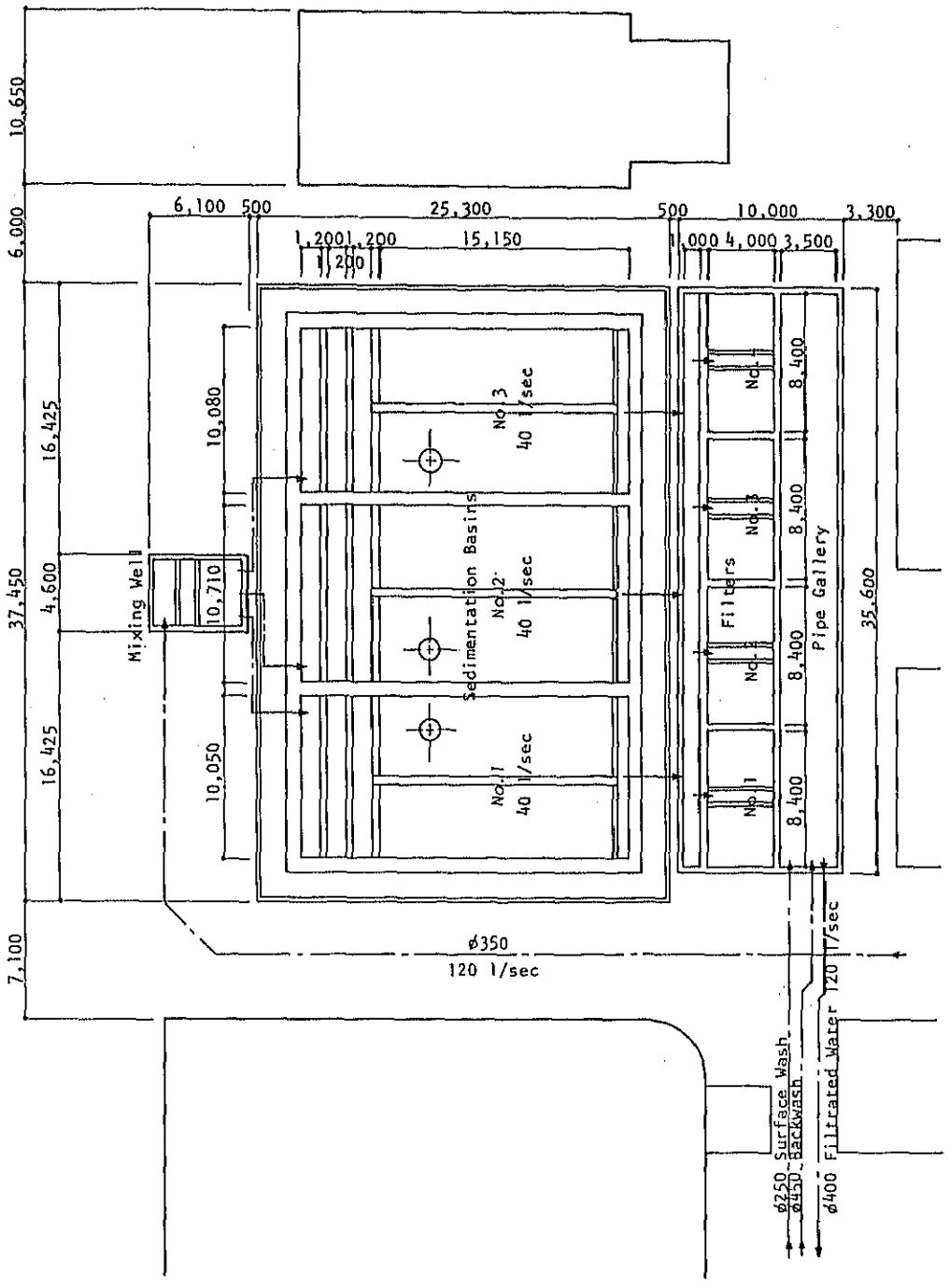


Fig-2.3.5 TREATMENT FACILITIES
(Zagazig Increase)

Plan

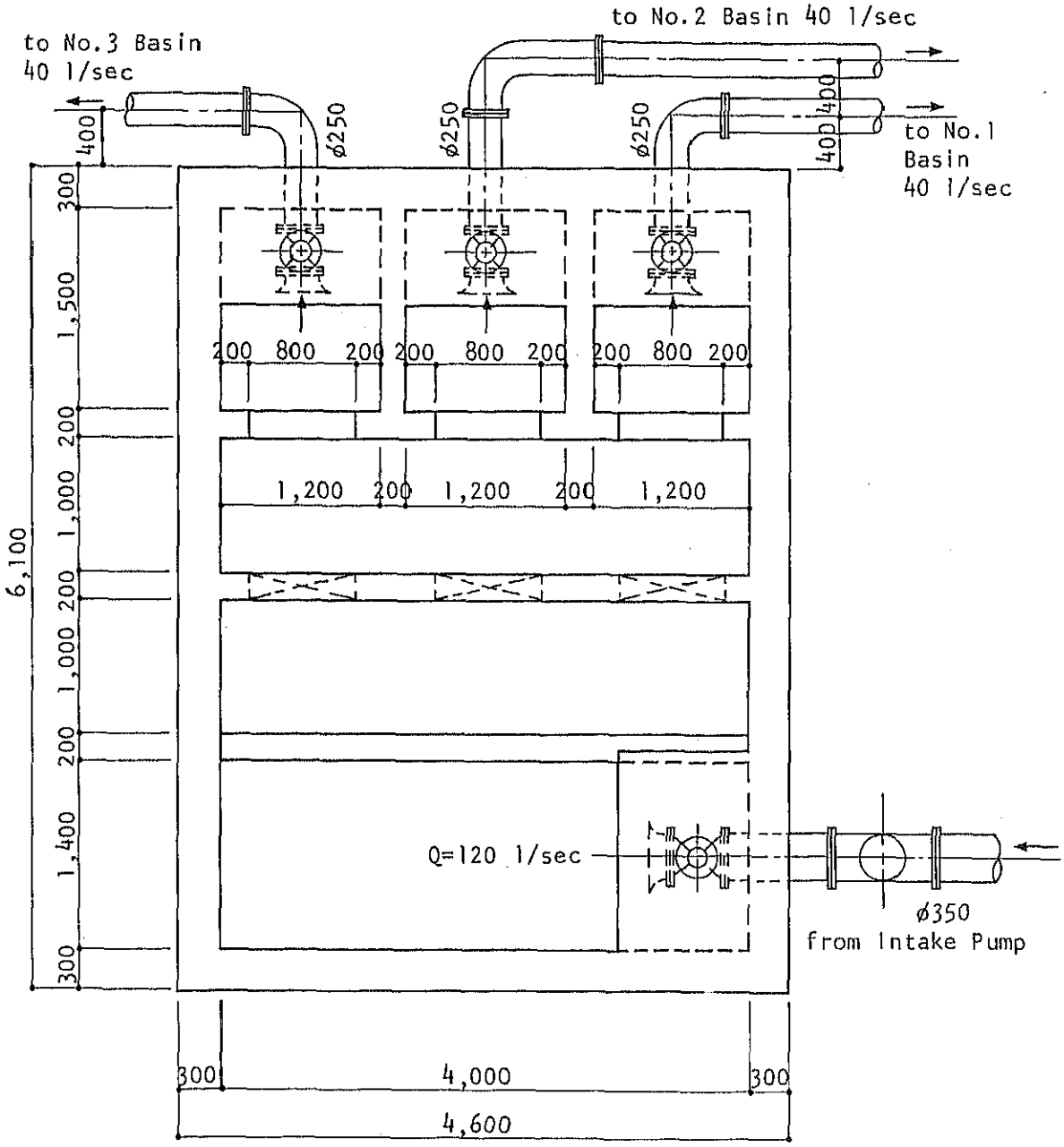


Fig-2.2.6 MIXING WELL
(Zagazig Increase)

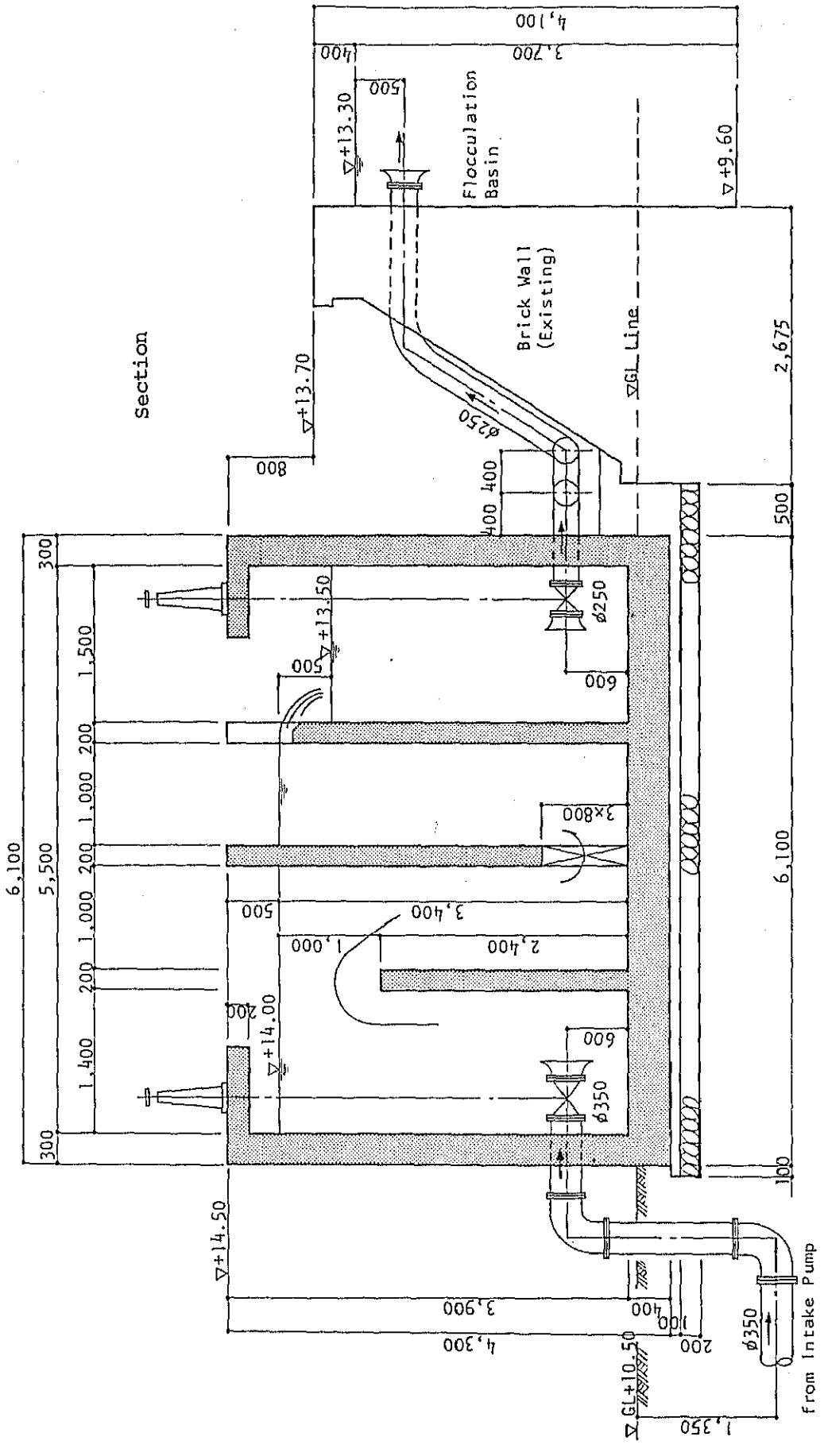


Fig-2.3.7 MIXING WELL
(Zagazig Increase)

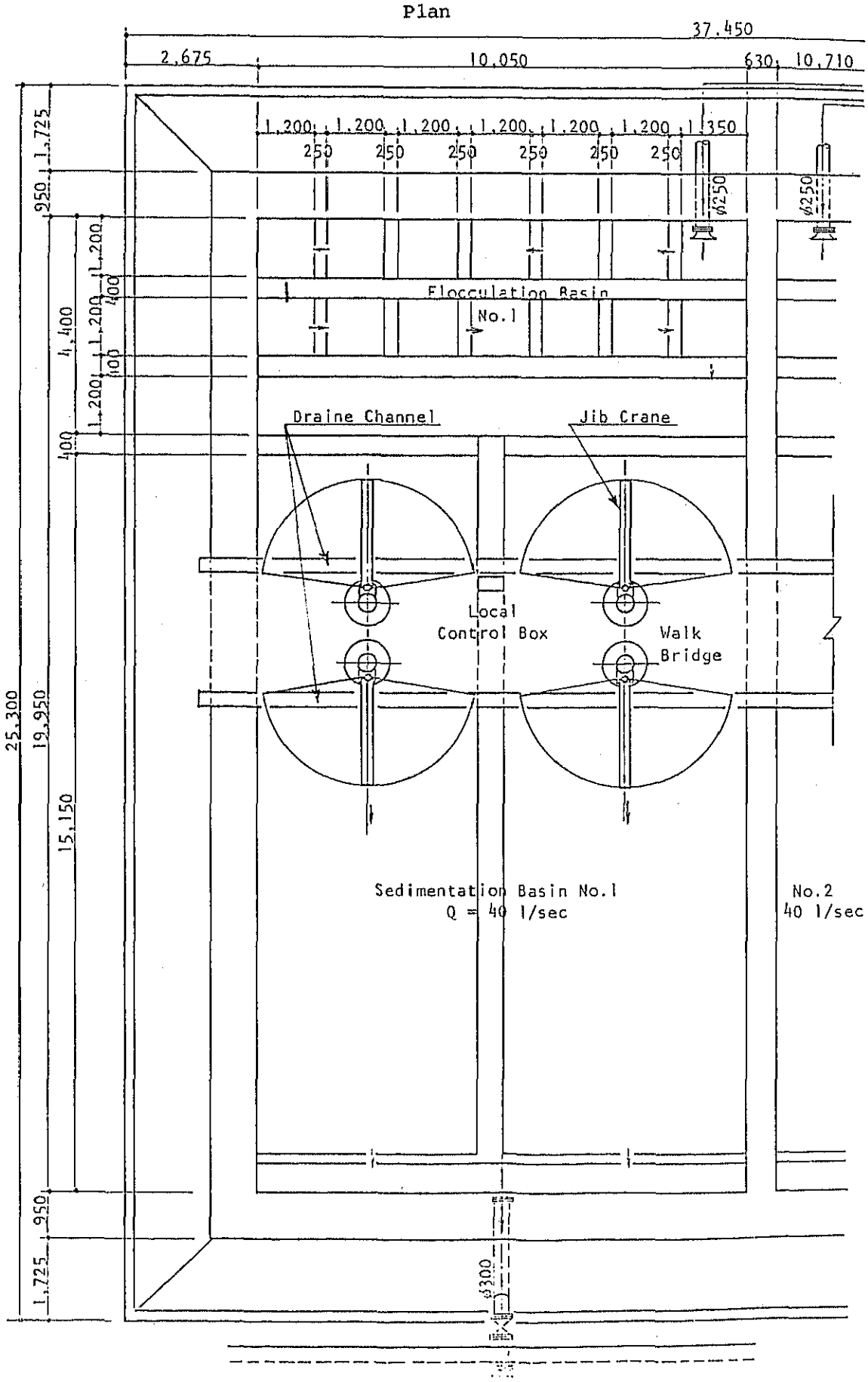


Fig-2.3.8 FLOCCULATION BASIN AND SEDIMENTATION BASIN
(Zagazig Increase)

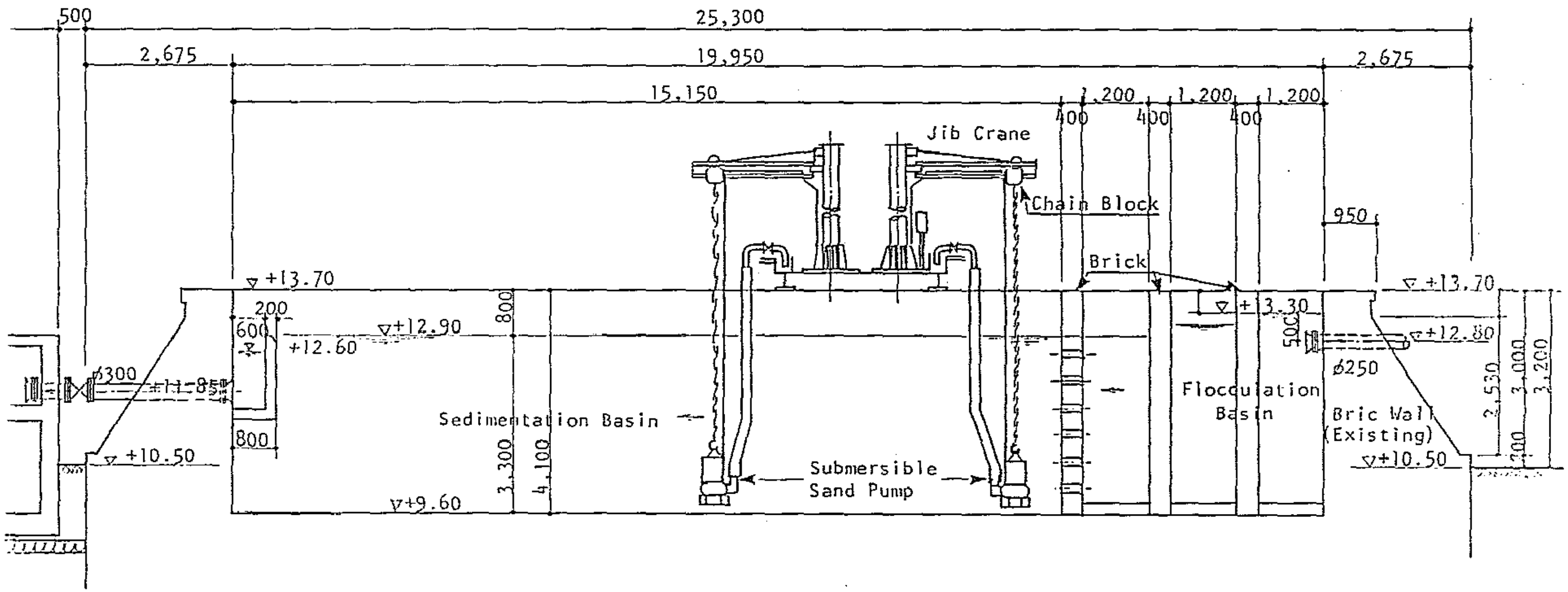


Fig-2.3.9 FLOCCULATION BASIN AND SEDIMENTATION BASIN
(Zagazig Increase)

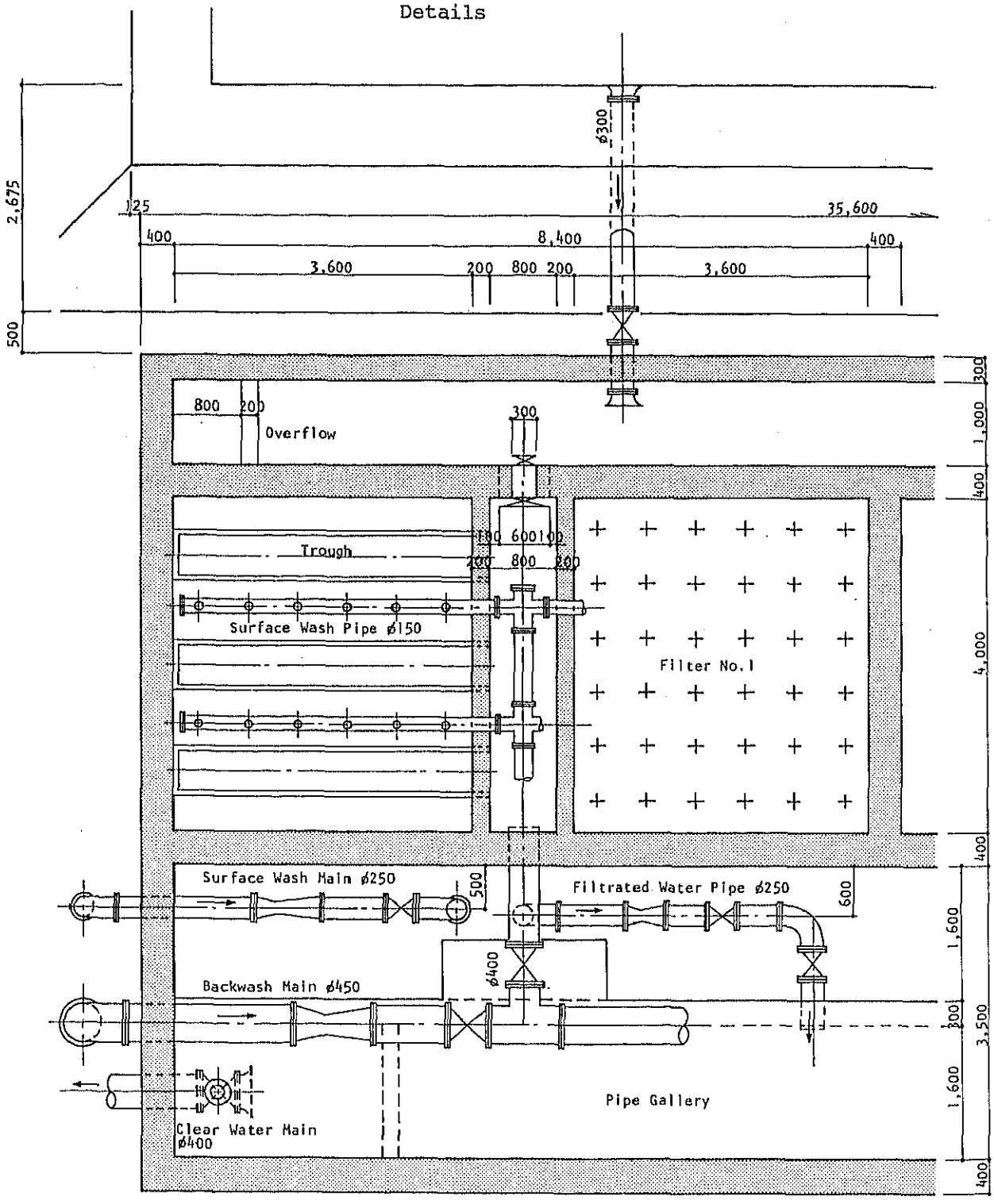


Fig-2.3.10 FILTERS
(Zagazig Increase)

