9. Factory Survey and Design of W.W.T.

The factory survey and the conceptual · basic design for the nominated 5 factories were carried out. The summary for each factory is shown as follows:

9.1 DELTA STEEL MILL CO. (DSM)

(1) Outline of Factory

1) DSM Factory is an aged steel mill and castings in Cairo city, and about 2,500 employees are working in the factory. It is desired to modernize the existing facilities and to install a new pollution control facility.

2) Industrial water is taken from the canal beside the factory, and wastewater is discharged to the public sewage system.

3) Air pollution by dust from the electric furnaces can be found. Wastewater containing free oil and suspended solids is discharged under incomplete treatment.

4) The improving plan for wastewater treating system in the whole factory is proceeding by EGITALEC Co. in Cairo.

(2) Conceptual Design

1) Based on the factory survey, the wastewater from the air station supply facility was selected for W.W.T. demonstration plant (Candidate).

2) The wastewater flow rate, quality and the target of treated water quality are shown as follow:

Table 9.1-1 Wastewater flow rate, quality and target of treated water

Item		Wastewater	Treated Water	Regulation Law48/82
Flow rate	[m^3/h]	Max. 120	120	
pH	[-]	6-7	6-9	6-9
COD	[mg/l]	30	15	30
BOD	[mg/l]	20	10	20
SS	[mg/l]	200	2	30
Oil & Grease	[mg/l]	1,000	5	5

Note: The above regulation is applied to the most stringent wastewater discharge regulations, which is Law48/82 Underground Reservoir & Nile Branches/Canals.

3) The W.W.T. system for a demonstration plant (Candidate) is shown as follow: and the attached drawing 9.1-1 in details.

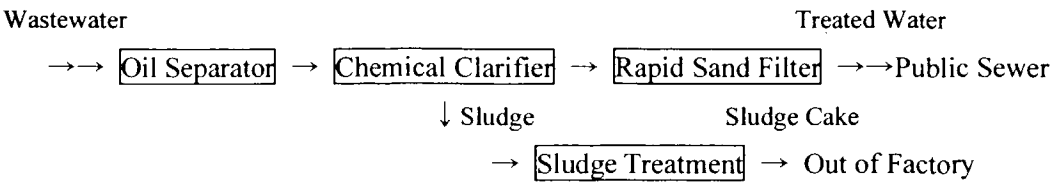


Fig. 9.1-1 Block Flow Diagram for W.W.T.

4) The estimated construction cost is as follow:

(a) Equipment, Instrument Supply	179,054,000 Yen	
(b) Field Construction Work	88,150,000	(2,593,000 LE)
(c) Indirect Cost	32,040,000	
Total	299,210,000 Yen	* Exchange Rate 1 LE = 34 Yen

(3) Recommendations concerning to W.W.T.

1) To remove accumulated sludge in the sewers, pits
2) To skim floating oil and scum in the oil collection pit and sewer
3) To maintain the equipment, instruments properly

9.2 EGYPTIAN FERROALLOYS CO. (EF)

(1) Outline of Factory

1) EF Factory manufactures ferro-silica, locates beside the Nile River at 700km south of Cairo, and 1,570 employees are working in the factory.
The capital and annual sales amount are 100 million LE, 130 million LE, respectively.
2) Water source of industrial water and drinking water is the Nile River, and wastewater except domestic wastewater are discharged to the Nile River.
3) A large amount of cooling water is used for 4 sets of electric furnaces (EF). A half of cooling water is recycled and the remaining ($725m^3/h$) is discharged to the Nile River directly because cooling system is not provided for 2 sets of EF.
4) It was found during our survey that free oil was leaking into wastewater from the transformer yard, and wash water of crushed quartz was not discharged due to no-operation.
5) Some toxic gases were exhausted from EFs, it is necessary to provide any pollution control.

(2) Conceptual Design

1) Based on the factory survey, the following wastewater was selected for W.W.T. demonstration plant (Candidate).
(a) Wastewater from Transformer Yard (b) Wash water from Crush quartz
(c) Wastewater from Air Supply Unit (d) Wastewater from Work Shop
2) The wastewater flow rate, quality and the target of treated water quality are shown on the following Table 9.2-1.
3) The W.W.T. system for a demonstration plant (Candidate) is shown as follow: and the attached drawing 9.2-1 in details.

Table 9.2-1 Wastewater flow rate, quality and target of treated water

Item		Mixed Wastewater	Treated Water	Regulation Law48/82
Flow rate	[m^3/h]	Max. 260	120	
pH	[-]	6.5 - 8	6-9	6-9
COD	[mg/L]	3 - 30	15	30
BOD	[mg/L]	<5	10	20
SS	[mg/L]	30 - 700	2	30
Oil & Grease	[mg/L]	0 - 20	5	5
SiO_2	[mg/L]	30	<10	-

Note: The above regulation is applied to the most stringent wastewater discharge regulations, which is Law48/82 Underground Reservoir & Nile Branches/Canals.

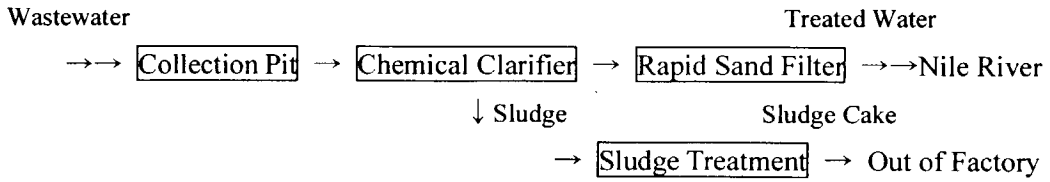


Fig. 9.2 -1 Block Flow Diagram for W.W.T.

4) The estimated construction cost is as follow:

(a) Equipment, Instrument Supply	184,800,000 Yen	
(b) Field Construction Work	111,670,000	(3,284,000 LE)
(c) Indirect Cost	37,920,000	
Total	334,390,000 Yen	* Exchange Rate 1 LE = 34 Yen

(3) Recommendations concerning to W.W.T.

1) To investigate the cause of leakage oil from Transformer Yard before studying of treating system plan.

2) To remove free oil as pre-treatment of W.W.T.

3) To install cooling towers for 2 sets of EFs to reduce intake and discharge water

9.3 EL NASR CO. FOR STEEL PIPES AND FITTINGS (NSP)

(1) Outline of Factory

1) NSP manufactures steel pipes, angles and fittings, located at Helwan Industrial District, 20km south of Cairo, and 2,630 employees are working in the factory.
The capital and annual sales amount are 90 million LE, 172 million LE, respectively.

2) 3,900 m^3/d of city water is used as industrial water, and wastewater is discharged to the public

sewage.

3) The major wastewater are acid wash water (rinsing water), skimming oily water of circulating cooling water and domestic wastewater in the factory.

(2) Conceptual Design (Omitted in detail)

1) Based on the factory survey, the wastewater of "neutralized wastewater of acid wash water" and "skimming oily water from the oil separator for cooling water" were selected for W.W.T. demonstration plant (Candidate). Then, the conceptual design had been carried out.

2) NSP Factory had been selected one of 3 representative factories for W.W.T. demonstration plant (Candidate), the basic design was commenced.

3) The Egyptian side pointed out the following comments to the conceptual design:

(a) The wastewater should be treated whole wastewater in NSP Factory, because wastewater to be treated in the conceptual design is only around half of whole wastewater in NSP Factory.

(b) Target of treated water should be applied Law 93/62 (discharge to Sewer System), because the most stringent regulation is applied in the conceptual design in spite of treated water will be discharged to the public sewage.

3) The above conditions is specified for W.W.T. demonstration plant on M/M of S/W. But, NSP Factory had not been selected as W.W.T. demonstration factory due to privatization of factory and other reasons.

(3) Basic Design

The basic design has been carried out considering the above conditions as the recommendable W.W.T plant for NSP Factory.

1) Whole wastewater in NSP Factory are treated by W.W.T. recommendable plant in the basic design.