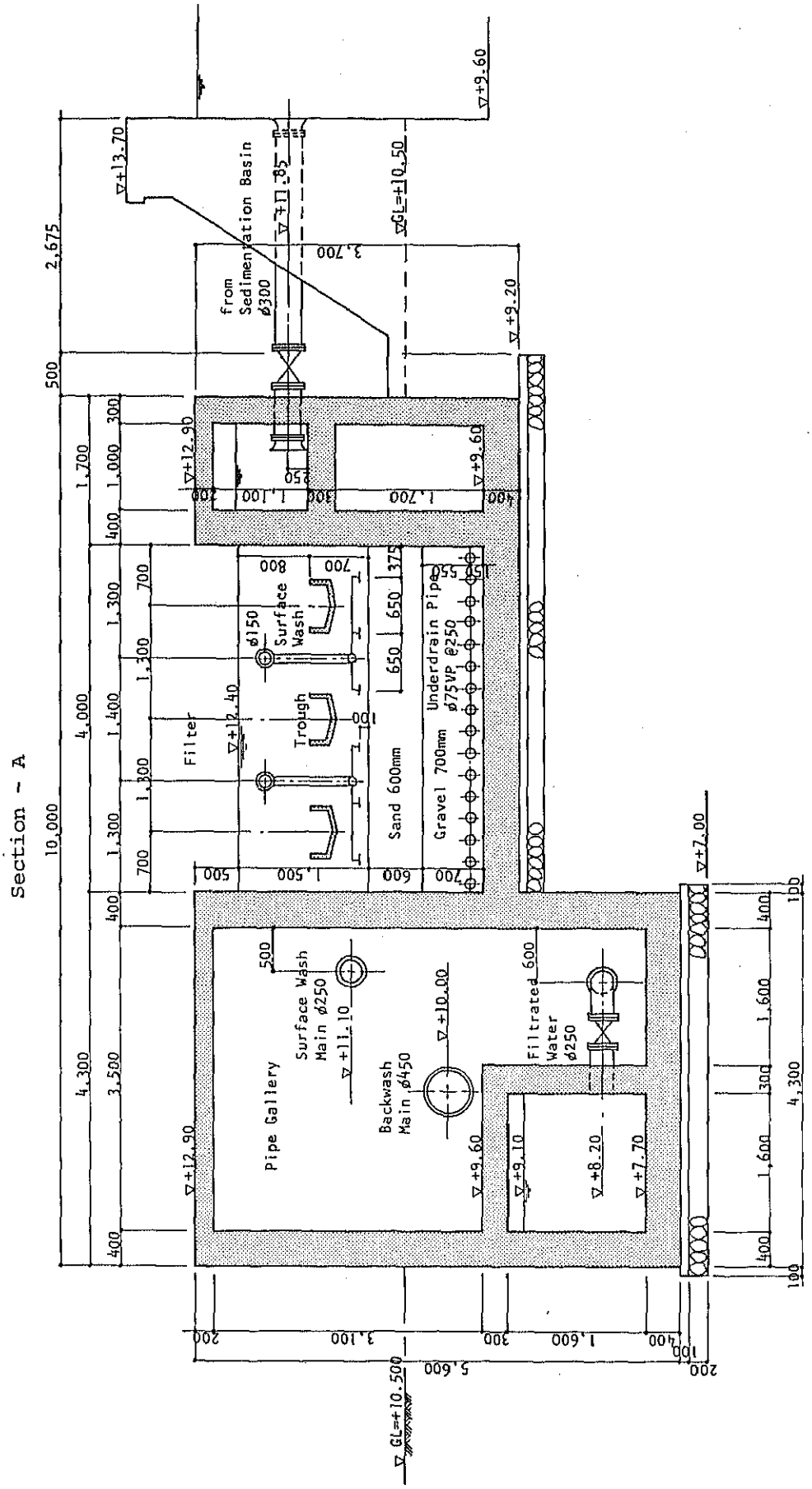


Fig-2.3.11 FILTERS (Zagazig Increase)

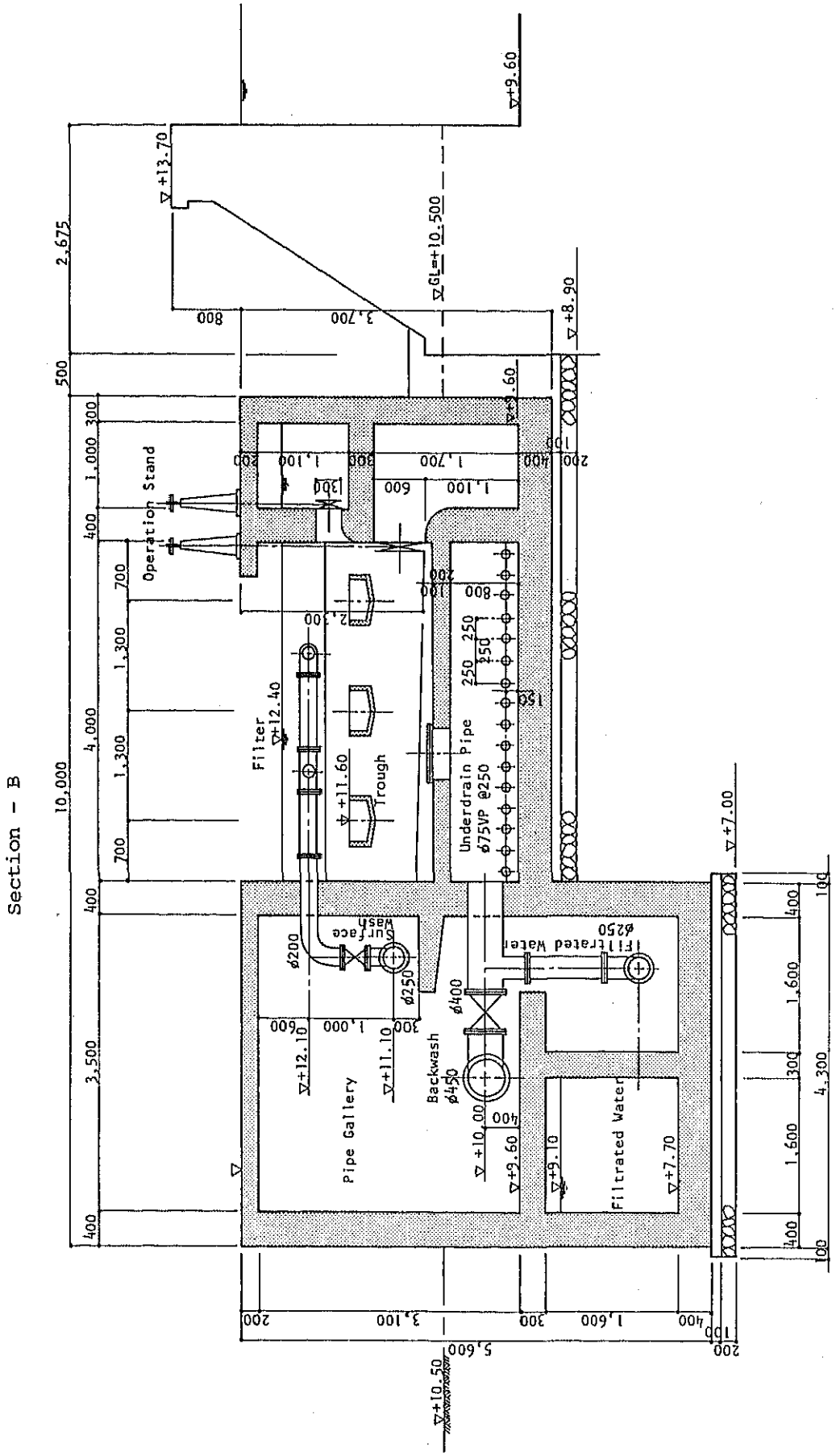


Fig-2.3.12 FILTERS
(Zagazig Increase)

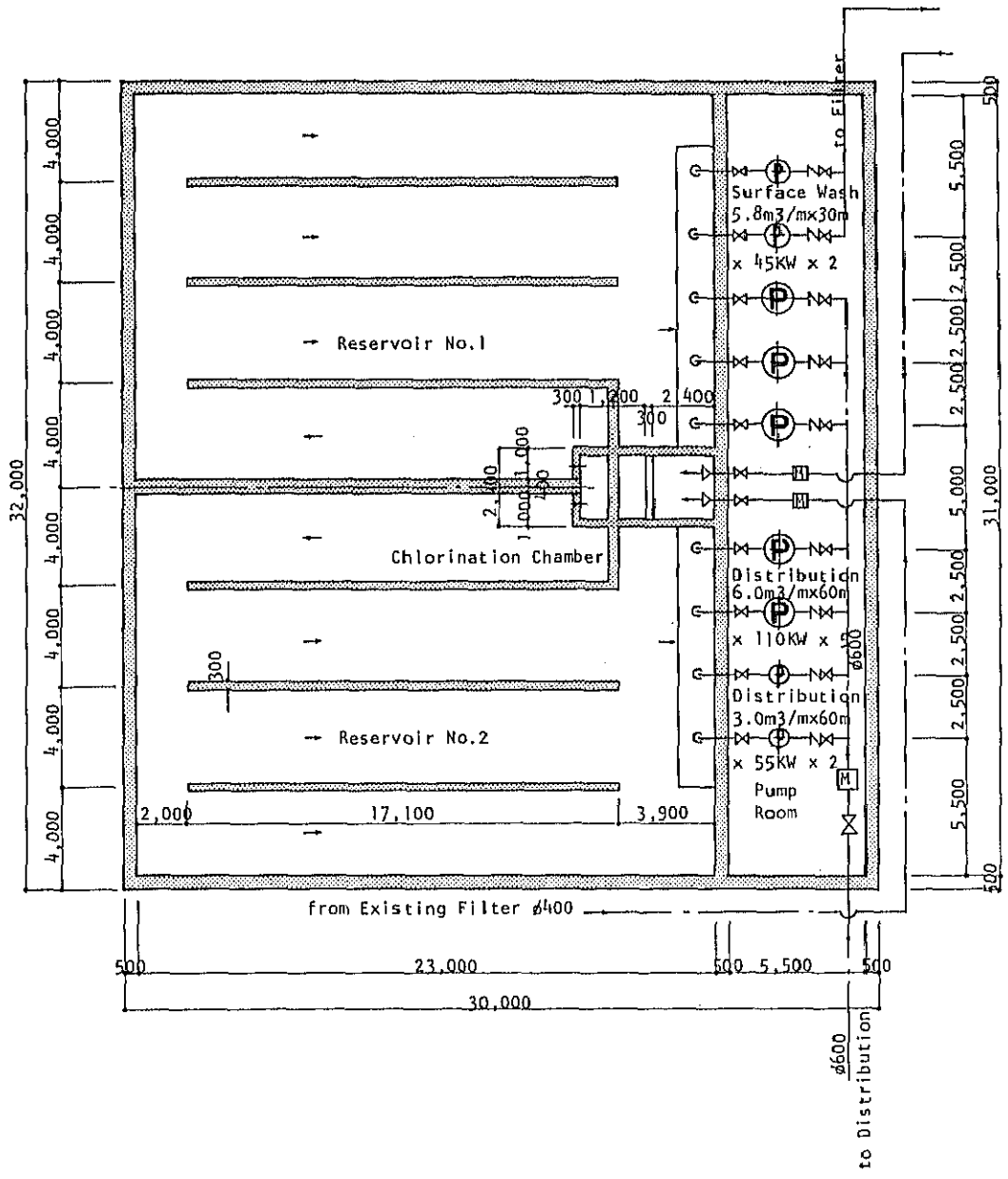


Fig-2.3.13 RESERVOIR AND DISTRIBUTION PUMP ROOM
(Zagazig Increase)

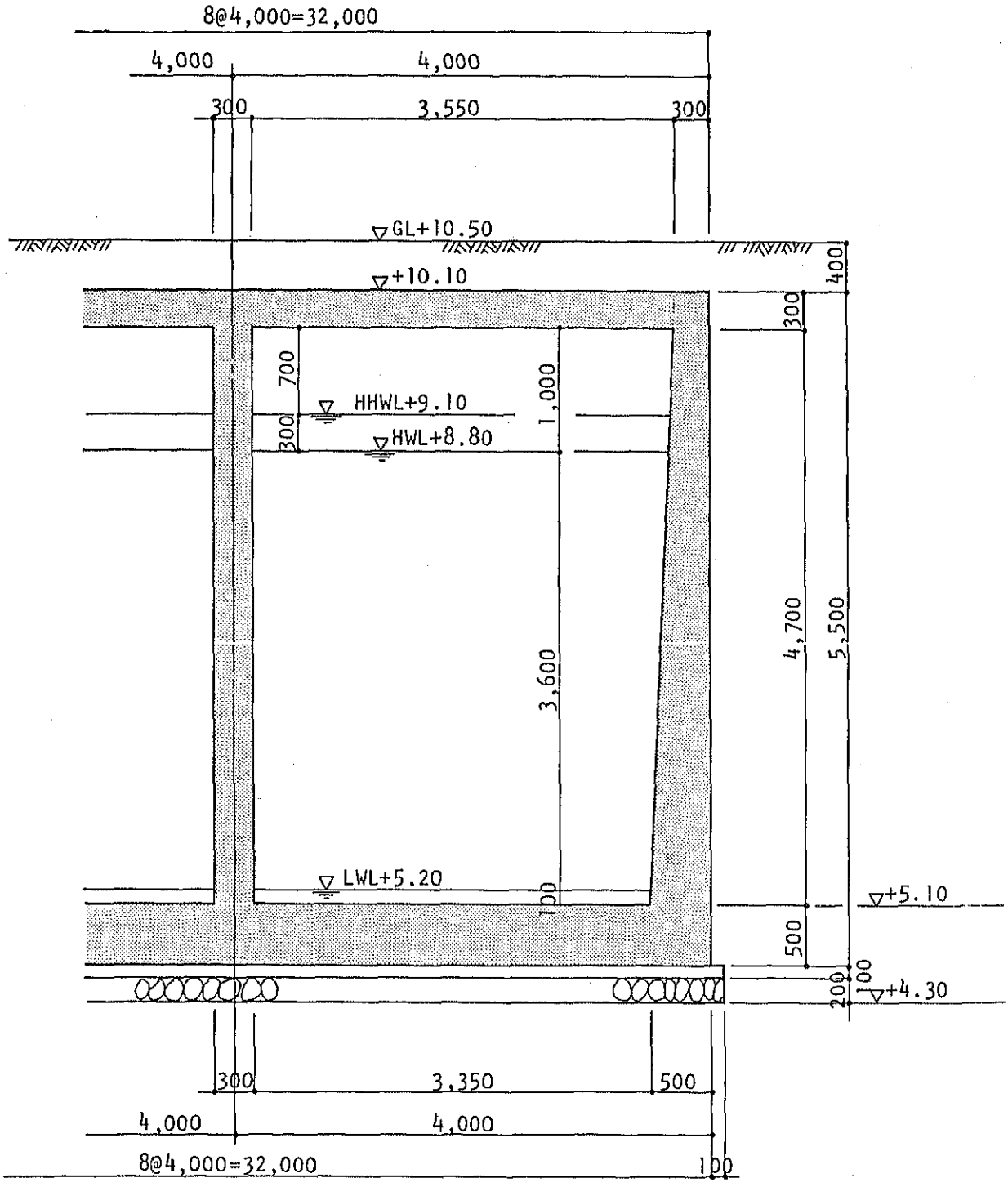


Fig-2.3.14 RESERVOIR
(Zagazig Increase)

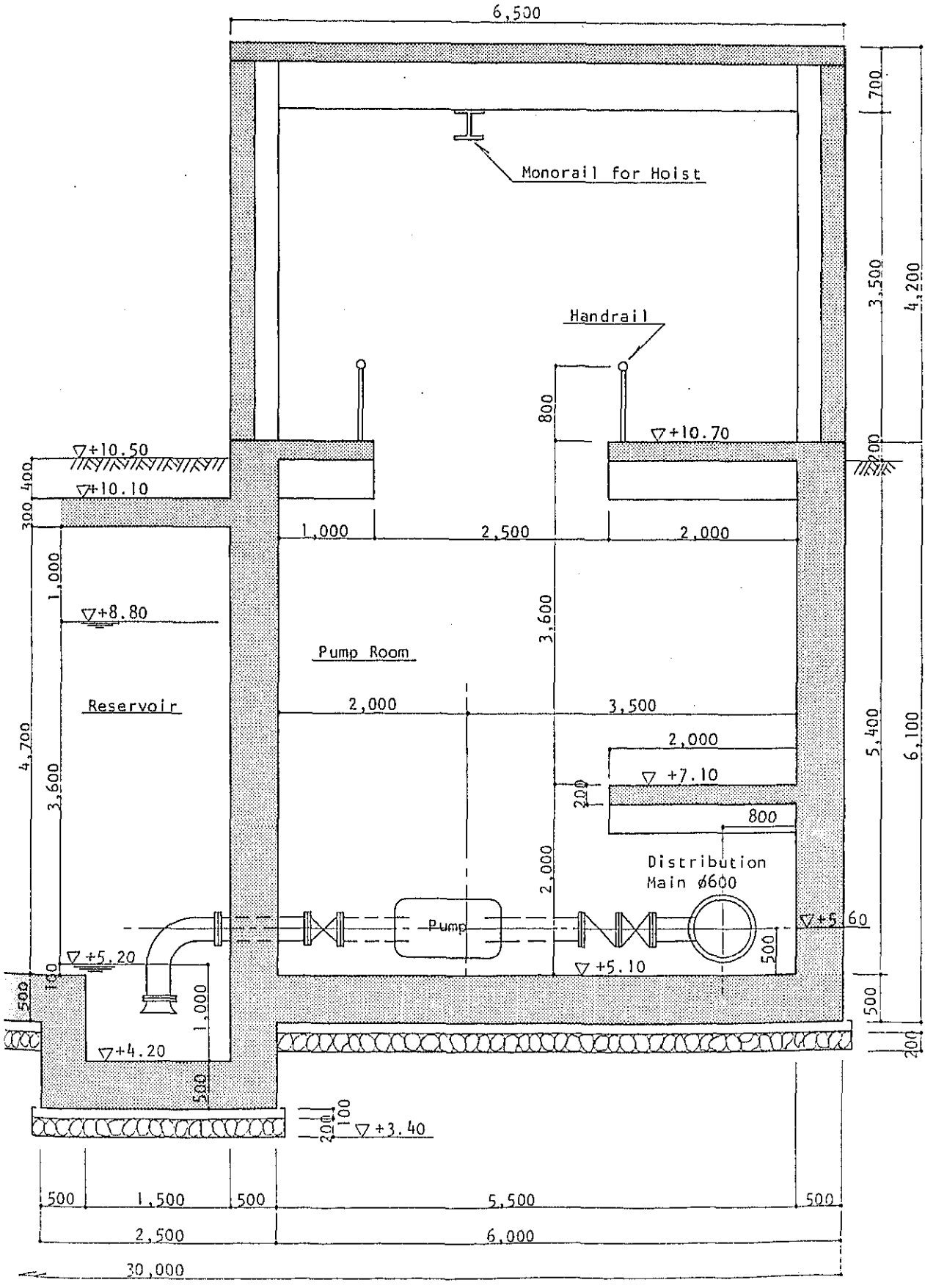


Fig-2.3.15 DISTRIBUTION PUMP ROOM
(Zagazig Increase)

Table-2.3.1 Water Level Table of Zagazig Treatment Plant

(Unit: Meters above sea level)

Facility		Water Level	
		Proposed Facility for 120 l/sec	Existing Facility for 120 l/sec
Muweis Canal:	- High Water Level (HWL)	+ 9.40	
	- Low Water Level (LWL)	+ 8.75	
	- Elevation of Canal bed	+ 5.15	
Suction well of raw water pumps:			
	- HWL	+ 9.40	
	- LWL	+ 8.50	
Mixing well:	- HWL at inlet	+ 14.00	-
	- HWL at outlet	+ 13.50	-
Sedimentation basin:			
	- At inlet of flocculation basin	+ 13.30	+ 14.50
	- At outlet of sedimentation basin	+ 12.90	
Filter:	- In the filter basin	+ 12.40	+ 14.30
	- After filtration	+ 9.10	+ 11.60
Reservoir & suction well of distribution pumps:			
	- HHWL	+ 9.10	
	- HWL	+ 8.80	+ 10.10
	- LWL	+ 5.20	+ 7.70

Note: 1) Ground elevation = + 10.50 m

2) Bench mark for elevation above sea level exists on the wall of the existing office building (On the westside wall of old pump room).
Elevation of the bench mark = + 10.62 m

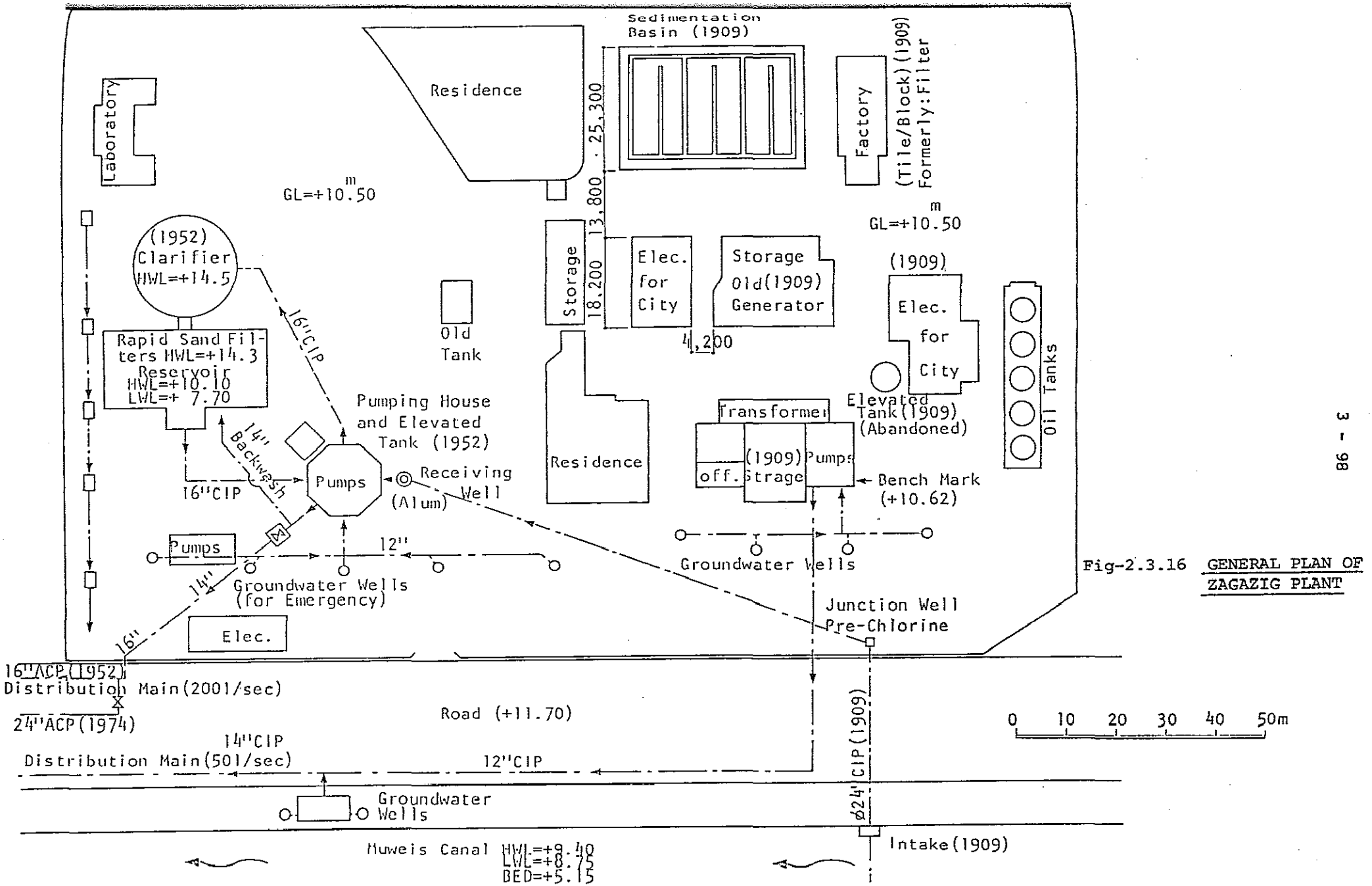


Fig-2.3.16 GENERAL PLAN OF ZAGAZIG PLANT

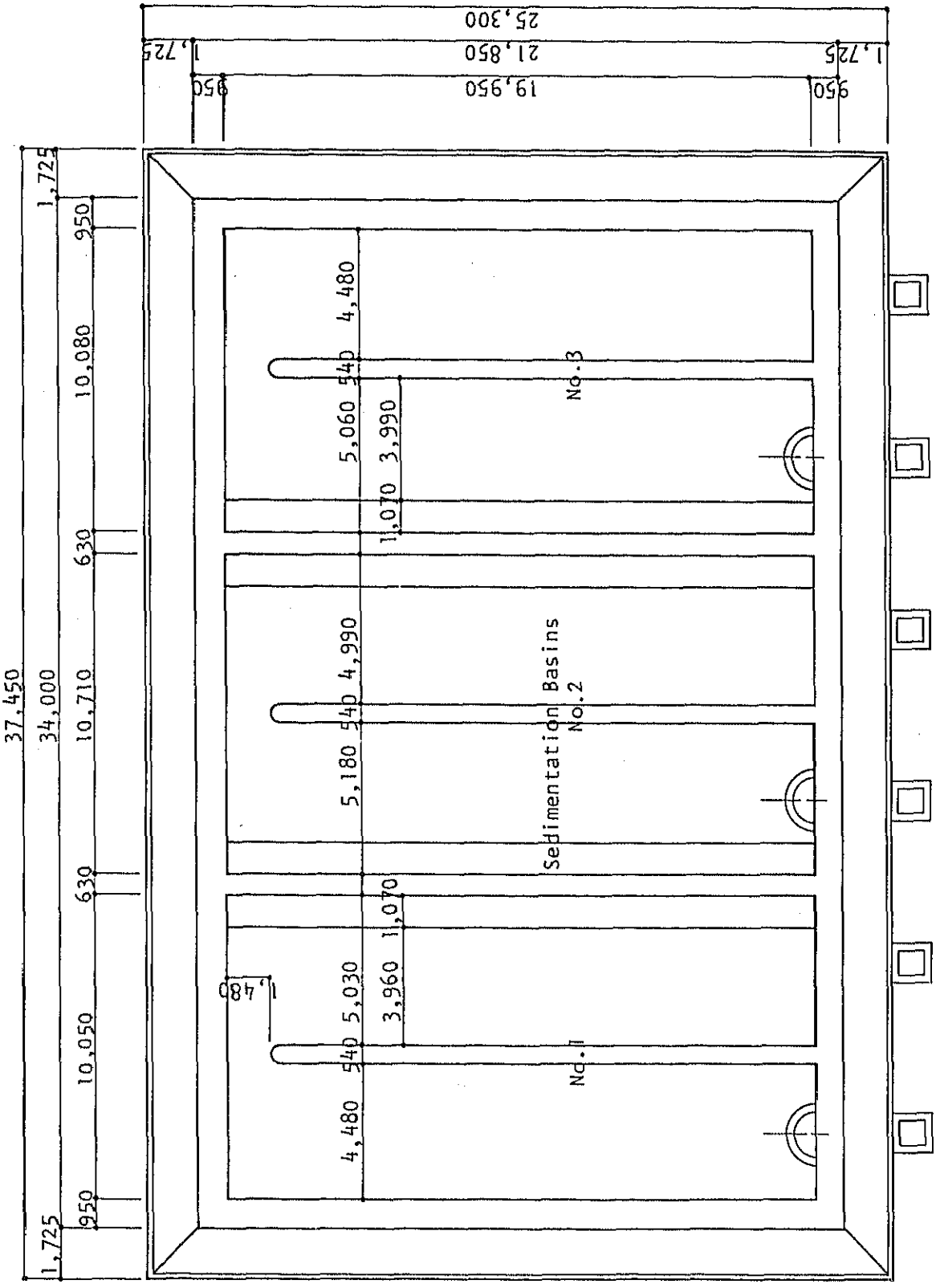


Fig-2.3.17 OLD EXISTING SEDIMENTATION BASIN
(Zagazig Increase)

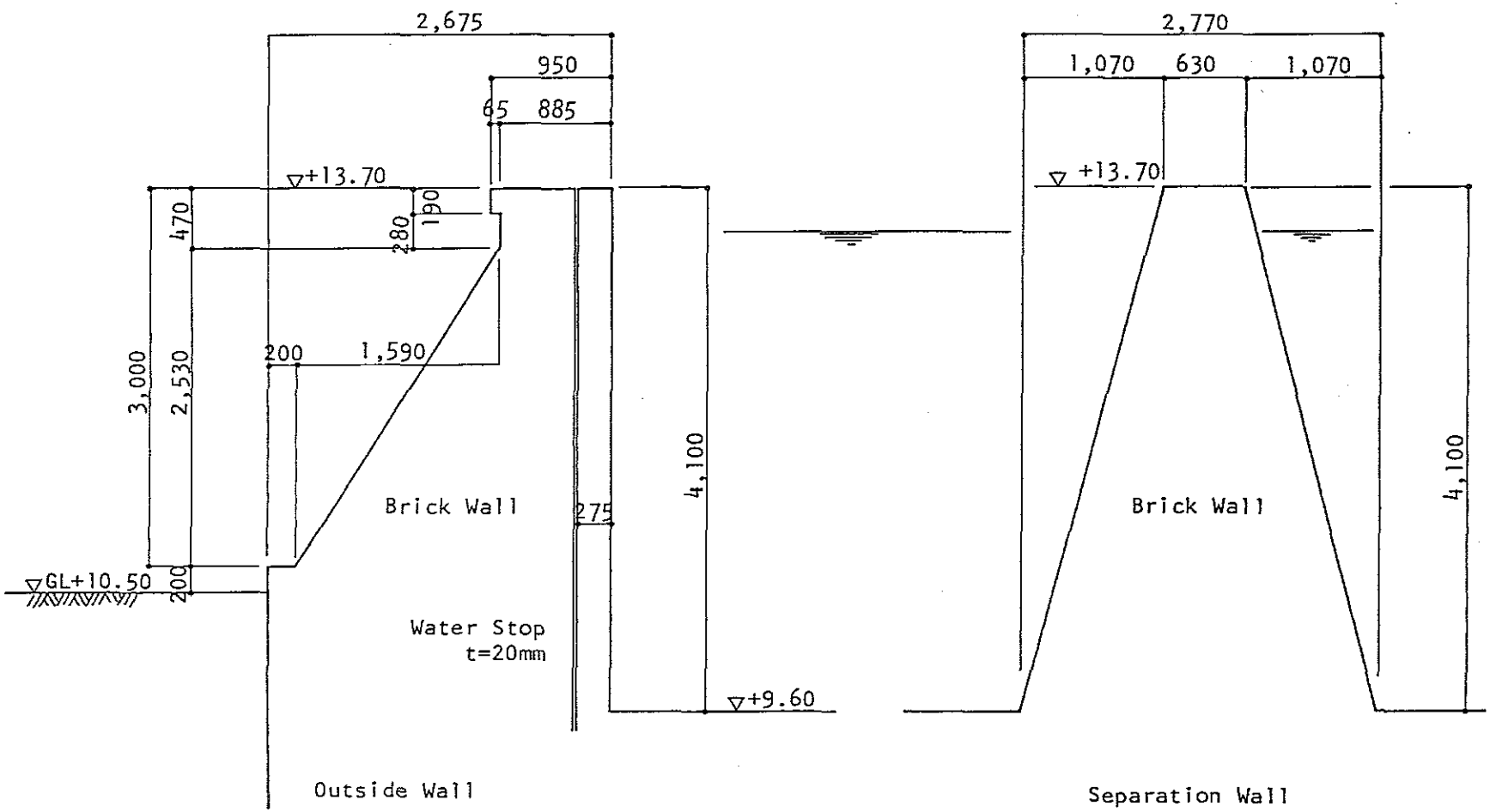


Fig-2.3.18 EXISTING WALL OF SEDIMENTATION BASIN
(Zagazig Increase)

2.3.2 Rehabilitation of Existing Treatment Plants

1) Outline of Works

The proposed rehabilitation of Abbasa plant consists of rehabilitation works for filters and filter control system, alum feed system and chlorinations.

The Faqus' rehabilitation works are composed of raw water pumping facilities, distribution on pumping facilities, groundwater pupming facilities, alum feed system, chlorination system and electric facilities including power receiving and supply system and instrumentation.

The Zagazig plant works are alum feed system and chlorination system.

2) Abbasa Plant

a) Filters and filter control

There are 16 units of filter and each filter is equipped with hydraulically operated gate valves except the outlet control valve which is electrically actuated. The operation of these valves is controlled at individual control cabinets located at each of the filters in upper filter-gallory area. All valves and filter control system are proposed to be replaced with new valves and control system with operation on cabinet. These valves except the outlet control valve are proposed to be air actuated butterfly valve and the outlet control valve electrically actuated butterfly valve. Valves to be replaced are as follows:

- Inlet valve : 350 mm x 16 sets
- Outlet valve : 250 mm x 16 sets
- Wash valve : 350 mm x 16 sets
- Wash drain valve : 400 mm x 16 sets
- Air scour valve : 150 mm x 16 sets
- Rewash valve : 150 mm x 16 sets
- Control valve : 250 mm x 16 sets

b) Alum feed system

Alum feed system is replaced and a new alum building is to be constructed. Alum feed system is as follows:

- Four stainless steel solution tanks, each capacity 12 m3
- Two air blower for mixing alum solutions
- Three transfer pumps, each capacity 250 liter/minute
- Two stainless steel elevated tanks, each capacity 12 m3
- One stainless steel head tanks for gravity feeding of alum solution
- One hand operated chain hoist
- Necessary piping

Flow diagram of proposed alum feed system and plan of alum building are shown in the attached drawings.

c) Chlorination system

Chlorination system and neutralization system for chlorine gas leakage are proposed, and a new chlorine building will be constructed.

Chlorination system includes:

- Three chlorinations for pre-chlorination, each capacity 7 kg/hour
- Two chlorination for post-chlorination, each capacity 7 kg/hour
- Two weight scales
- One hand operated chain hoist
- Thirty one-ton-containers
- Necessary piping

Flow diagram of the proposed new chlorination system and the plan of the chlorine building are shown below.

Neutralizations system consists of :

- Two washing tower
- One caustic soda storage tank
- One Blower
- One circulation pump
- One Chlorine gas leakage detector
- Necessary piping

3) Faqus Plant

a) Pump Facilities

The existing raw water pumps, distribution pumps and groundwater pumps are replaced with new pumps having same capacity as the existing pumps. Capacity of each pump is:

- Raw water pump
  80 liter/sec x 15 m x 22 KW x 2 units

- Distribution pumps
  40 liter/sec x 50 m x 37 KW x 3 units

- Groundwater pumps
  40 liter/sec x 50 m x 37 KW x 2 units

b) Alum feed system

New alum feed system is proposed and new alum building will be constructed. Alum feed system is as follows:

- Two stainless steel solution tanks, each capacity 3.0 m3
- Two air blowers for mixing alum solution
- Three transfer pumps, each capacity 200 liter/minute
- Two stainless steel elevated tanks, each capacity 3.0 m3
- One stainless steel tank for gravity feeding of alum solution
- One hand operated chain hoist
- Necessary piping

Flow diagram of the poposed new alum feed system and plan of the new alum building are shown in the attached drawings.

c) Chlorination system

Chlorination system and neutralization system for chlorine gas leakage are proposed, and a new chlorine building will be constructed. Chlorination system is :

- Two chlorinators for pre-chlorination, each capacity 2.0 kg/hour
- Two chlorinators for post-chlorination, each capacity 1.0 kg/hour
- Two weight scales
- One hand operated chain hoist
- Six one ton containers
- Necessary piping

Neutralization system includes same facilities proposed for Abbasa plant.

d) Electric Facilities

At Abbasa and Zagazig plants, low tension power supply, 380 V is used. At Faqus plant, low tension electric power, 220 V is used. New electric power receiving and supply system of Faqus plant is proposed considering maintenance and availability of spare parts. Proposed electric power receiving and supply are composed of two main transformers, receiving cubicles, circuit breakers, motor starters, local control boxes and necessary equipment.

The flow meters, venturi type are installed in the raw water pump suction line and distribution pump discharge line respectively. Both flow meters are already out of function. Ground water is injected into distribution main without meter. Total distribution flow is not measured at present.

From these conditions, the following are proposed:

- For water flow measuring, venturi meter is installed in raw water pump discharge line.

- For distribution pump discharge flow measuring (existing), venturi meter is replaced with new venturi type flow meter.

- For groundwater pump discharge flow measuring, new venturi type flow meter is installed in pump discharge line.

- For total distribution flow measuring, new venturi type flow meter is installed in distribution main.

4) Zagazig Plant

a) Alum feed system

Alum feed system and alum building will be constructed.

Alum feed system includes:

- Two stainless steel solution tanks, each capacity 5.5 m3
- Two air blowers for mixing alum solution
- Three transfer pumps, each capacity 200 liter/minute
- Two stainless steel elevated tanks, each capacity 5.5 m3
- One stainless steel head tank
- One hand operated chain hoist
- Necessary piping

Flow diagram of proposed new alum feed system and plan of new alum building are shown below.

b) Chlorination system

Chlorination system and neutralization system for chlorine gas leakage are proposed, and new chlorine building is constructed. Chlorination system consist of :

- Two chlorinators for pre-chlorination, each capacity 7.0 kg/hour
- Two chlorinators for post-chlorination, each capacity 3.0 kg/hour
- Two weight scales

- One hand operated chain hoist
- Fourteen one-ton-containers
- Necessary piping

Flow diagram of proposed new chlorination system and plan of new chlorine building are as attached drawings.

Neutralization system is same as Abbasa plant's system

Drawing List

No.	Title	Plant
2.3.19	General Plan	Abbasa Plant Rehabilitation
2.3.20	New Alum Feed System Flow Diagram	"
2.3.21	Alum Building	"
2.3.22	Chlorination Flow Diagram	"
2.3.23	Neutralization System Flow Diagram	"
2.3.24	Chlorine Building	"
2.3.25	General Plan	Faqus Plant Rehabilitation
2.3.26	New Alum Feed System Flow Diagram	"
2.3.27	Alum Building	"
2.3.28	Chlorination Flow Diagram	"
2.3.29	Neutralization Flow Diagram	"
2.3.30	Chlorine Building	"
2.3.31	General Plan	Zagazig Plant Rehabilitation
2.3.32	New Alum Feed System Flow Diagram	"
2.3.33	Alum Building	"
2.3.34	Chlorination Flow Diagram	"
2.3.35	Neutralization Flow Diagram	"
2.3.36	Chlorine Building	"