2) The W.W.T treating system is designed as follows (refer to the attached DWG 9.3-1 in detail):

3) The wastewater flow rate, quality and the target of treated water quality are shown on the following Table 9.3-1.

Table 9.3-1 Wastewater flow rate, quality and target of treated water

Item		Equalized Wastewater	Treated Water	Regulation Law48/82
Flow Rate	[m^3/h]	77	77	
pH	[-]	6.5 - 8	6.5 - 8	6 - 9
COD	[mg/L]	200	80	100
BOD	[mg/L]	98	30	60
SS	[mg/L]	224	10	60
Oil & Grease	[mg/L]	17	2	10

Note: The target quality of treated water is applied to Law48/82 Non Potable Surface Water (Industrial) considering enforcement of regulation in stead of Law 93/62.
Flow rate is not included the treated water of No.1 WWT.

4) Wastewater Treating System

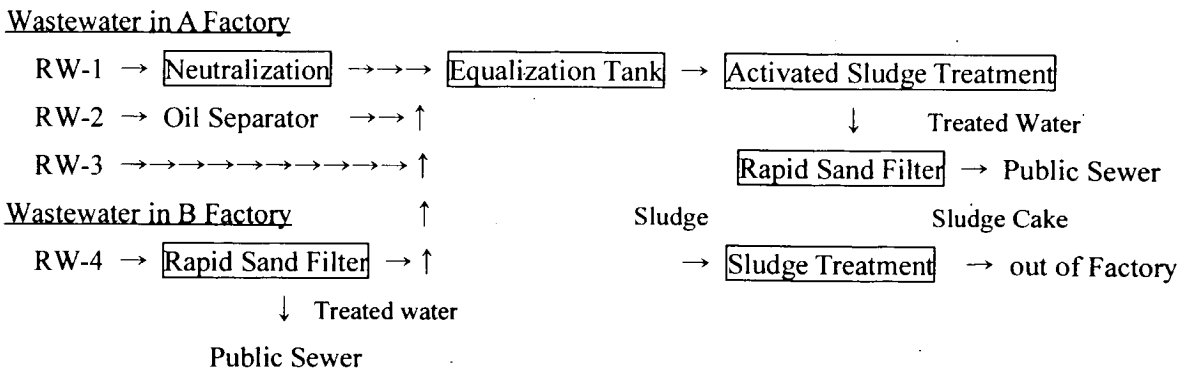


Fig. 9.3-1 Block Flow Diagram for W.W.T.

4) Construction Site

(a) The required area for NO.1 W.W.T. in A Factory: 58mx55m (3,190m^2)

(b) The required area for NO.2 W.W.T. in B Factory: 25mx16m (400m^2)

5) Others of the basic design

- Skeleton Drawings for Major Equipment
- Equipment List, Instrument List, Motor List
- Single Line Diagram for Motor Control Board
- Standard Construction Schedule for Demonstration Plant
- Study Report, Calculation Sheet

6) The Estimated construction cost is as follow:

Table 9.3-2 The Cost Summary of Estimated Construction Cost

Item	Paid in Japan [1000 Yen]	Paid in Egypt [1000 LE]	Total
1. Direct Cost Total	173,000	5,071	
(1)Equipment Procurement	173,000	0	
(2)Field Construction	0	5,071	
2. Indirect Cost Total	28,100	3,349	
Total (1 + 2)	201,400	8,420	
Total [1000 Yen]	201,400	286,300	487,700
Total [1000 LE]	5,923	8,420	14,343

* Exchange Rate 1 LE=34 Yen

7) Maintenance Cost-

Annual maintenance cost is estimated 867,000 LE, and an unit treating cost is 1.74 LE/m^3-wastewater.

(4) Recommendations concerning to W.W.T.

1) Oil Separator for Cooling Water

(a) The level of skimming pipes and outlet weirs should be leveled correctly, and skimmed floating oil layer periodically as routine work.

(b) The oil should be recovered as fuel oil after separation oil from skimmed oily water in a tank which provides newly. And, the remaining water should be treated with other wastewater.

2) Neutralization Unit

(a) The pH indicators and recorders should be replaced and maintained adequately.