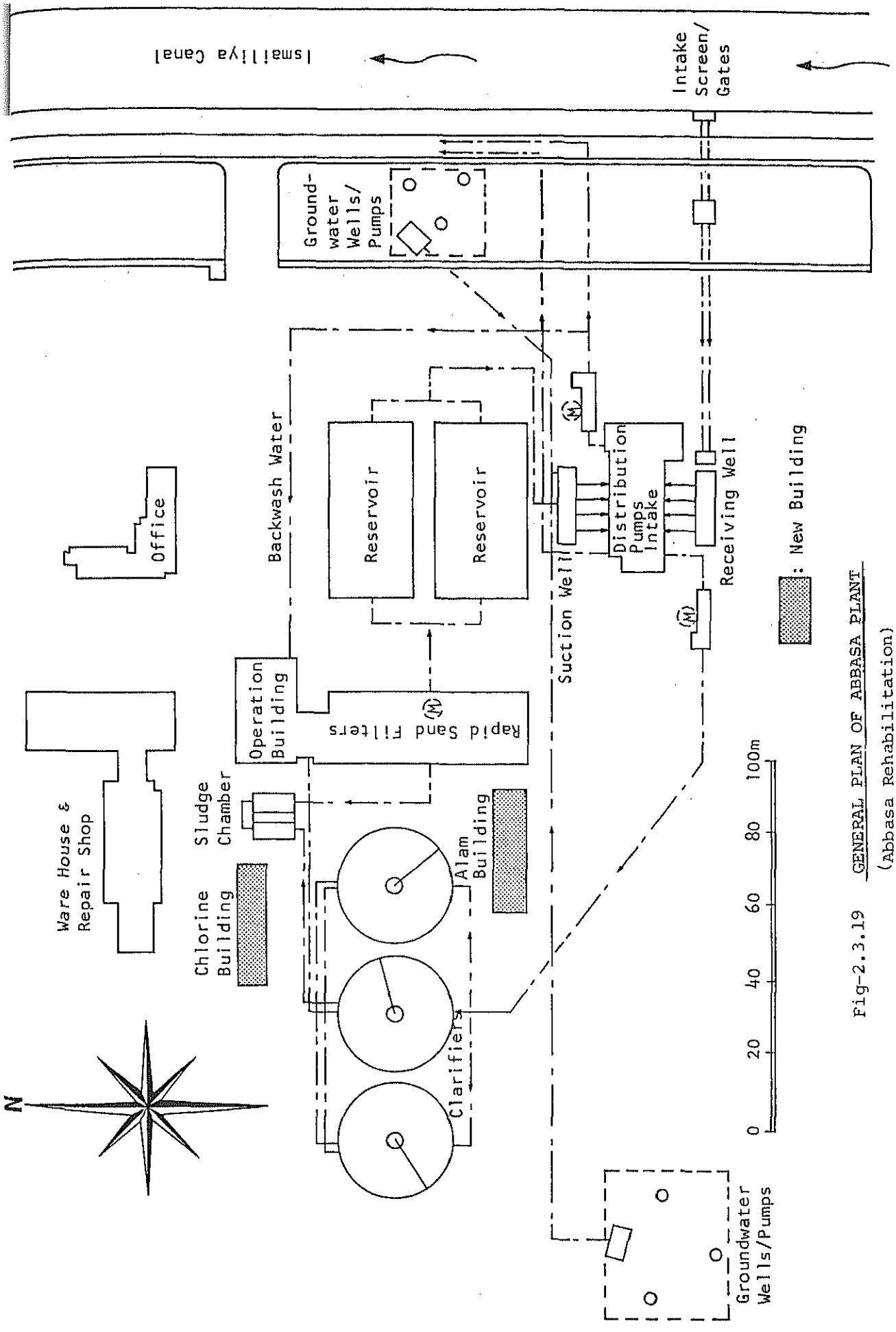
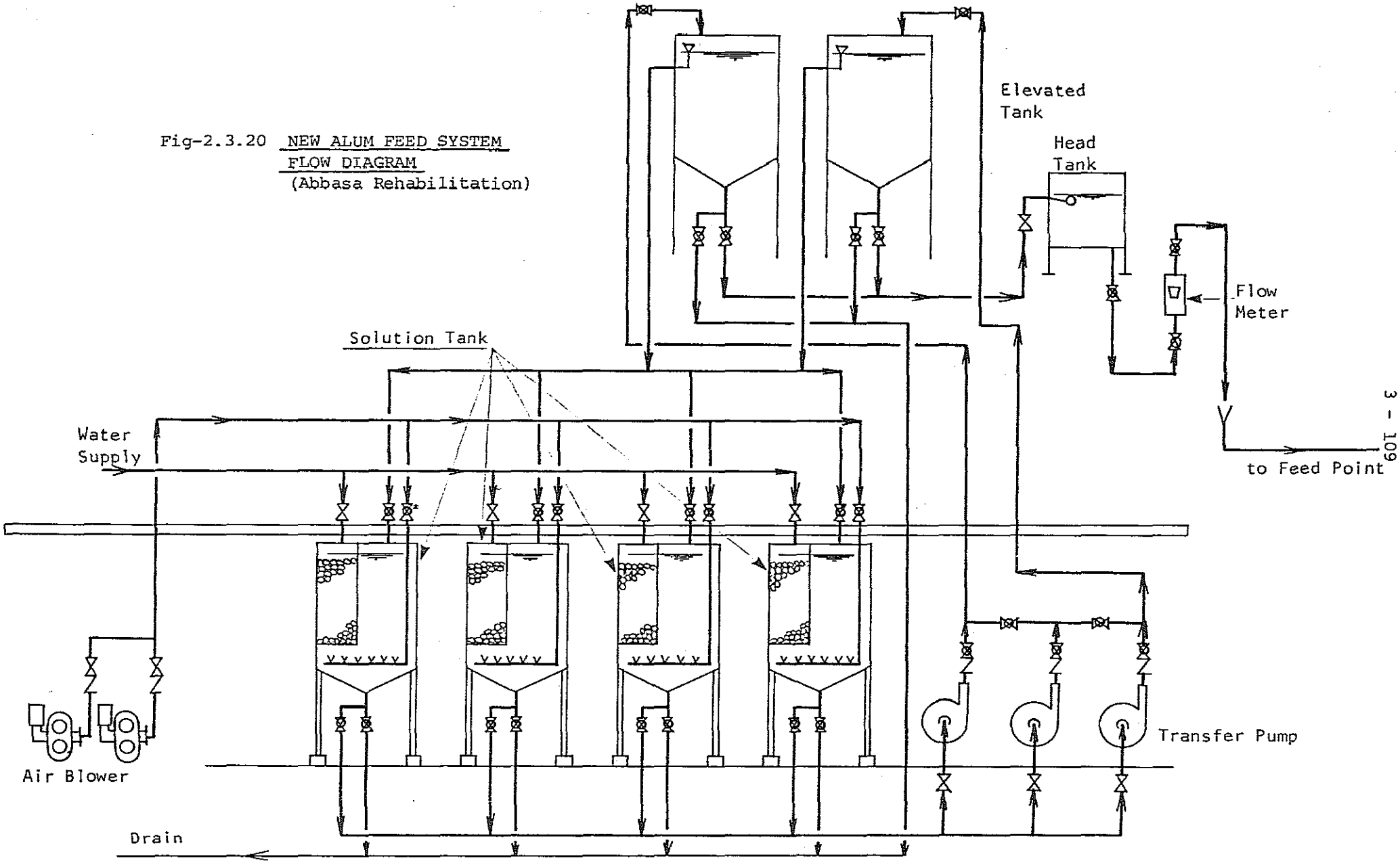
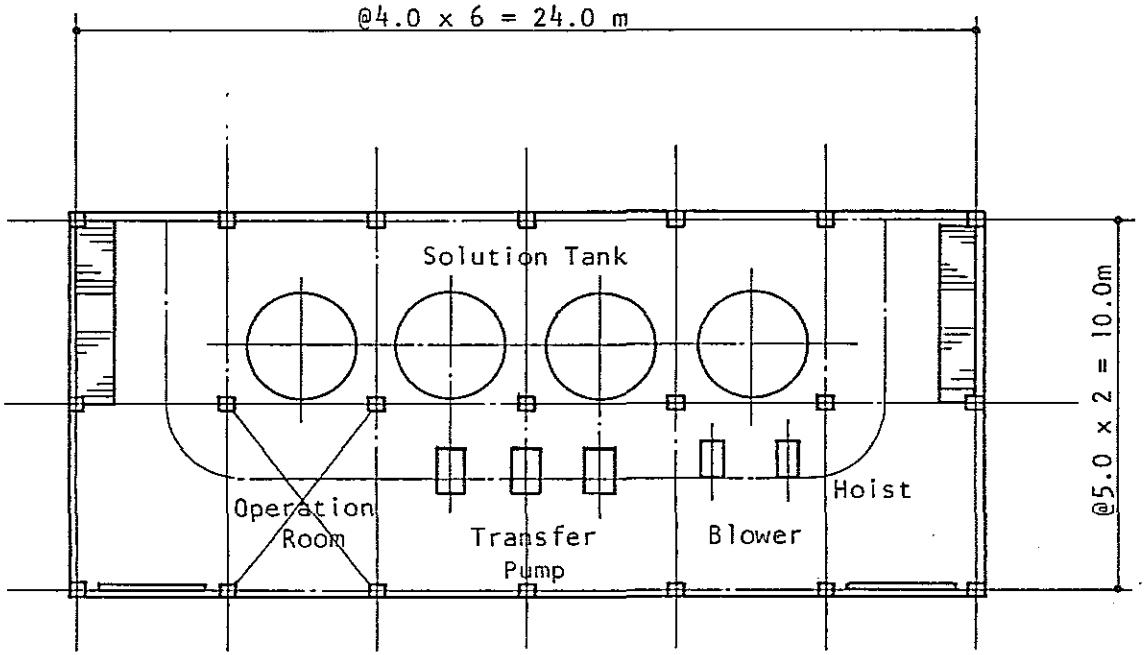


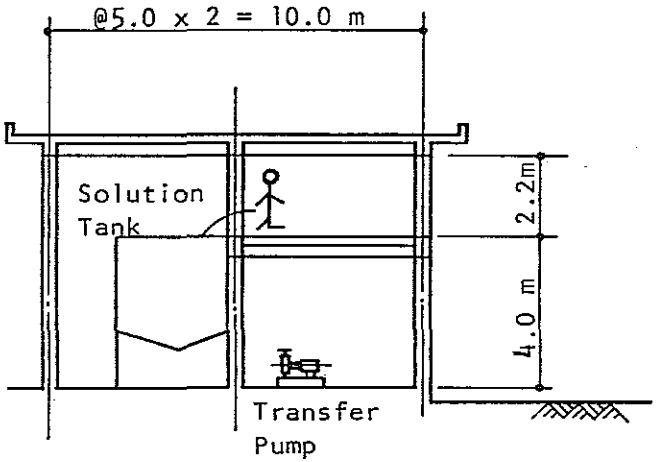
Fig-2.3.19 GENERAL PLAN OF ABBASA PLANT
(Abbasa Rehabilitation)

Fig-2.3.20 NEW ALUM FEED SYSTEM
FLOW DIAGRAM
(Abbasa Rehabilitation)





Alum Building Plan



Alum Builcing Section

Fig-2.3.21 ALUM BUILDING
(Abbasa Rehabilitation)

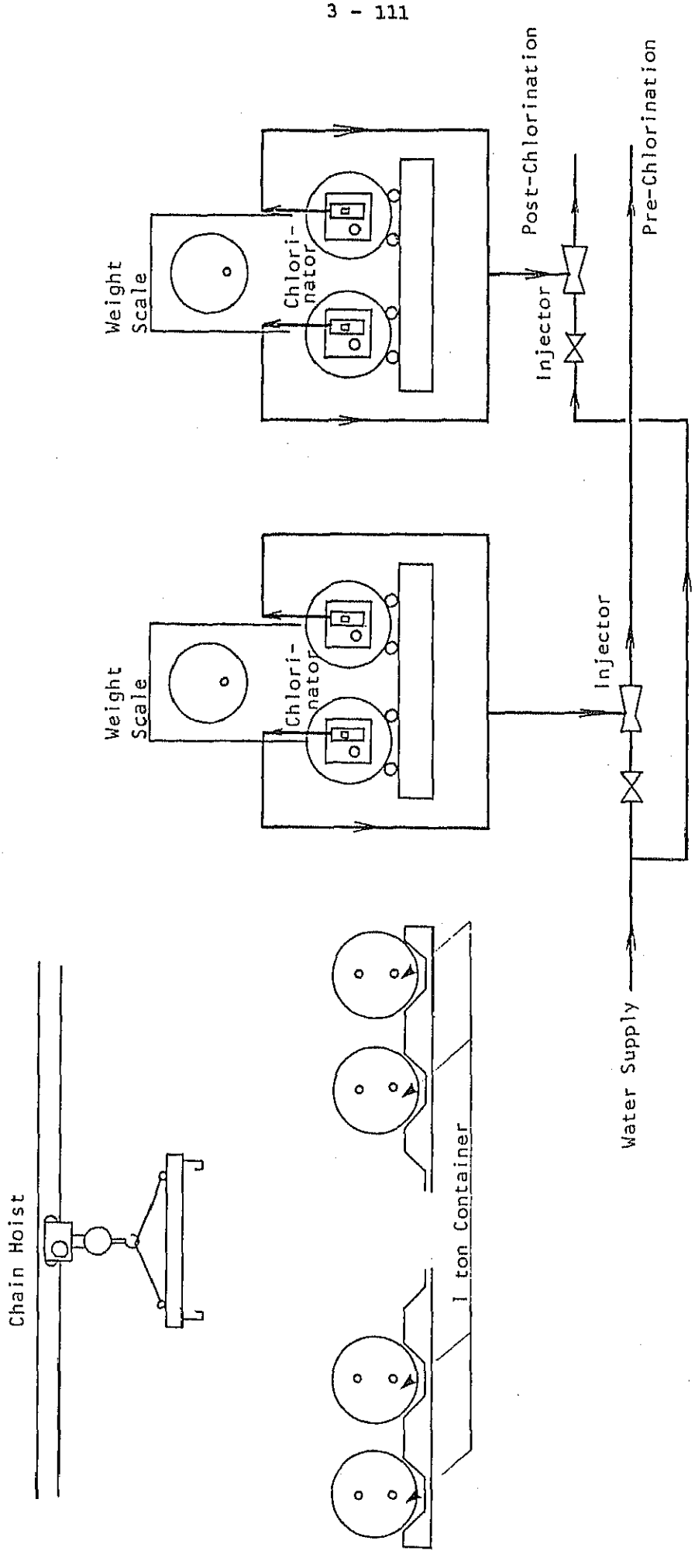


Fig-2.3.22 CHLORINATION FLOW DIAGRAM
(Abbasa Rehabilitation)

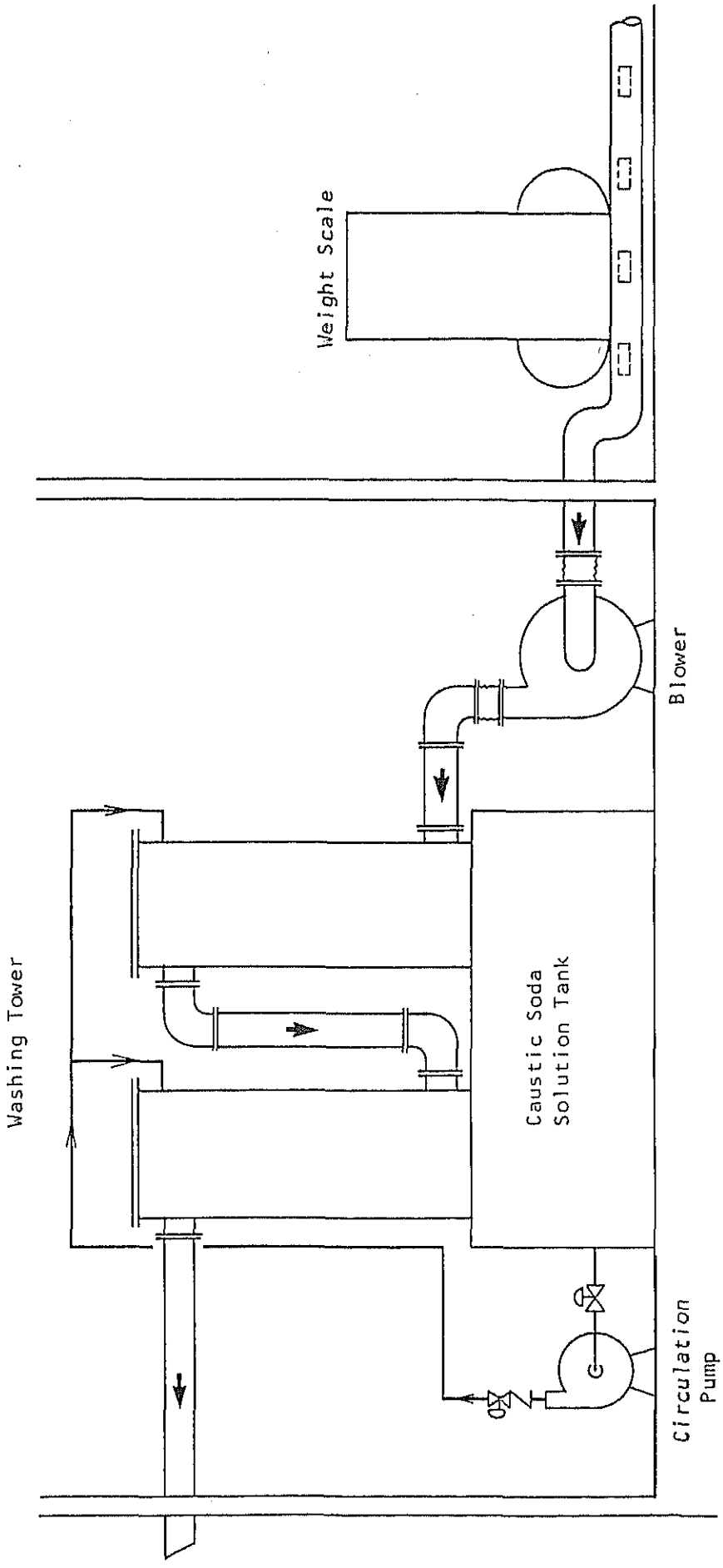
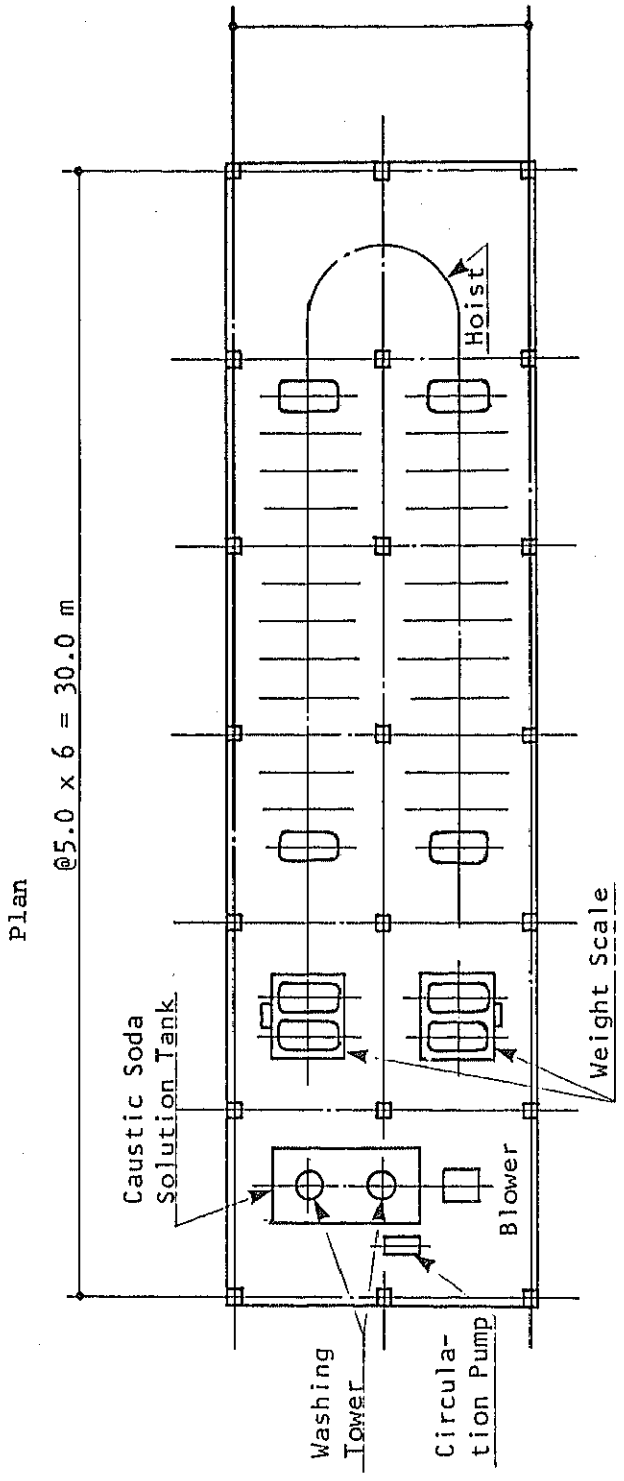


Fig-2.3.23 NEUTRALIZATION SYSTEM FLOW DIAGRAM
(Abbasa Increase)



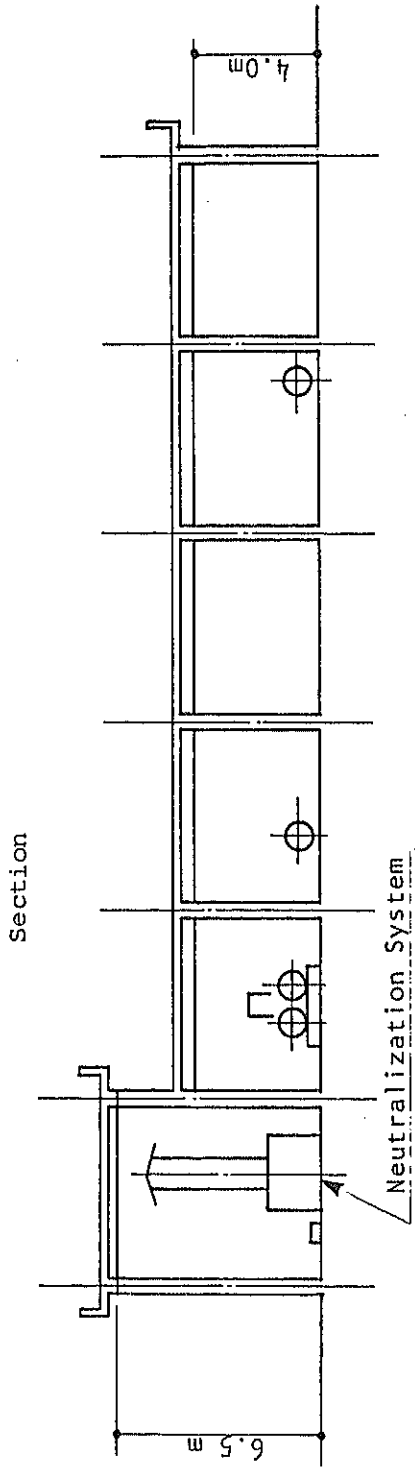


Fig-2.3.24 CHLORINE BUILDING
(Abbasa Rehabilitation)