(b) The electrodes of pH meters should be washed and calibrated once a week at least.

3) Routine Work

(a) It is possible to evaluate the effectiveness of neutralization by observing appearance of wastewater in the unit. A periodical routine work is required suitably.

(b) The accumulated sludge and floating debris in the sewers should be cleaned as routine work.

4) Others

The waste HCl and the flux discharged from the pickling plant should be taken out by a special recovery trader. Do not dispose them to the wastewater sewer.

9.4 MONSOURA CO. FOR RESINS AND CHREMICALS (MRC)

(1) Outline of Factory

1) MRC factory products phenol resins and wood particulate boards, located in Mansoura city at 125 km north of Cairo city. and 350 employees are working in the factory.
The capital and annual sales amounts are 21 million LE, 15.7 million LE, respectively.

2) Average 300 m^3/d of city water is used as industrial water, and wastewater is discharged to the public sewer (into the wastewater canal at the industrial district).

3) The process plant works at batch operation, and high concentration toxic wastewater (liquid) of phenols and formaldehyde are discharged to the public sewer without any treatment.

(2) Conceptual Design (Omitted in details)

1) 30 m^3/h of process wastewater and sanitary wastewater are selected as for W.W.T. demonstration plant (Candidate). As precede conditions, the following waste liquid should be burnt in an incinerator or boiler.

(a) Formaldehyde Plant Regeneration Waste

(b) Novolak Resin Solid Resin of Phenol Formaldehyde

2) As a result of the conceptual design, MRC Factory had been selected one of 3 representative factories for W.W.T. demonstration plant (Candidate), the basic design was commenced.

3) The Egyptian side pointed out the following comment to the conceptual design:

- Target of treated water should be applied Law 93/62 (discharge to Sewer System), because the most stringent regulation is applied in the conceptual design in spite of treated water will be discharged to the public sewage.

4) The above conditions is specified for W.W.T. demonstration plant on M/M of S/W. But, MRC Factory had not been selected as W.W.T. demonstration factory.

(3) Basic Design

The basic design has been carried out considering the above condition as the recommendable W.W.T. plant except above 2 waste liquid.

1) The wastewater flow rate, quality and the target of water quality are shown as follow:

Table 9.4-1 Wastewater flow rate, quality and target of treated water

	Equalized Wastewater	Treated Water	Regulation Law48/82
Flow rate [m^3/h]	Max. 40 Ave. 30	40 30	-
pH [-]	6 - 7	6 - 9	6 - 9
COD [mg/L]	2,400	30	100
BOD [mg/L]	1,300	20	60
SS [mg/L]	100	1	60
Oil & Grease [mg/L]	20	1	10
phenols [mg/L]	400	0.005	0.005

Note: The target quality of treated water is applied to Law48/82 Non Potable Surface Water (Industrial) considering enforcement of regulation in stead of Law 93/62.

4) Wastewater Treating System is as follow (refer to the attached drawing 9.4-1):

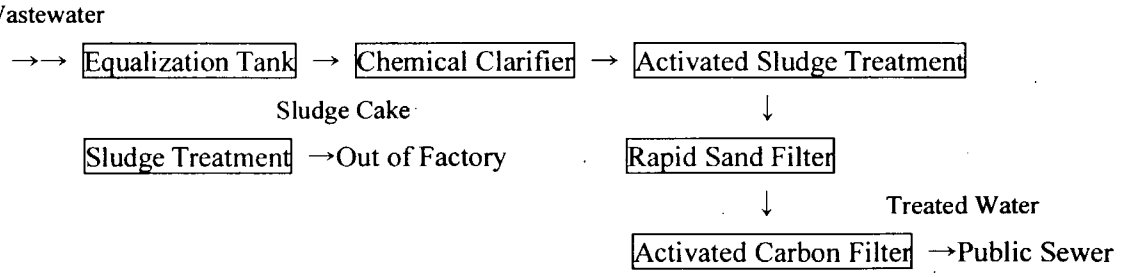


Fig. 9.4-1 Block Flow Diagram for W.W.T.