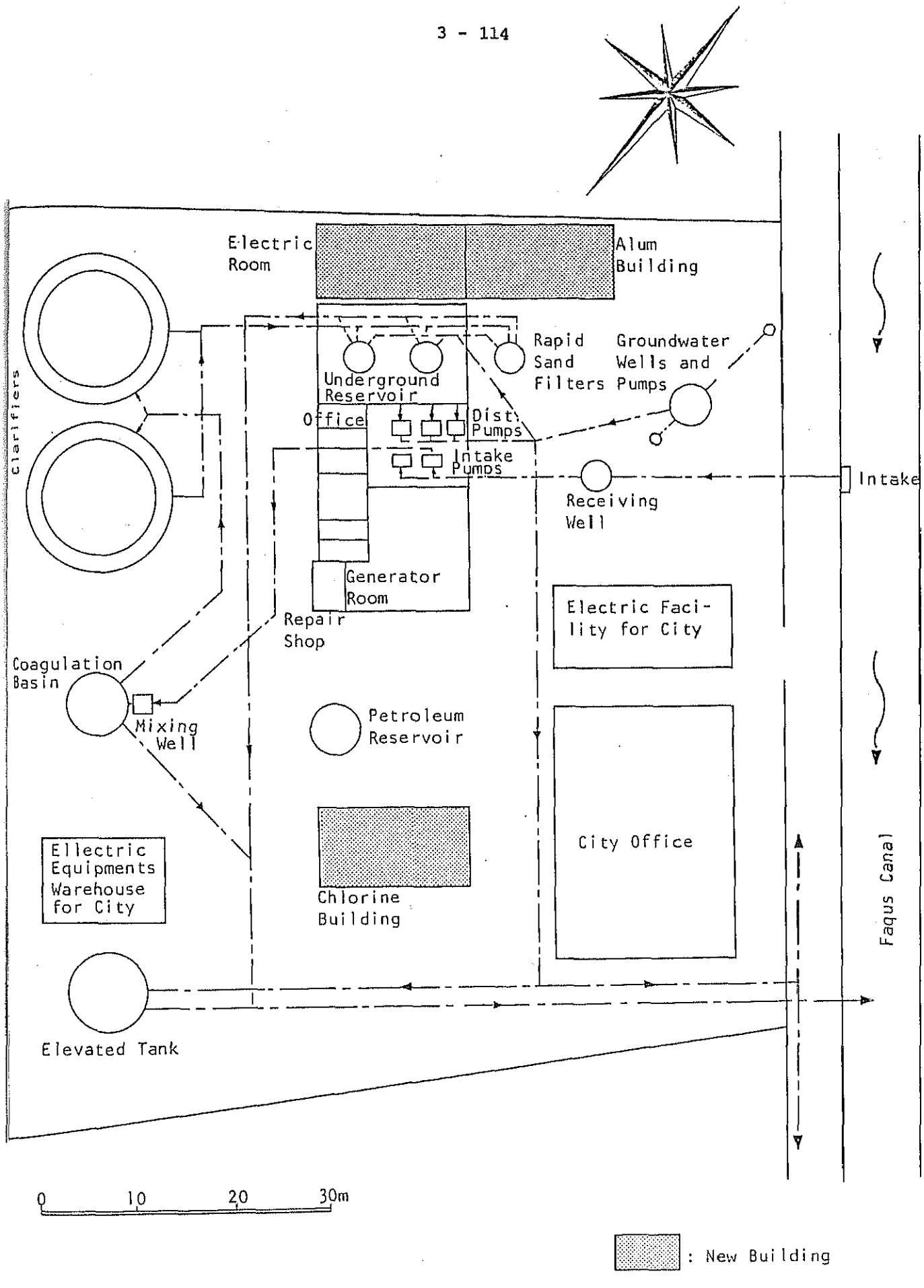
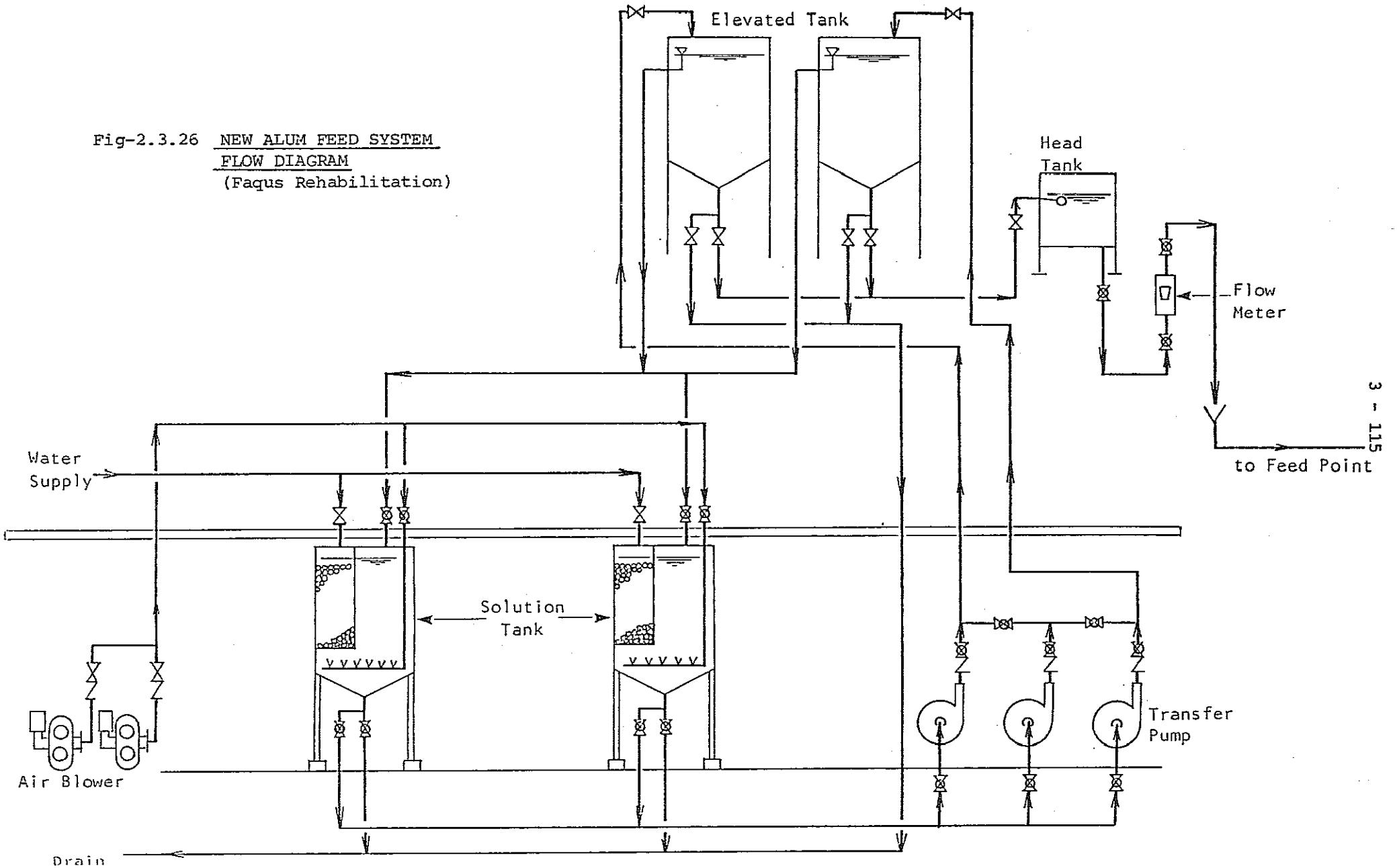


Fig-2.3.25 GENERAL PLAN OF FAQUS PLANT
(Faqus Rehabilitation)

Fig-2.3.26 NEW ALUM FEED SYSTEM
FLOW DIAGRAM
(Faqus Rehabilitation)



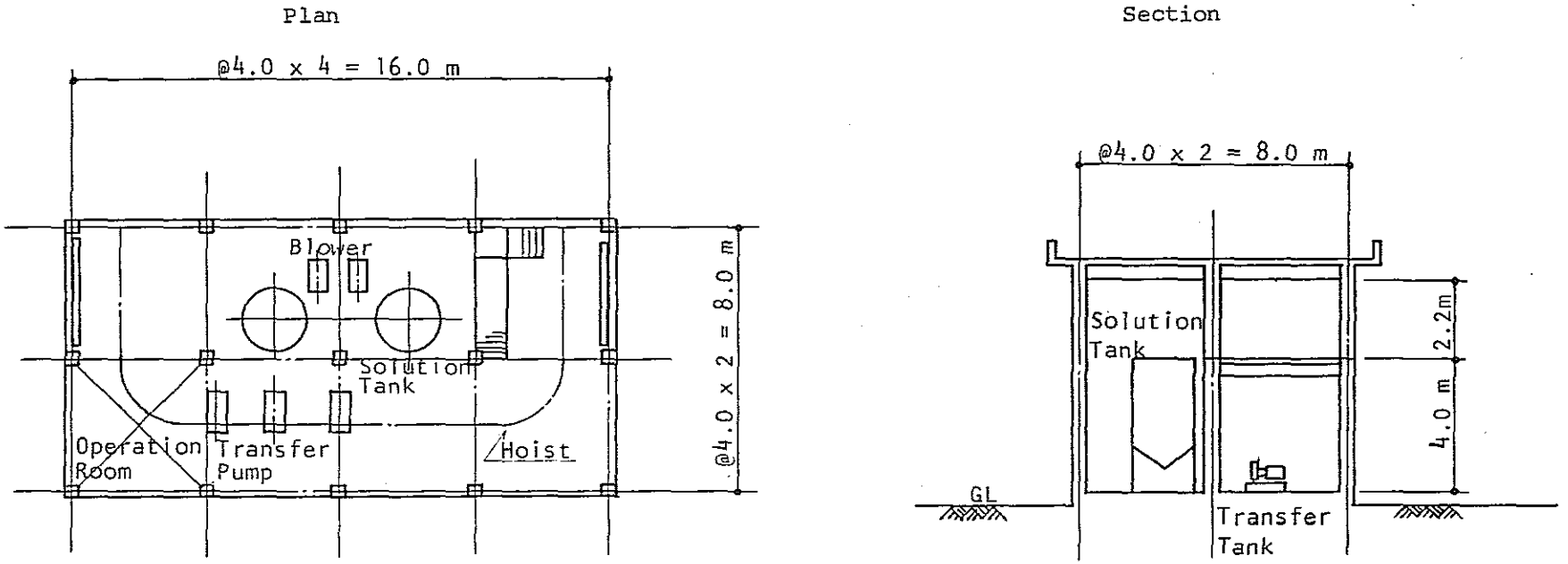


Fig-2.3.27 ALUM BUILDING
(Faqus Rehabilitation)

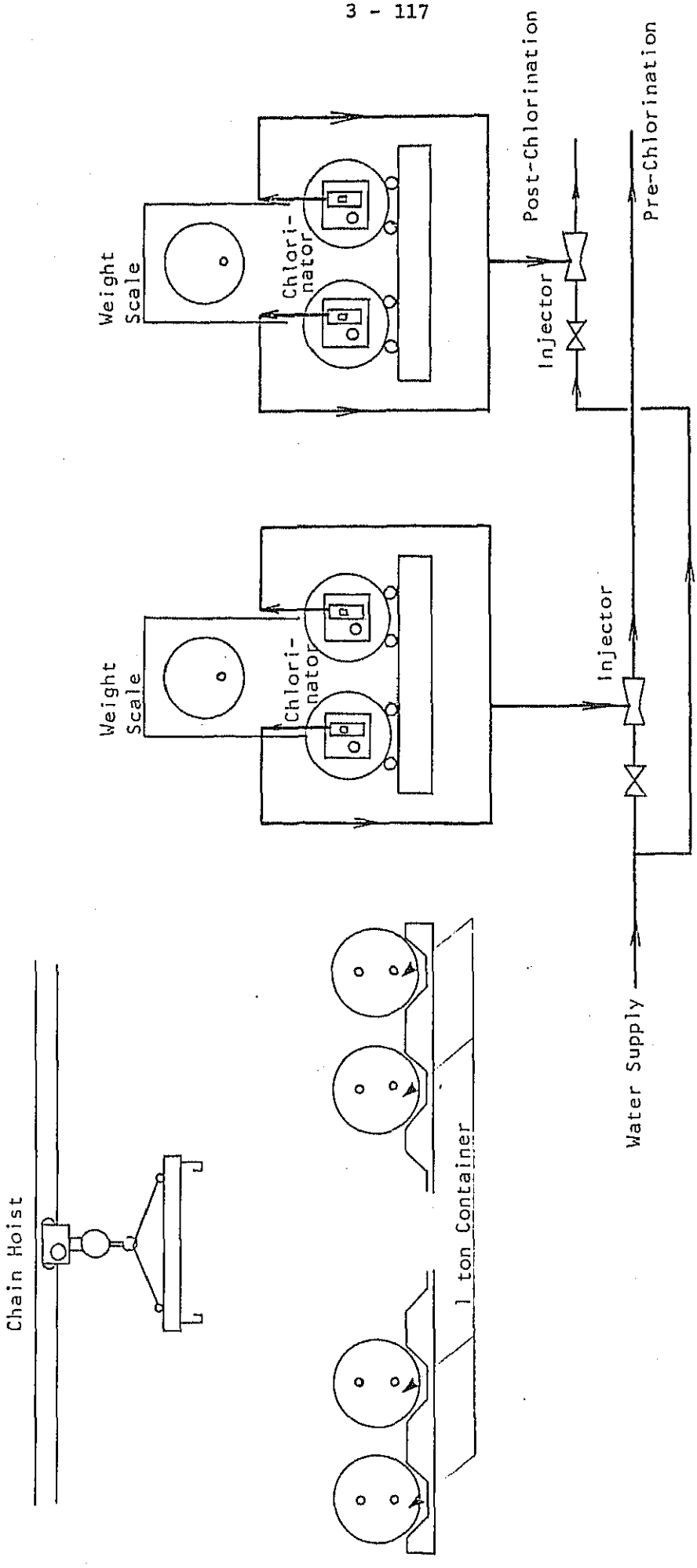


Fig-2.3.28 CHLORINATION FLOW DIAGRAM
(Fagus Rehabilitation)

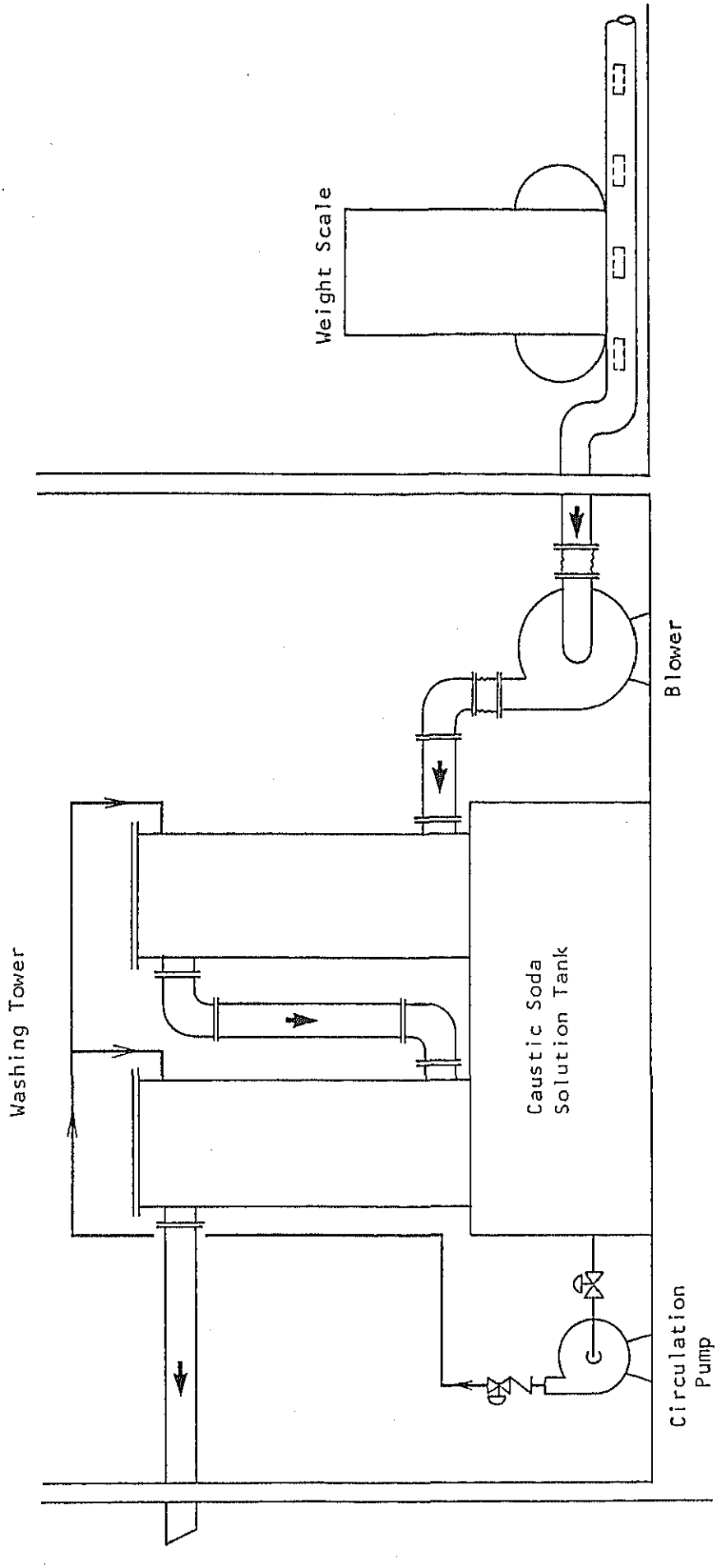


Fig-2.3.29 NEUTRALIZATION FLOW DIAGRAM
(Faqus Rehabilitation)

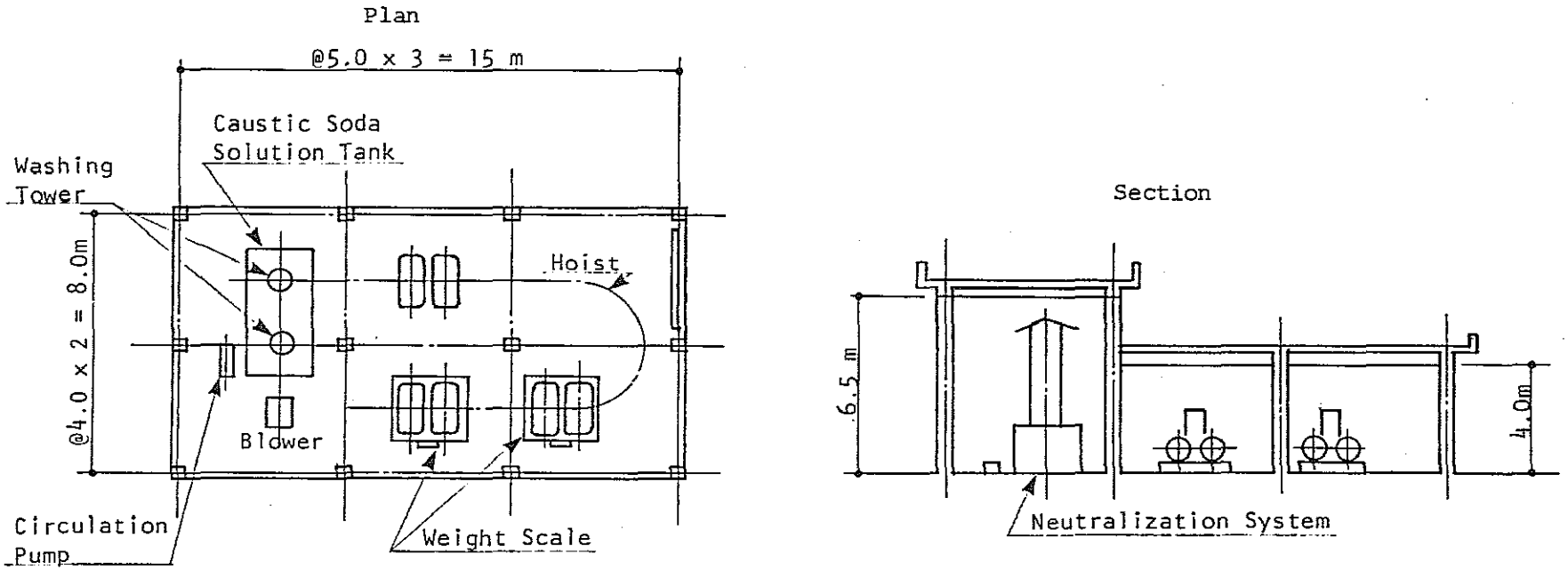


Fig-2.3.30 CHLORINE BUILDING
(Faqus Rehabilitation)

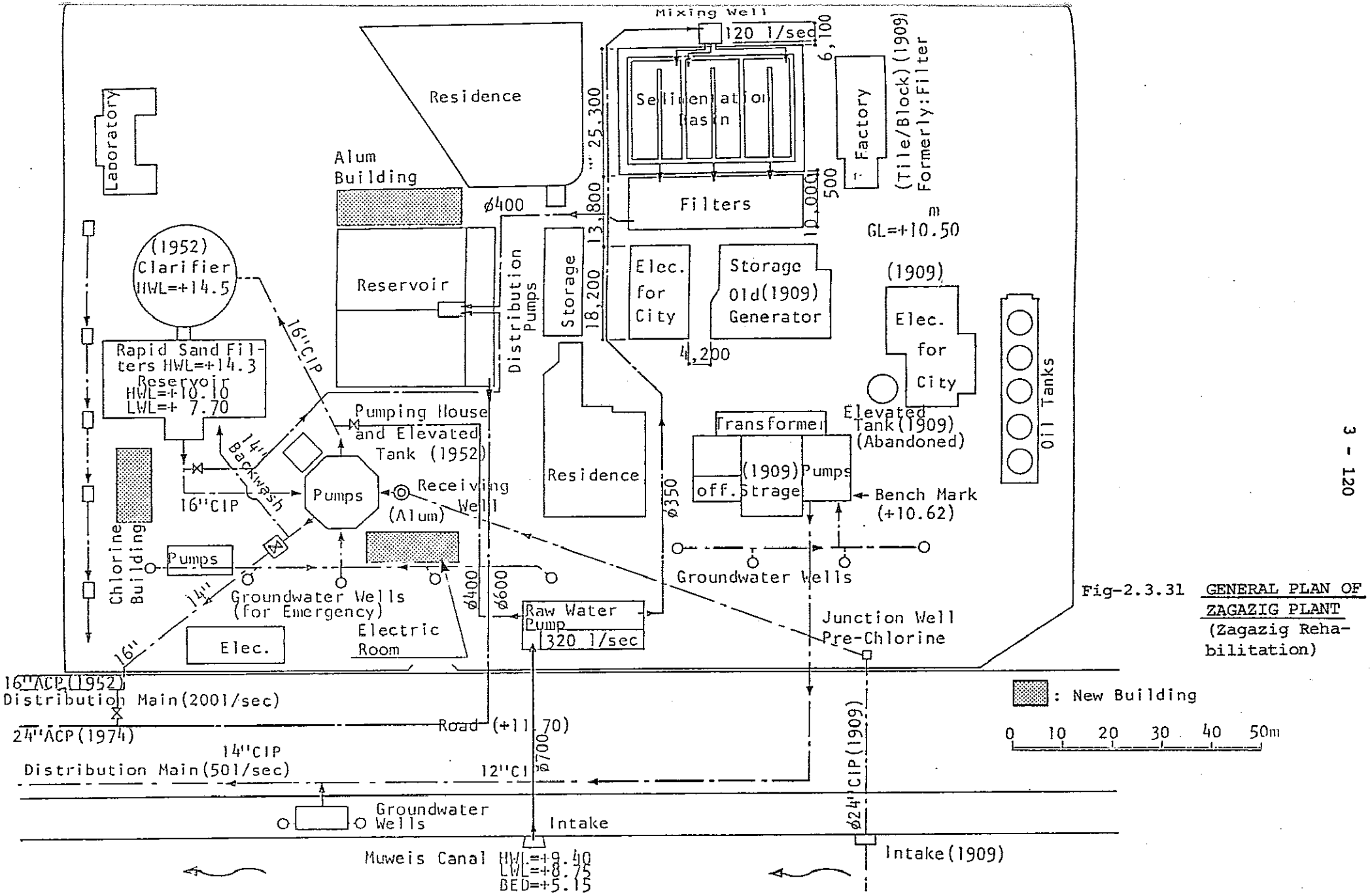


Fig-2.3.31 GENERAL PLAN OF ZAGAZIG PLANT (Zagazig Rehabilitation)

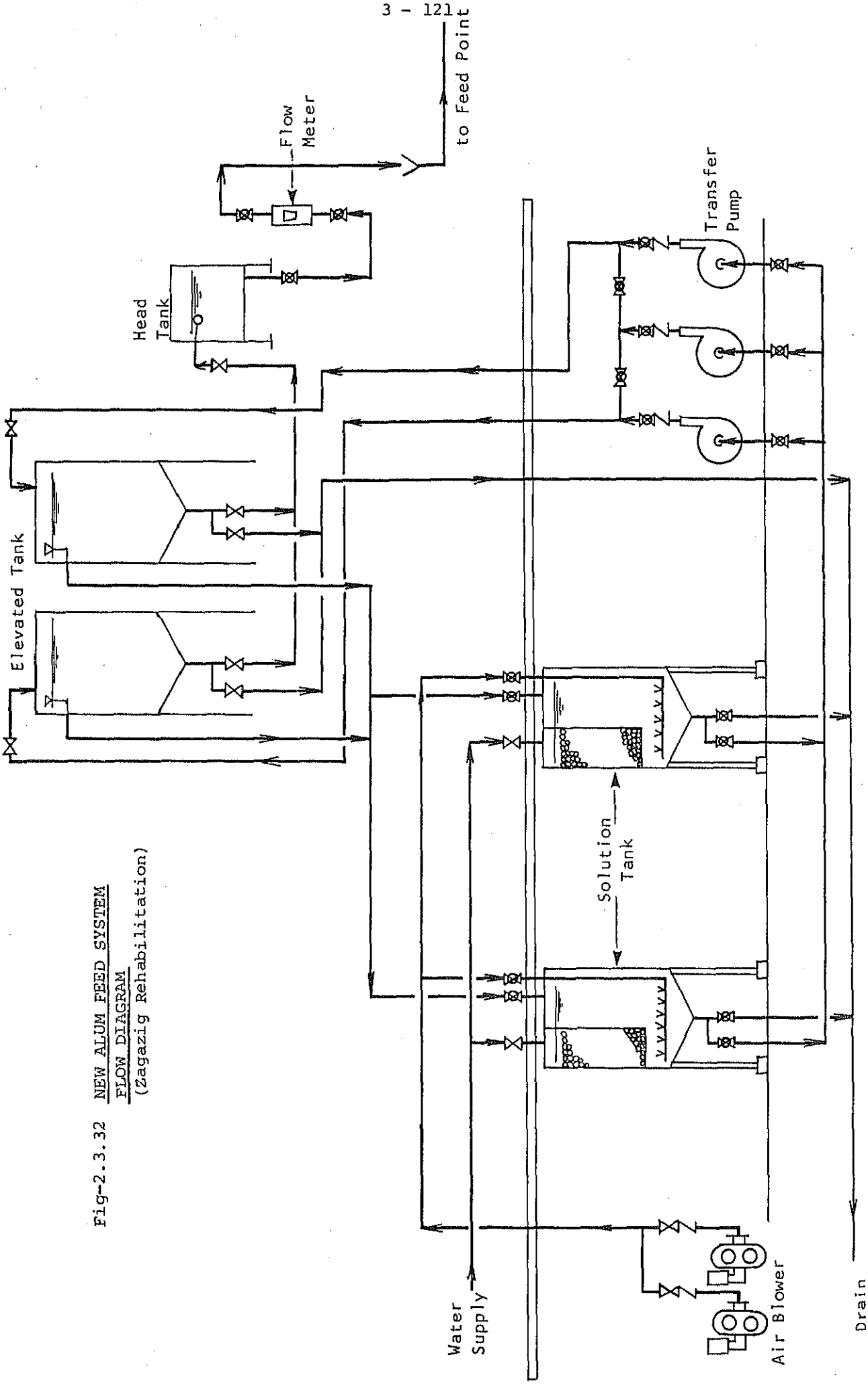


Fig-2.3.32 NEW ALUM FEED SYSTEM
FLOW DIAGRAM
(Zagazig Rehabilitation)

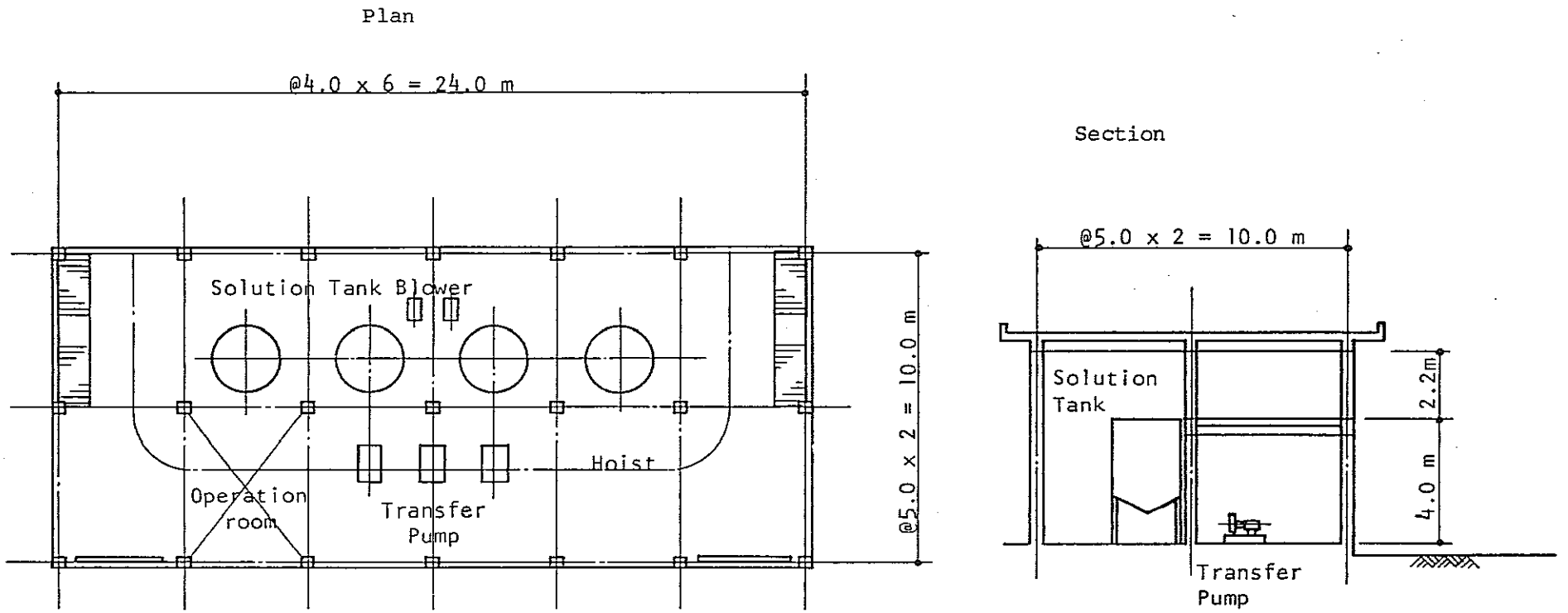


Fig-2.3.33 ALUM BUILDING
(Zagazig Rehabilitation)

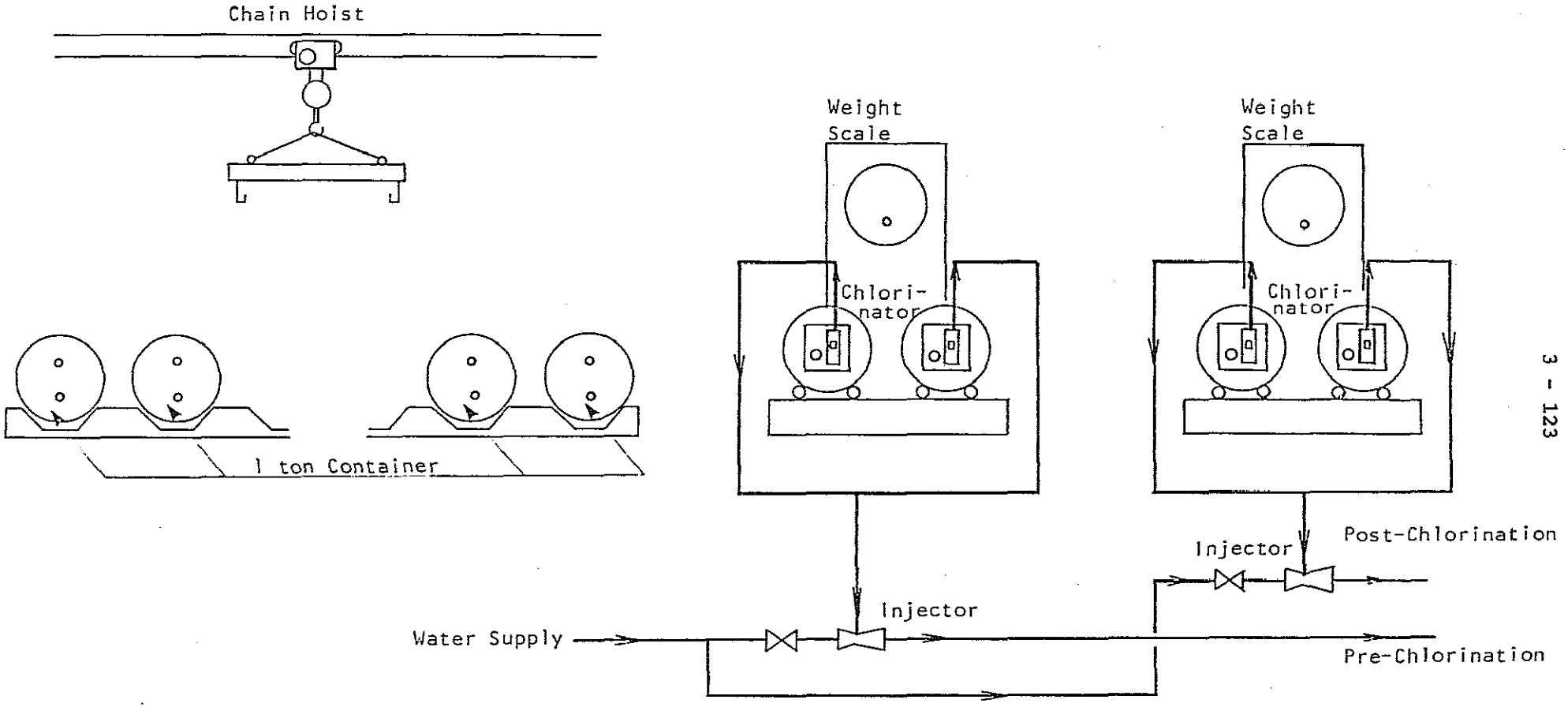


Fig-2.3.34 CHLORINATION FLOW DIAGRAM
(Zagazig Rehabilitation)

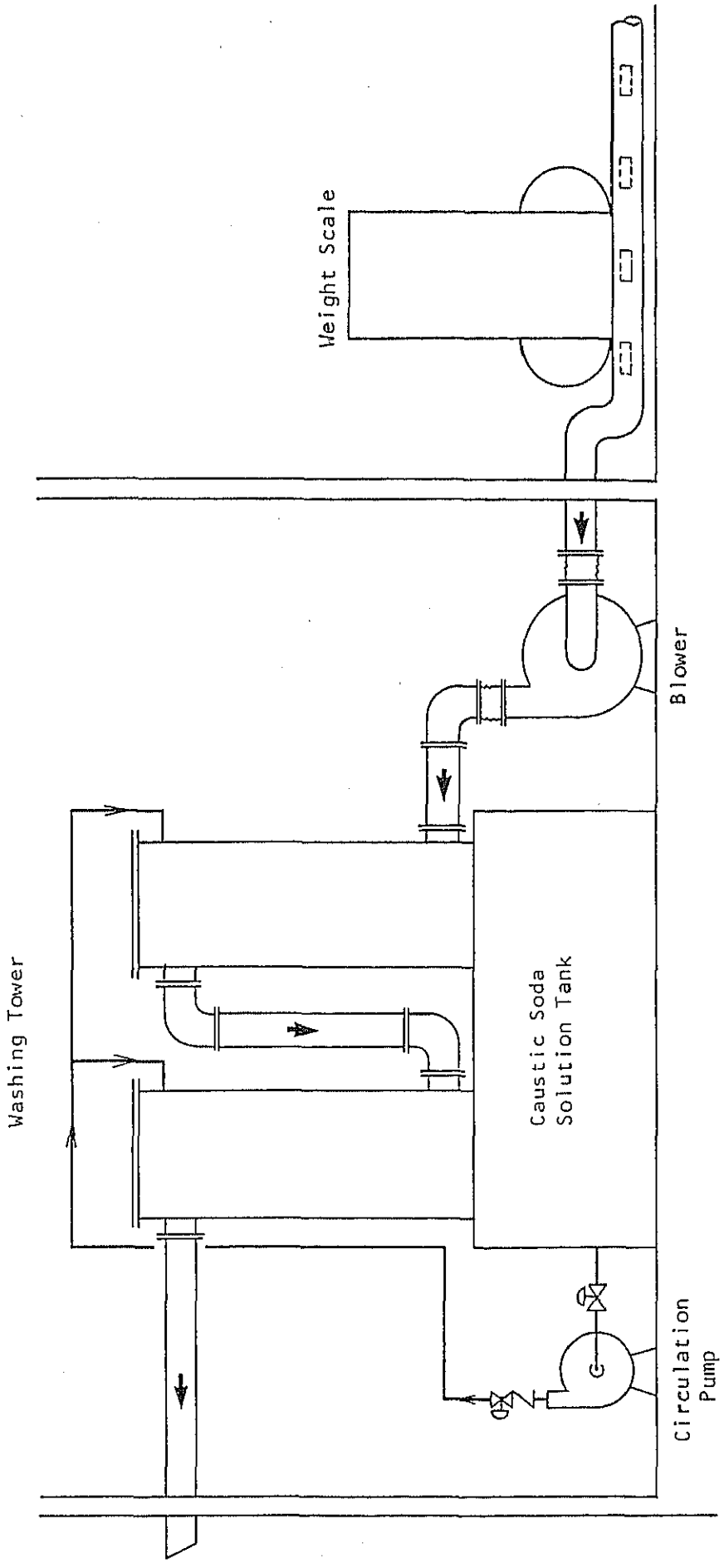


Fig-2.3.35 NEUTRALIZATION FLOW DIAGRAM
(Zagazig Rehabilitation)

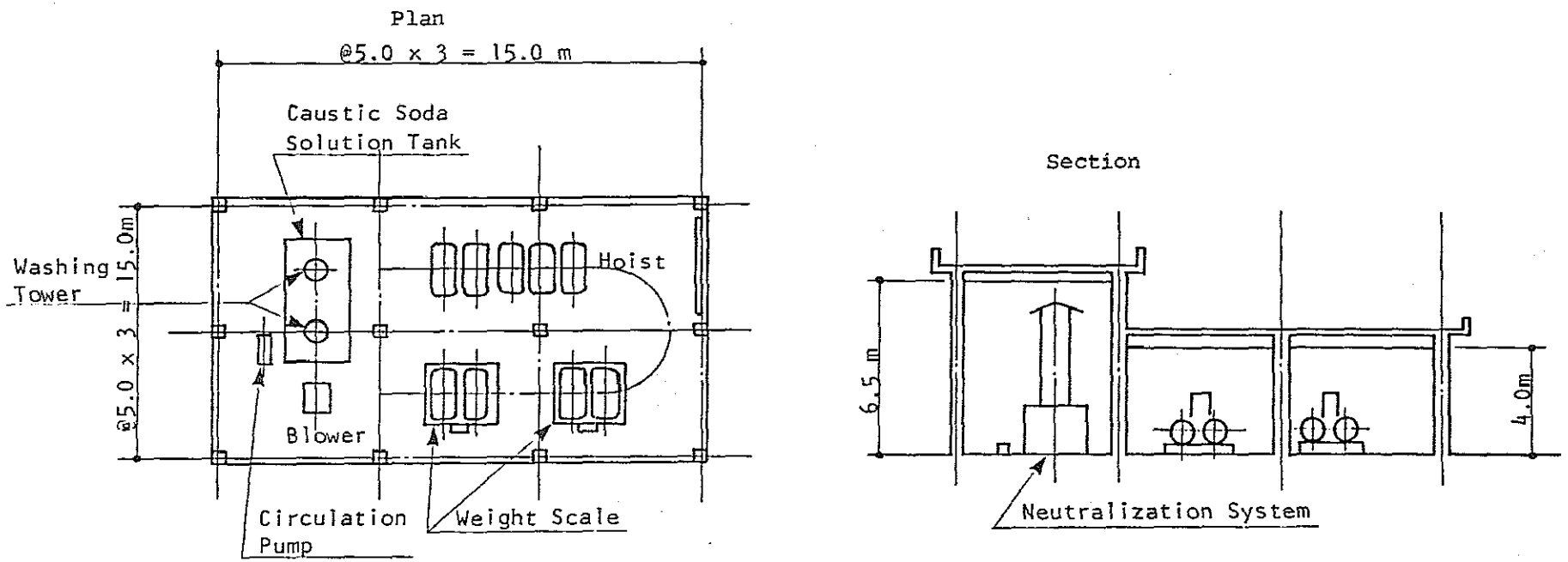


Fig-2.3.36 CHLORINE BUILDING
(Zagazig Rehabilitation)

2.3.3. Development of Groundwater in Southern Area

(1) City-Owned Systems

The existing systems of the following cities are proposed to be developed in the scope of the emergency works by construction of additional groundwater stations.