4) Construction Site

- The required area for W.W.T. recommendable plant: 31mx55m (1,705 m^2)

5) Others of the basic design

- Skeleton Drawings for Major Equipment
- Equipment List, Instrument List, Motor List

- Single Line Diagram for Motor Control Board
- Standard Construction Schedule for Demonstration Plant
- Study Report, Calculation Sheet

6) The Estimated construction cost is as follow:

Table 9.4-2 The Cost Summary of Estimated Construction Cost

Item	Paid in Japan [1000 Yen]	Paid in Egypt [1000 LE]	Total
1. Direct Cost Total	93,901	2,484	
(1)Equipment Procurement	93,901	0	
(2)Field Construction	0	2,484	
2. Indirect Cost Total	23,500	1,704	
Total (1 + 2)	117,401	4,188	
Total [1000 Yen]	117,401	142,400	259,801
Total [1000 LE]	3,453	4,188	7,641

* Exchange Rate 1 LE=34 Yen

7) Maintenance Cost

Annual maintenance cost is estimated 1,273,782 LE, and an unit treating cost is 5.36 LE/m^3-wastewater. About two third (2/3) of maintenance cost is for activated carbon cost.

(4) Recommendations concerning to W.W.T.

1) Phenol should be extracted from waste liquid using solvent, and recovered. Then remaining waste liquid should be burnt by an incinerator or boiler.
2) The accumulated sludge and floating debris in the sewers should be cleaned as routine works.
3) It should be reduced an exhausted steam whole factory to save energy.
4) Air pollution proof equipment should be installed to prevent toxic gases around the reactors.

9.5 EGYPTIAN IRON AND STEEL CO. (EIS)

(1) Outline of Factory

1) EIS Factory is the biggest full-integrated steel manufacturing plant in Egypt, located in the Hewan Industrial District at about 20km south of Cairo city, 19,500 employees are working in the factory.

The capital and annual sales amount are 664.7 million LE, and 1,089 million LE, respectively.

2) Industrial water is taken from Nile River, and almost all water is recycle used for cooling water. Acid rinsing water is discharged to the desert at 10 km far from the factory after neutralization.
3) It is informed that penetrate water from disposed wastewater at Desert impacts to underground water.

(2) Conceptual Design (Omitted in details)

1) The acid wash water from the pickling plant at cold rolling mill plant was selected for the demonstration plant (Candidate), which was requested to treat urgently.

2) Flow rate of acid wash water is 150 m^3/h normally, and waste sulfuric acid is discharged in an emergency only. Therefore, W.W.T. demonstration plant (Candidate) treats by neutralization only acid wash water in design.

(3) Basic Design (Original)

1) Wastewater to be treated

On the way to the development of conceptual design, it was revealed that 40 m^3/d of excess waste acid was discharging during normal operation (3 shift/day) of the pickling plant at present because the existing spent sulfuric acid recovery (SSAR) unit is a lack of treating capacity. Therefore, it is required to discharge it after neutralization. Wastewater to be treated are:

(a) Acid Wash Water

(b) Waste Sulfuric Acid

2) Wastewater flow rate, quality and the target of treated water quality are shown on as follows:

Table 9.5.1 Wastewater flow rate, quality and target of treated water

Item	Acid wash water	Waste sulfuric acid	Regulation Law48/82
Flow rate [m^3/h]	Max. 170 Ave. 150	1.67 (40m^3/d)	-
pH [-]	1 - 2		6 - 9
H_2SO_4 [mg/L]	2,500	30,000	-
$FeSO_4$ [mg/L]	3,500	20,000	-
SS [mg/L]	100	1	20
COD [mg/L]			30
BOD [mg/L]			20
TDS [mg/L]	>5,000	>10,000	800

Note: Regulation shows the most stringent regulation of Law 48/82 Underground Reservoir & Nile Branches /Canals (except TDS).

3) Wastewater treating system is as follow (refer attached drawing 9.5-1 in details):

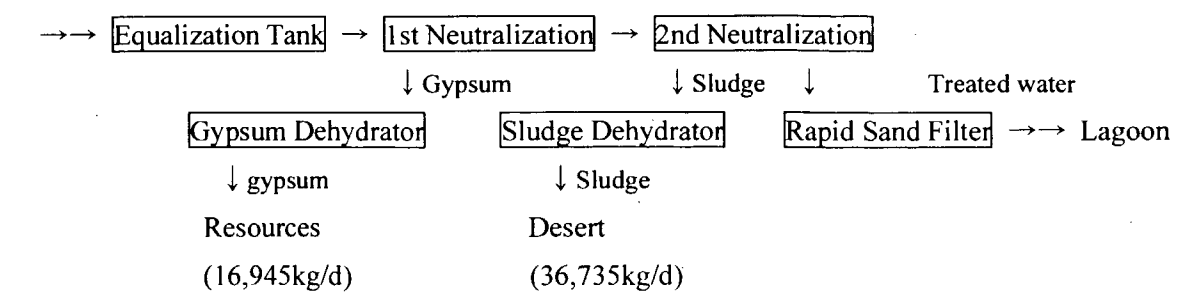


Fig. 9.5-1 Block Flow Diagram for W.W.T.

Recovered gypsum may be used for structure materials, improving agent for soil and etc.

4) Construction Site

The required area for W.W.T. is 50mx70m (3,500m^2).

5) Others of the basic design

- Skeleton Drawings for Major Equipment
- Equipment List, Instrument List, Motor List
- Single Line Diagram for Motor Control Board
- Standard Construction Schedule for Demonstration Plant
- Study Report, Calculation Sheet

6) The Estimated construction cost is as follow:

Table 9.5-2 The Cost Summary of Estimated Construction Cost

Item	Paid in Japan [1000 Yen]	Paid in Egypt [1000 LE]	Total
1. Direct Cost Total	244,000	7,690	
(1)Equipment Procurement	235,000	0	
(2)Field Construction	9,000	7,690	
2. Indirect Cost Total	40,000	4,474	
Total (1 + 2)	284,000	12,164	
Total [1000 Yen]	284,000	413,600	697,600
Total [1000 LE]	8,353	12,164	20,517

* Exchange Rate 1 LE=34 Yen

7) Maintenance Cost

Annual maintenance cost, unit cost are estimated 3,545,516 LE, 2.635 LE/m^3-wastewater, respectively. About 72 % of maintenance cost is for chemical cost.

(4) Basic Design (Modified)

1) Preceding conditions

The phase 2 (Implementation of Demonstration Plant) has suspended due to not to satisfy "the conditions of introducing demonstration plant" in addition to the lack of Japanese budget.

But, the basic design was proceeded under the following conditions as the modified case:

(a) The SSAR unit should be improved adequately.

(b) The new W.W.T. should not treat spent sulfuric acid in any emergency case.

2) Additional Wastewater Survey

In order to confirm the design conditions of the basic design (Original), wastewater survey (flow rate, quality and operating conditions) was carried out trough 3-day and night.

The survey results are very different from the design conditions used in the conceptual design and basic design (Original)

3) Wastewater to be treated

(a) Rinsing water (same as acid wash water in the former)

(b) Leakage water (newly)

Leakage water flows trough in the wastewater pipe trench, may come from leakage of acid wastewater pipes and pickling and rinsing bathes, but not be clear.

4) The wastewater flow rate, quality and the target of treated water are shown on Table 9.5-3.

Table 9.5-3 Wastewater flow rate, quality and target of treated water

Item	Rinsing Water + Leakage Water		Regulations Law48/82
	Flow rate Max.	Concentration Max.	
Flow rate [m^3/h]	90	40	-
pH [-]	0.5 - 2	0.5 – 1.0	6 - 9
H_2SO_4 [mg/L]	4,300	9,500	-
$FeSO_4$ [mg/L]	4,300	9,500	-
SS [mg/L]	100	1	20
COD [mg/L]	-	-	30
BOD [mg/L]	-	-	20
TDS [mg/L]	>2,000	>5,000	800

Note 1: The above regulation shows the most stringent discharge regulations of Law48/82 Underground Reservoir & Nile Branches / Canals(except TDS).