Table - 2.3.2 DEVELOPMENT OF CITY-OWNED SYSTEMS
(Emergency Works)

City	Facilities to be Constructed	Production Increase
a) Bilbeis	3 groundwater stations	3,888 m3/day
b) Ibrahimiya	1 " "	1,296 "
c) Hihiya	1 " "	1,296 "
d) Diarb Nigm	1 " "	1,296 "
e) Mashtul el Souk	1 " "	1,296 "
f) Minyet el Qamh	1 " "	1,296 "
g) " "	Electric facility for recently-constructed groundwater station	1,296 "
	Total production increase =	11,664 m3/day

(Note) Each of the above groundwater station will consist of one deep well (Ø250 x 60 m), two electric pumps (30 l/s x 60 m x 19 kw, one standby), and electric equipment, and pipelines (Ø250 x 1,000 m, DCIP).

(2) Housing Department System

Among 82 existing groundwater stations of Housing Department system, seven stations were selected to be reconstructed/expanded in the frame of the Emergency Works, considering their urgency. The seven stations supply to many consumers as well as 13,000 - 18,000 persons

in villages, but their per capita productions are very low as 10 - 30 lcd, and require urgent reconstruction/development.

Table-2.3.3 DEVELOPMENT OF HOUSING DEPARTMENT SYSTEM
(Emergency Works)

Station No. & Place	Facilities to be Constructed	Production Capacity Existing	Production Capacity Additional
a) No.23 El Bayoum	1 groundwater station	504 m3/day	792 m3/day
b) No.32 Nishwah	1 "	756 "	540 "
c) No.36 El Tallin	1 "	432 "	864 "
d) No.43 Meet Bashaar	1 "	504 "	796 "
e) No.44 Shalshalamoon	1 "	432 "	864 "
f) No.62 Inshaas el Khasah	1 "	151 "	1,145 "
g) No.82 El Sahafah	1 "	360 "	936 "
Total additional production capacity		=	5,937 m3/day

(Note) - Each of the above groundwater station will consist of one elevated tank (200 m3 x 30 m), two wells (Ø250 x 60 m), two electric pumps (30 l/sec x 50 m), one diesel pump (30 l/sec x 50 m), and electric equipment; and pipelines (Ø200 x 1,000 m, ACP and Ø150 x 1,000 m, ACP).

- In addition to be above reconstruction of 7 groundwater stations, other 13 stations require extension of pipelines (Ø200 x 1,000 m, ACP and Ø150 x 1,000 m, ACP, each); and further 14 stations need extension of pipelines (Ø150 x 1,000 m, ACP, each).

2.3.4 Procurement of Machines/Vehicles for Maintenance

The present condition of the maintenance is insufficient. Especially the following matters are to be improved urgently:

a) Transportation
b) Machines and tools for the maintenance of pipelines
c) Training of engineers

Considering the aforementioned matters, machines and vehicles listed below are to be purchased for the maintenance works, as one of Emergency Works.

Table-2.3.4 PROCUREMENT OF MAINTENANCE MACHINES/VEHICLES
(Unit : 1,000 LE)

No.	Item	Capacity	Qty.	Remarks
1.	Four-Wheel-Drive Car	3,000 cc	3	
2.	Truck	2 ton	4	
3.	Backhoe	0.08 m3	1	
4.	Vibration Roller	B 0.6 m	2	
5.	Generator	25 KVA	2	With Engine
6.	Pipe Cutter	Chain Type	5	
7.	Drain Pump	Q 0.6 m3/min x PS 3.5	5	With Engine
8.	Rammer	Engine 3 PS	5	
9.	Water Level Detector		2	For Well
10.	Portable Chlorinator	50 g/hr	2	With 10 kg Containor and Engine
11.	Box Locator	F-50 Type	3	
12.	Leak Detector	WL-200 Type	3	
13.	Spare Parts		L.S.	
14.	Overseas Training		L.S.	5 Engineers x @30 days

2.4 Construction Cost

2.4.1 Outline of Cost Estimation

In the Working Paper No.3, local unit costs of labor and material employed not only for private construction fields but for public in the Governorate are studied in detail.

From these basic labor and material costs, unit construction costs were estimated on condition that labor efficiency and construction way are basically almost similar to Japanese. Obtained unit construction costs were cross-checked in comparison with past contract prices. The construction costs were estimated on the basis of the unit construction costs stated above.

The obtained construction cost is tabulated below:

No.	Item	Construction Cost (x 1,000 LE)		
		Total	Foreign Currency	Local Currency
1.	Northeast Treatment Plant System	44,056.3	22,815.8	21,240.5
2.	Kafr Saqr Treatment Plant System	27,078.0	10,939.7	16,138.3
3.	Emergency Works	11,757.6	4,464.5	7,293.1
	Total	82,891.9	38,220.0	44,671.9

2.4.2 Northeast Treatment Plant System

	Item	Construction Cost (x 1,000LE) Total	Foreign Currency	Local Currency
1.	Treatment Plant	14,000.0	3,200.0	10,800.0
	a) Intake	76.0	12.0	63.8
	b) Junction Well	54.1	33.4	20.7
	c) Raw Water Pump Well	63.4	8.6	54.8
	d) Distribution Well	67.2	26.5	40.7
	e) Mix. Well & Flocc. Basin	177.1	20.2	156.9
	f) Sedimentation Basin	888.6	71.7	816.9
	g) Filter	1,083.5	482.7	600.8
	h) Reservoir	793.1	49.7	743.4
	i) Distribution Pump Well	189.1	10.9	178.2
	j) Waste Water Basin	262.9	45.9	217.9
	k) Piping Works in Premises	865.4	605.8	259.6
	l) Duct	181.3	-	181.3
	m) Buildings	5,246.0	-	5,246.0
	n) Mechanical & Electrical Facilities	1,615.3	1,449.0	166.3
	o) Landscaping	261.0	-	261.0
	p) Miscellaneous Works	1,576.0	384.3	1,191.7
	q) Land Acquisition	350.0	-	350.0
	r) Allotted Charges for Power Supply	250.0	-	250.0
2.	Trunk Mains	25,752.8	17,924.8	7,828.0
	a) Trunk Mains (1)	24,596.2	17,510.5	7,085.7
	b) Trunk Mains (2)	1,156.6	414.3	742.3
3.	Service Mains	2,580.0	1,349.0	1,231.0
	a) Urban Service Mains	713.0	243.0	470.0
	b) Rural Service Mains	1,867.0	1,106.0	761.0
4.	Elevated Tanks	540.0	54.0	486.0
5.	Booster Pumping Station	1,182.5	287.0	895.5
	Total	44,055.3	22,814.8	21,240.5

2.4.3 Kafr Saqr Treatment Plant System

	Item	Construction Cost (x 1,000LE) Total	Foreign Currency	Local Currency
1.	Treatment Plant	10,700.0	2,300.0	8,400.0
	a) Intake	75.2	12.2	63.0
	b) Junction Well	63.2	28.3	34.9
	c) Raw Water Pump Well	45.2	7.2	38.0
	d) Distribution Well	54.9	22.0	32.9
	e) Mix. Well & Flocc. Basin	125.6	15.3	110.3
	f) Sedimentation Basin	649.1	48.2	600.9
	g) Filter	676.5	209.8	466.7
	h) Reservoir	649.5	45.7	603.8
	i) Distribution Pump Well	175.3	7.9	167.4
	j) Waste Water Basin	225.7	37.5	188.2
	k) Piping Works in Premises	577.0	403.9	173.1
	l) Duct	205.1	-	205.1
	m) Buildings	3,969.0	-	3,969.0
	n) Mechanical & Electrical Facilities	1,341.3	1,200.5	140.8
	o) Landscaping	217.0	-	217.0
	p) Miscellaneous Works	1,166.4	261.5	904.9
	q) Land Acquisition	284.0	-	284.0
	r) Alloted Charges for Power Supply	200.0	-	200.0
2.	Trunk Mains	12,707.0	7,415.4	5,291.6
	a) Trunk Mains (1)	9,004.2	6,152.8	2,851.3
	b) Trunk Mains (2)	3,702.8	1,262.6	2,440.3
3.	Service Mains	2,126.0	929.8	1,196.2
	a) Urban Service Mains	1,309.9	446.5	863.3
	b) Rural Service Mains	816.1	483.3	332.9
4.	Elevated Tanks	810.0	81.0	729.0
5.	Booster Pumping Station	735.0	213.5	521.5
	Total	27,078.0	10,939.7	16,138.3

2.4.4 Emergency Works

Item	Construction Cost (x 1,000LE)		
	Total	Foreign Currency	Local Currency
1. Production Increase of Zagazig Plant	3,600.0	1,500.0	2,100.0
a) Intake	59.2	9.0	50.2
b) Raw Water Pump Station	153.7	26.7	127.0
c) Mixing Well	29.7	13.3	16.4
d) Sedimentation Basin	65.1	10.9	54.2
e) Filter	327.5	99.9	227.6
f) Reservoir	368.3	66.6	301.7
g) Piping Works in Premises	267.4	187.2	80.2
h) Mechanical & Electrical Faicilies	808.5	724.5	84.0
i) Buildings	624.0	-	624.0
j) Miscellaneous Works	796.6	361.9	434.7
k) Allotted Charges for Power Supply	100.0	-	100.0
2. Rehabilitation of Existing Treatment Plants	3,515.1	1,540.7	1,974.4
a) Abbasa Plant Rehabilitation	(1,670.8)	(878.5)	(792.3)
(i) Filter, Mechanical & Electric Facilities	950.8	878.5	72.3
(ii) Chemical Building	720.0	-	720.0
b) Faqus Plant Rehabilitation	(1,080.3)	(494.2)	(586.1)
(i) Mechanical & Electric Facilities	552.3	494.2	58.1
(ii) Chemical Building	528.0	-	528.0
c) Zagazig Plant Rehabilitation	(764.0)	(168.0)	(596.0)
(i) Chemical Feed System	188.0	168.0	20.0
(ii) Chemical Building	576.0	-	576.0
3. Development of Groundwater in Southern Area	4,468.5	1,249.8	3,218.7
a) City-Owned System	(1,512.7)	(437.8)	(1,074.9)
(i) Groundwater Stations	759.5	-	759.5
(ii) Pipelines	753.2	437.8	315.4

Item	Construction Cost (x 1,000LE)		
	Total	Foreign Currency	Local Currency
b) Housing Department System	(2,955.8)	(812.0)	(2,143.8)
(i) Reconstruction of Groundwater Station	1,624.0	-	1,624.0
(ii) Pipelines	1,331.8	812.0	519.8
4. Procurement of Machines/Vehicles for Maintenance	174.0	174.0	-
a) Four-Wheel Drive Cars	24.3	24.3	-
b) Trucks	28.0	28.0	-
c) Backhoe	21.4	21.4	-
d) Drain Pumps	4.5	4.5	-
e) Portable Chlorinators	11.2	11.2	-
f) Leak Detectors & Others	34.5	34.5	-
g) Spare Parts	24.1	24.1	-
h) Overseas Training for Local Engineers	26.0	26.0	-
Total	11,757.6	4,464.5	7,293.1

2.5 Construction, Material and Labor

2.5.1 Construction and Contractor

In the government proejct, open tendering is employed, as a rule, for construction works and material procurement. Tendering is to be announced publicly in the national gazette and general newspapers. In construction works necessitating special method and/or experience, direct appointment contract could be employed exceptionally.

Two sectors (types) of construction contractors, one the publicly owned and the other privately owned, have co-existing in Egypt. For years in the past, the former was awarded more of larger and higher technology orienting works, due to its better staffing and financial credibility. However in the recented years, the latter has caught up and is now in a nearly equal position to the former.

A rental system of construction machinery has been developed in the recent years. There are two types of rental agents presently : one is those agents which do only rental business and another is the construction contractors which rent their machinery purchased for particular projects and laid idle afterwards to other contractors. Presently, a wide variety of machinery is utilized for construction works and commonly used machines like diesel engines, dewatering pumps and concrete mixers can be available locally.

To promote the contractors' ability, a regulation which gives opportunities, as many as possible, to more contractors is being enforced at present. When a special construction method, like jacking pipes underground instead of laying in open-cut trenches for Cairo Water Supply System, is to be employed, experienced contractors are urged to help less-experienced contractors in training on the job and by lending necessary machines and equipments.

For the project, appropriate construction method will have to be employed to suit the local conditions of the Governorate, even though almost all methods are applicable at present.

2.5.2 Construction Material

Most basic materials for construction work can be obtained in the market freely. Fundamental materials such as cement and steel bar have been produced domestically, not only for the domestic needs but also for the expert. Only some specific "shaped steel" is imported for construction consequently. Wood is imported mostly as the country is incapable of production.

For stabilizing supply and promoting construction, the Government controls the market price of cement, steel bar, glass and wood by subsidizing them for the public projects use. They are low cost housing, masque and education facility construction and so forth. The difference between the controlled and free market price is about 15 - 25 % at present. In some cases it is as high as 40 % but the trend is that the difference has been kept stable or rather decreasing under the current government policy.

Cast iron pipes and fittings are produced by the local munufacturers except for big size one, in conformity with Egyptian, ISO, BS and other standards, upon the specification of users. Ductile iron pipes are not produced in Egypt yet, though the domestic production is being prepared.

Sluice valves and various types of gates can also be produced locally, as the Irrigation and Canal Authority, as a big buyer/user, has helped improvement of the local manufacturers' capability. Asbestos cement pipes, polyvinyl chloride pipes and steel pipes with their fittings are widely used in water supply projects, due to the reasonable price and local production.

There are some cases that even the locally produced materials like asbestos cement pipes is imported, when the production capacity can not meet a large amount of demand which occur all at once.

2.5.3 Labor and Unit Cost

Generally the ability of average workers is almost similar to other countries' workers' except that the construction speed will slow down during Ramadan season.

The labor costs widely employed in the Governorate are described in detail in Working Paper No.3, together with the material costs and estimated unit construction costs.

As for the working hours, it is instructed that it should basically be 7 hours a day for employees in the guideline issued by the Ministry of Labor. Following the guideline, all public offices and private companies fix their employees' working hours from 8 a.m. to 3 p.m. usually, based on 6 working days a week. However, 5 working days system is gradually becoming popular, especially for private companies.

The guideline is observed also by the construction industry, though many construction works are promoted by the worker' overtime and/or night shift, when necessary.

3. Implementation Program and Project Cost

3.1 Project Implementation Schedule

The project of the first phase program and the emergency works will be carried out in the following schedule, the duration as shown in the bracket :

1) Completion of the feasibility study..... December 1984
2) Loan application ..... Early 1985 - Middle 1985 (1/2 years)
3) Detail design ..... Middle 1985 - Middle 1986 (One year)
4) Emergency works ..... Middle 1986 - Middle 1987 (One year)
5) Construction of Northeast Plant system and
   Kafr Saqr Plant system ..... Middle 1986 - Middle 1988 (Two years)

The above schedule is shown with bar chart in Fig-3.1.1.

3.2 Project Cost

The total cost for project implementation is estimated at LE 126,015,000- The cost is composed of the construction works cost, engineering service cost, physical contingency and price contingency.

The construction cost was estimated in the preceding chapter, at 1984 price level.

The cost of engineering service for detail design and construction supervision is assumed at 5 % of the total construction cost. The cost is composed of 55 % for detail design work, and 45 % for construction supervision service.

The physical contingency is estimated at 10 % of the above costs (Construction cost plus engineering services cost).

The price contingency is calculated based on the implementation schedule. Price escalation rates are assumed 12 % per annum for the local currency portion and 7 % per annum for the foreign currency portion.

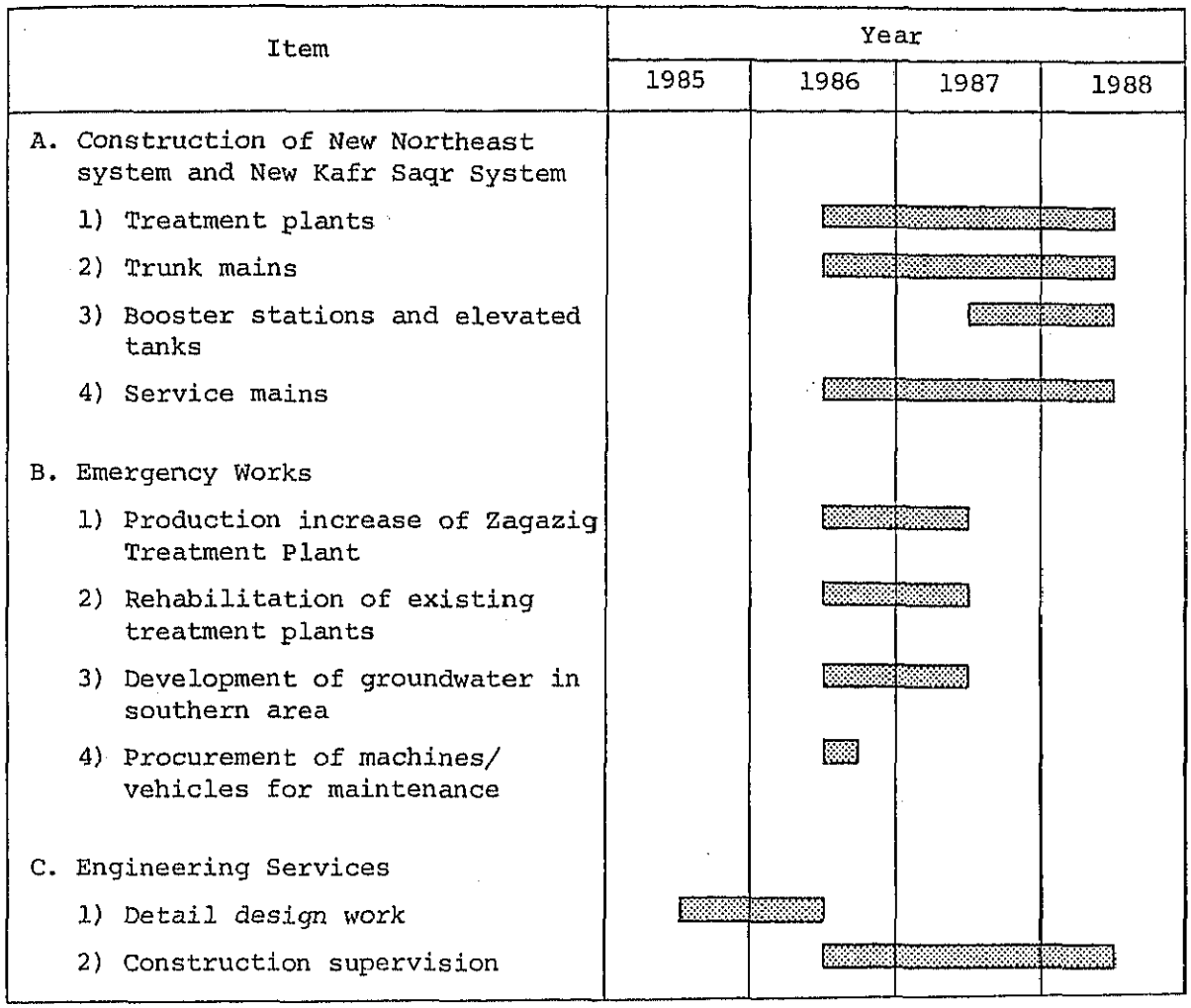


Fig -3.1.1 PROJECT IMPLEMENTATION SCHEDULE

The above costs are broken down in Table-3.2.1, and summarized below:

a) Construction of Northeast Plant system	LE	44,056,000-
b) Construction of Kafr Saqr Plant system	LE	27,078,000-
c) Emergency works	LE	11,758,000-
d) Engineering services	LE	4,145,000-
e) Physical contingency	LE	8,704,000-
f) Price contingency	LE	30,274,000-
Total Project Cost	= LE	126,015,000-

The total project cost of LE 126,015,000- will be broken down into the foreign currency portion of LE 54,287,000- (Equivalent to US$66,230,000- at the changing rate: US$ 1.00 = LE 0.82); and the local currency portion of LE 71,728,000-.

3.3 Disbursement Schedule

The proejct will be commenced in 1985 and completed in 1988. The disbursement by each year will be made as shown in Table-3.2.1, which is based on the implementation schedule.

Table-3.2.1 DISBURSEMENT SCHEDULE

Note: - Unit: One Thousand Egyptian Pounds = '000 LE
- F/C = Foreign Currency Component
- L/C = Local Currency Component
- Prices: As of Year 1984
- Foreign Exchange Rate: US$ 1.00 = LE 0.82
- Price Escalation Rate: 7 % annual for F/C,
12 % annual for L/C

(Unit: Thousand Egyptian Pounds)

Item	Cost			Yearly Disbursement							
	Total Cost	Breakdown		1985		1986		1987		1988	
		F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C
A. Construction of New North-east Plant system											
a) Plant construction	14,000	3,200	10,800	-	-	-	2,700	1,600	5,400	1,600	2,700
b) Trunk mains	25,753	17,925	7,828	-	-	5,378	783	10,755	4,697	1,792	2,348
c) Service mains	2,580	1,349	1,231	-	-	405	123	809	739	135	369
d) Elevated tanks	540	54	486	-	-	-	-	54	243	-	243
e) Booster pumping station	1,183	287	896	-	-	-	-	144	448	143	448
Total (A)	44,056	22,815	21,241	-	-	5,783	3,606	13,362	11,527	3,670	6,108
B. Construction of New Kafr Sakr Plant system											
a) Plant construction	10,700	2,300	8,400	-	-	-	2,100	1,150	4,200	1,150	2,100
b) Trunk mains	12,707	7,415	5,292	-	-	2,225	529	4,449	3,175	741	1,588
c) Service mains	2,126	930	1,196	-	-	279	120	558	717	93	359
d) Elevated tanks	810	81	729	-	-	-	-	81	365	-	364
e) Booster pumping station	735	214	521	-	-	-	-	107	261	107	260
Total (B)	27,078	10,940	16,138	-	-	2,504	2,749	6,345	8,718	2,091	4,671
C. Emergency Works											
a) Production increase of Zagazig Plant	3,600	1,500	2,100	-	-	750	1,050	750	1,050	-	-
b) Rehabilitation of existing treatment plants	3,515	1,541	1,974	-	-	770	987	771	987	-	-
c) Development of Groundwater in southern area	4,469	1,250	3,219	-	-	625	1,610	625	1,609	-	-
d) Procurement of machines/ Vehicles for maintenance	174	174	-	-	-	174	-	-	-	-	-
Total (C)	11,758	4,465	7,293	-	-	2,319	3,647	2,146	3,646	-	-
D. Engineering Services	4,145	2,487	1,568	684	456	963	642	560	373	280	187
Total (A+B+C+D)	87,037	40,707	46,330	684	456	11,569	10,644	22,413	24,264	6,041	10,966
E. Physical Contingency (10%)	8,704	4,071	4,633	69	46	1,157	1,064	2,241	2,426	604	1,097
Total (A+B+C+D+E)	95,741	44,778	50,963	753	502	12,726	11,708	24,654	26,690	6,645	12,063
F. Price Contingency	30,274	9,509	20,765	53	60	1,844	2,979	5,547	10,808	2,065	6,918
Total Project Cost	126,015	54,287 (43%)	71,728 (57%)	806	562	14,570	14,687	30,201	37,498	8,710	18,981

Note: - Foreign currency portion cost of LE 54,287 Thousand (43 % of total project cost):
Equivalent to US$ 66,230 Thousand.
Exchange Rate : LE 0.82 = US$ 1.00
US$ 1.00 = LE 1.22
The cost described above is denoted in 1984 price.

4. Institution and Organization

In the preceding part of this report, the desirable organizational framework has been proposed in the light of long term water supply development program. In this section further organizational arrangement are dealt with to meet the immediate needs for the implementation of the first priority-phase program of the proposed project within the framework of the proposed Sharqiya Public Water Company(PWC) and its relation with central and local government agencies as accepted for the long term plan.

4.1 Organization and Functions of Sharqiya PWC

The more simplified and economized organizational arrangements are considered desirable at the earlier stage of the reorganization program while step by step organizational development can be achieved with ultimate objective to set up a full-scaled organization avoiding any difficulties to be derived from drastic reformation at the burgeoning stage.

For the long term program three levels of water supply management are proposed namely headquarters, regional offices and district offices taking account of extensive water supply development envisaged up to the year 2005. For the first priority-phase program it is considerded more appropriate to combine the headquarter and regional office functions.

In addition to the departments of the headquarter previously recommended a manpower development department to meet the specific needs for staffing, recruiting and training is additionally recommended and an ad hoc project implementation committee are recommended.

The organization chart modified especially for the first priority-phase program is indicated by Fig-4.1.1.

The principal objectives and powers and functions of the recommended Sharqiya Public Water Company has been described in the part of long term program.

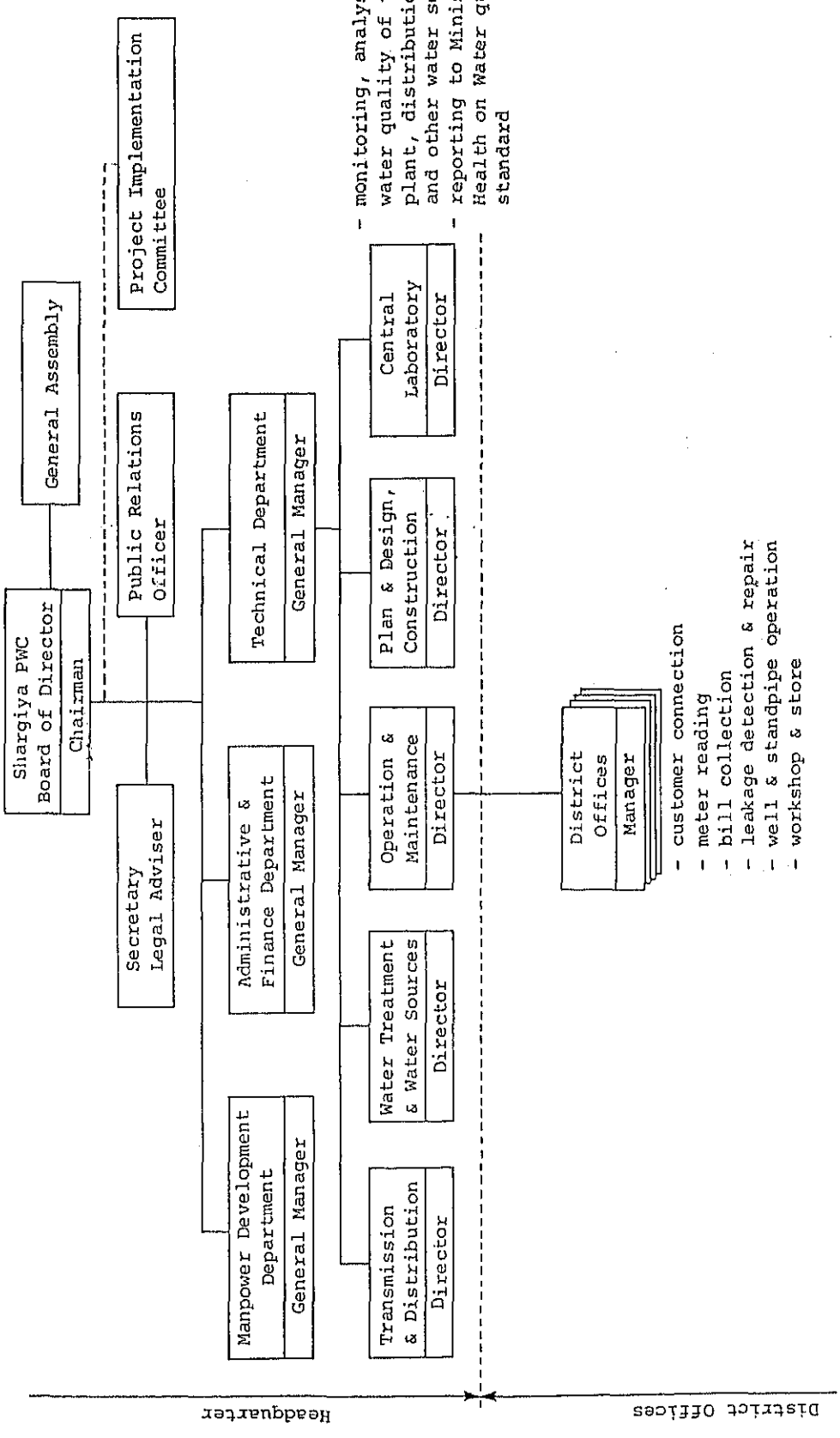


Fig-4.1.1 Proposed Organization Chart for First Priority-Phase Program

The management structure modified especially for the first priority-phase program and functions of respective departments in the Company are as follows.

The company activities are to be performed based on two levels of water management control, i.e., headquarter and district offices.

The headquarter is to be located in Capital City of Zagazig and perform central control of water supply operation throughout the Sharqiya Governorate including political, planning, technical, financial, administrative and supervisory functions.

The district offices are to be located in every Marakaz preferably in the present municipal offices or nearby, and perform day to day operation of water supply and customer services.

Chairman: The chief executive power is vested with Chairman as the head of the Board of Director and responsible for management, control and external representation of the Company. The Board as the executive body of the Company comprises General Managers and selected employees of the Company and perform all tasks needed to fulfill the Company's objective and policy makings.

General Assembly: The general assembly is to be provided comprising shareholders, representatives of other Ministries concerned, the Company employees and other nominated outside experts presided by the Governor to perform general supervisory duties for the Company's activities.

Secretary, Legal Adviser: He is responsible for the legal arrangements as required for the water supply operation, contracting and other legal settlement for any conceivable disputes in connection with water consumers.

Public Relation Officer: He is responsible to enhance public awareness of the value and cost of safe water, dealing with a number of activities, including customer queries and complaints, information program about company's activities and support activities to the implementation of the project.

Project Implementation Committee: The ad hoc committee is to be provided prior to the initiation of the proposed project in order to facilitate and accelerate project implementation involving key personnels for

the project. This committee is to play a vital role concentrating their efforts on the project mobilization which is likely to be delayed when the project executive organization is new and not fully experienced for implementation of the project of significant magnitude.

This committee therefore should be involved in the various activities normally required at the outset of the project including project financing, procurement of equipments and materials and construction contracting which are to be undertaken by other department when normal operation of the Company is fully achieved.

Manpower Development Department: This department is to be provided reflecting the significant importance to provide the sufficient capable staff for the water supply activities to be expanded by the project.

The vigorous training program by this department especially for the existing staff is required to upgrade their skills in coordination with NOPWASD which is implementing nationwide training program.

A properly qualified professional for the training should be selected to become the manager of this department.

The special task force should be created in this department to start the immediate training program as well as recruiting the personnel and internal arrangement for the assignment of existing staff to newly organized position.

This department is to maintain personnel records and prepare reports on manpower levels and performance to be reviewed for incentive payments and promote discipline.

Administrative & Finance Department: This department is to play a key role of overall financial control of the Company's activities as well as project implementation.

The regular financial reporting system should be consolidated including annual operating and capital expenditures in parallel with annual revenue account.

The funding arrangement necessary to meet the Company's noraml activities or project implementation should be performed by this department with legitimate control over the funding results.

The financial sheet should be prepared to indicate the financial performance of the Company including income & loss statement, cash flow and balance sheet with assets register.

The financial adjudication for the procurement of equipments and materials and capital works should be performed by this department.

Technical Department: This department is to perform the central control over the technical aspects of water supply operation coordinating Sub-Divisions of (1) Transmission & Distribution, (2) Water Treatment & Water Sources, (3) Operation & Maintenance, (4) Plan & Design, Construction, (5) Central Laboratory.

(1) Transmission & Distribution Sub-Division: This Sub-Division is responsible in keeping major transmission and distribution mains extending over all Marakaz in efficient working order performing direct control and supervision of routine maintenance and emergent repair crews to ensure uninterrupted water supply to the consumers in accordance with the preventive maintenance program.

(2) Water Treatment & Water Sources Sub-Division: This Sub-Division is responsible for overall control of the water treatment plant and major groundwater stations to ensure safe drinking water.

The workshop facilities, stores should be maintained to safeguard the electrical and mechanical equipments for the proper functions of the treatment plants and groundwater stations.

(3) Operation & Maintenance Sub-Division: This Sub-Division maintains overall responsibility for the day to day water supply operation throughout the district offices resolving disputes or conflicts of priority between district offices and advise the district offices on appropriate technical solution for the operational and maintenance problems.

(4) Plan & Design, Construction Sub-Division: This Sub-Division is to prepare future estimation of the level of the service and demand for the potable water within the Company's service area and identfy potential

sources of water supply and appropriate means of water treatment and extending distribution networks in coordination with other related technical departments.

They should develop medium term investment program showing the scale, timing and order of priority of projects to meet future demand within the available investment resources in consultation with Finance and Administration Department.

After the project is determined to be implemented based on above estimation and program, they should develop design of the facilities to be constructed and prepare the tender documents, invitation and awards of the contract necessary for project implementation and undertake supervisory work for the consecutive construction works.

At the initial stage of organization development, the task of this Sub-Division is recommended to be performed with full supports of experienced consulting engineers until the staffing is duly strengthened to undertake such tasks.

(5) Central Laboratory Sub-Division: This Sub-Division is to perform monitoring and analysis of water quality samples collected from treatment plants, distribution systems, wells and standpipes and study acceptability of the water in conformance with water quality standard maintaining contacts and consultation with Ministry of Health.

They should maintain the data of water quality and results of the testing and analysis in satisfactory condition to be utilized whenever necessary for the progressive water quality improvement program.

District Offices: Distict Offices are the basic day-to-day operational units under the control of Operation & Maintenance Sub-Division. The appropriate size of the Offices to be located in every Marakaz in terms of staffing and space will be dependent on the numbers of consumers and geographical extents.

The administrative boundaries of existing Marakaz will provide a base to form the District Offices. Sub-divided zones can be considered in the Markaz where size of population and area is too large to administer.

The principal tasks of District Offices are to maintain safe and continuous water supply in their administrative areas by performing

- routine inspections and minor maintenance of transmission and distribution mains and reporting major faults to Transmission & Distribution Sub-Division through Operation & Maintenance Sub-Division
- routine operation and maintenance of wells, public standpipes and minor treatment plants such as compact units
- repairing and laying of all minor distribution pipes including water leakage and loss detection and prevention
- installment of customer connections after receiving their application and perform routine inspection and programmed meter maintenance.
- customers' meter reading, and billing and collection of water tariff.

Each District Office should have at least one maintenance center including work shop for equipments repairs and store for spare parts.
The existing maintenance centers should be consolidated with appropriate size of maintenance crews, equipments, chemicals and vehicles.

In addition to the structural and staffing arrangements, the management procedure together with personnel management are required to be consolidated for the total operating efficiency of the organization.

The new company vested with autonomous power should fully exerts its power to promote work-oriented disciplinary climate in the organization by setting the incentive payment system such as payment for overtime works and other allowances for good performance.

In this connection some other organizations of similar type to the proposed water company can be referred and its philosophy could be applied.
The Electric Authority is a suitable example, among others, because it operates the public utility and has a structure of public company and enjoys more freedom in the area of incentive payment and has greater flexibility on personnel promotion.

The integrated management information system is also important and should be available at all levels of company's activities. The information on performance measures on all operational activities at the plant and district office level should be reported to the managers to enable them

to monitor actual performance of particular activities and take appropriate action or instruction to meet specified physical and financial objectives and standards. Such information should be reported at predetermined regular intervals with a consolidated reporting format. The following major items for which information is required.

- quantity of production and distribution of treated water, consumption, and billed water
- water quality data including chemical dosing rate, chemical and bacteriological testing results
- existing mains and distribution pipe network, house connection and meters, number of default meters, demand of new connection, leakage detection and related program for maintenance and repairs and expansion
- billed and collected water charge, total revenues and expenditure, estimated cash requirements and sources of funds
- actual number of staff in each job group.

4.2 Staffing Plan

A careful analysis has been made of the quality and numbers of staff to be required for the proposed Company for the first priority-phase program on the assumption that in addition to the existing water supply systems a new system construction starts from 1986 after the detailed designing in 1985 and fully operates the schemed treatment plant from 1989 .

The estimation of the staffing has been made taking into account:

- magnitude of the existing and newly proposed treatment plant
- numbers of existing groundwater stations including wells and elevated tanks
- number of served population

The personnels are considered to be distributed basically in three large functional groups of headquarter, treatment plant and district offices and the staffing schedule has been made reflecting such functional groups as shown in Table-4.1.1.

The number of the staff required during the project's construction period is normally less than those required after the completion of the new systems construction and initiation of the operation, but this concept can not be reflected in the staffing pattern of the presently proposed project since there is a social and political constraint in reducing existing staff by firing or transferring to other organization. The morale problem should also be minimized by making possible efforts to allocate existing employee within the organization.

Consequently the staffing schedule from 1985 to 1988 in the table can be considered overmanned by the existing employee especially the laborers and other non-technical staff to be assigned in District Offices.
It is urgently required to upgrade the skills of surplus manpower so that they can undertake the required job in the future.

Table -4.1.1 Estimated Staffing Schedule for First Priority Program

Job Title	1985	1986	1987	1988	1989	1990
PWC Headquarter						
Top Management	10	10	10	10	10	10
Engineer	10	10	10	12	12	12
Chemist	2	2	2	4	4	4
Superintendent/Inspector	6	6	6	8	8	8
Technician	17	17	17	19	19	19
Water Operator	8	8	8	10	10	10
Legal Officer	1	1	1	1	1	1
Personnel/Training Officer	5	5	5	5	5	5
Financial Officer	1	1	1	2	2	2
Accountant	5	5	5	7	7	7
Administrative Staff	3	3	3	5	5	5
Procurement/Supply Officer	3	3	3	5	5	5
Clerk	67	67	67	69	69	69
Laborer	30	30	30	30	30	30
Treatment Plant						
Manager (Engineer)	3	3	3	5	5	5
Chemist	3	3	3	4	4	4
Laboratory Technician	3	3	3	5	5	5
Electrician	3	3	3	4	4	4
Mechanic/Fitter	3	3	3	5	5	5
Operator	35	35	35	40	43	48
Supervisor	30	30	30	35	35	40
Storeman	6	6	6	10	10	10
Clerk/typist	8	8	8	10	10	10
Laborer/Foreman	150	150	150	152	152	152
District Offices						
Manager (Engineer)	12	12	12	12	12	12
Superintendent/Inspector	140	140	140	140	140	140
Craftsman	90	90	90	96	96	96
Water Operator	193	193	193	196	196	196
Maintenance Crew	210	210	210	210	210	210
Laborer	280	280	280	280	280	280
Meter Reader	84	84	84	84	84	84
Billing/Collection Staff	188	188	188	188	188	188
Clerk	206	206	206	206	206	206
Total	1815	1815	1815	1869	1872	1882

4.3 Training

It is apparent that staffing schedule as proposed in the previous section requires a major upgrading of the skills and quality of the existing staff which will be incorporated in the new organization.

The immediate action necessary to take is to consolidate the proposed Manpower Development Department with a special task force and to initiate the well programmed training activities especially for the key personnels in order that they can upgrade their skills and simultaneously train their subordinates.

The training program should be prepared in accordance with the urgency of the required functions of water supply system development identifying the personnels and subjects for the training.

The followings are outlines of required knowledge and skills for the key staff of each functional division of the newly proposed Sharqiya Public Water Company indicating training subject for any potential personnels who would be assigned in new position in case they lack required skills and knowledge.

Job Title	Required Knowledge and Skills
Chairman:	- top management procedure in water sector or other public utility field - the principal managerial skills of communication, delegating, decision-making and motivating - the political, economic and technological implications affecting water supply company
Legal Adviser:	- legislation associated with central and local government agencies - acts, decrees and regulations related to the water supply - contract negotiation

Public Relation Officer:	- advertising, publication and communication media - publicity campaigns for public health education
General Manager, Manpower Development Department:	- Personnel administration - general management practice and organization design - personnel recruitment and training as well as personnel evaluation - basic knowledge about water operation
General Manager, Administrative & Finance Department:	- budgets preparation and control - financial accountancy - financial analysis on cost and revenue including billing and cashering
General Manager, Technical Department:	- basic knowledge about treatment plant and distribution network - comprehensive knowledge about water supply engineering including health factors - management controls
Director, Transmission & Distribution:	- extensive knowledge about many phases of water production and supply - water supply administration, including main and distribution installation with relevant mechanical engineering skills
Director, Water Treatment & Water Sources:	- chemical testing and control and all mechanical operation of plant - detailed knowledge of routine and major maintenance requirements for treatment plants

Director, Operation and Maintenance:
- detailed knowledge of water supply administration on local distribution network and groundwater stations as well as customer relations such as water charge billing and collection
- skills and ability to coordinate a number of district offices managers and make a administrative and technical solution on water operation problem

Director, Plan & Design, Construction:
- technical knowledge of water treatment and distribution
- project planning and appraisal
- contract documentation and negotiation
- construction management

Director, Central Laboratory:
- basic knowledge on water quality and analysis and control
- water chemistry and bacteriology related to public health aspects and water quality standards

Manager, District Offices:
- local water supply operation and maintenance including leakage detection, operation of groundwater station, and customer services and revenue collection
- personnel management and control
- preventive maintenance program

The required skills and knowledge for the personnels as directors and managers of each functional division are concerned with broader range of administrative and engineering activities and these subordinate staff under the responsible personnels of each division are requested to receive necessary training to meet the specific assignment in each division in a more practical manner such as on-the-job training.

Prior to the introduction of future permanent training activities, the foreign consultants expertise and skills are recommended to be fully utilized and passed on to the counterpart staff as the technology transfer. It is also recommended to take advantage of the foreign training program to be executed by the bilateral and mutilateral technical assistance agencies.

It has been considered from the observation on local water operation that one of the most effective way to achieve the objectives of the training is to have the foreign professionals with specific expertise involved in the day- to - day activities of managerial and engineering divisions of water supply organization for a considerable time in a range of 6 months to a year so that they can transfer the skills and knowledge by theoretical as well as practical manner.

The present shortage of skilled laborers and technical staff should progressively be reduced by training of existing unskilled laborers instead of recruiting new staff which is less desirable due to difficult availability of the qualified personnel in the labor market and present policy of employment.

NOPWASD is presently developing the nationwide water sector training program by establishment of several training centers at the strategic locations. The periodical dispatch of the trainees to above centers is desirable but specific attentions should be paid to encourage such trainees to receive training by providing them with necessary fund for transportation and lodging.

It is also considered necessary to give them some incentives for their training by giving them the certificates advantageous to the career development after their completion of the trainings.

Above recommendation has been derived from the findings of existing poor willingness of the staff to receive the training due to the absence of funding supports and other incentives under difficult situation to force them to receive the trainings.