Note 2: The above Max. flow rate is assumed about 2 times of actual measured flow rate. That is the reasons why the existing aged water supply system (pump and piping) will be improved in the near future. But, amount of H_2SO_4 will not change.

5) Wastewater treating system is shown as follow (refer to the attached drawing 9.6-1):

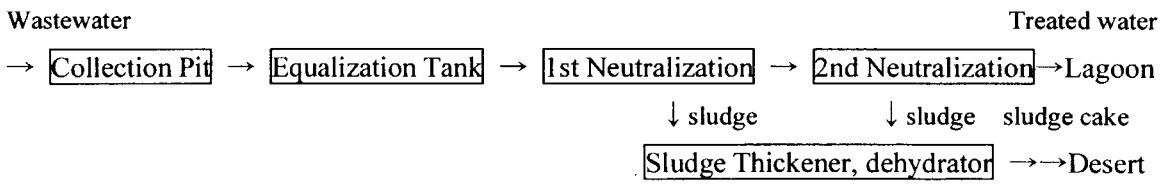


Fig. 9-5-2 Block Flow Diagram for W.W.T.

6) Construction Site

The required area for W.W.T. recommendable plant: 38mx48m (1,824 m^2)

7) Others of the basic design

Same as the basic design (Original)

8) The Estimated construction cost is shown on Table 9.5-4.

9) Maintenance Cost

Annual maintenance cost is estimated 1,701,311 LE, and unit treating cost is 2.38 LE/m^3-wastewater.

Table 9.5-4 The Cost Summary of Estimated Construction Cost

Item	Paid in Japan [1000 Yen]	Paid in Egypt [1000 LE]	Total [1000 LE]
1. Direct Cost Total	209,270	4,942	12,061
(1)Equipment Procurement	209,270	0	6,115
(2)Field Construction	0	4,942	5,906
2. Indirect Cost Total	29,500	3,290	3,930
Total (1 + 2)	238,770	8,232	15,991
Total [1000 Yen]	238,770	279,900	
	543,670		

* Exchange Rate 1 LE=34 Yen

(4) Recommendations concerning to W.W.T.

1) Pickling and Rinsing Plant

(a) Replacement or renewal of aged and corroded equipment, piping and instruments

(b) Installation of indicators (pH, level, flow, pressure and temperature, etc.)

(c) Revamping or increasing capacity of SSAR unit

2) Operation and Management

(a) Establishment and implementation of W.W.T. management organization

(b) Preparation and accomplishment of an operation manual

(c) Adequate maintenance and supplement of spare parts and consumables

(d) Control adequate water and steam consumption, and save them as possible.

(e) Cleaning, arrangement around working places

(f) Execution of safety education

(5) Recommendations concerning to Process Plant

It may be expected to increase productivity, quality and improvement of operational management consciousness by execution of the followings:

1) Increasing capacity of SSAR unit

2) Repairing of the sealing parts of pickling and rinsing bathes

3) Changing to indirect heating of sulfuric acid in the pickling bathes

(6) Discussions

1) Leakage water

(a) Leakage water is strong acid, it may come from aged wastewater pipes and bathes. Therefore, even if SSAR unit is renewed or improved, it does not eliminate any leakage water. H_2SO_4 concentration of leakage water is 43,600 mg/L, about 10 times of rinsing water. So that, it is possible to decrease the construction cost, running cost of W.W.T by eliminating and/or decreasing of leakage water.

(b) It is possible to recover H_2SO_4 from leakage water in the SSAR unit not to neutralize it.

But, H_2SO_4 concentration of spent sulfuric acid to be recovered H_2SO_4 is 12-16%. On the other hand, H_2SO_4 concentration of leakage water is only 4.36%, too low. Therefore, recovery of H_2SO_4 from leakage water is not economical.

2) Recovery of Gypsum

(a) The gypsum recovery system was applied in the basic design (Original), and not applied in the basic design (Modified). It is the reason why a production amount of gypsum in the basic design (Modified) may decrease because H_2SO_4 concentration in the wastewater decreases comparing to the basic design (Original). Therefore, it may be not valuable to provide a gypsum recovering system in W.W.T.

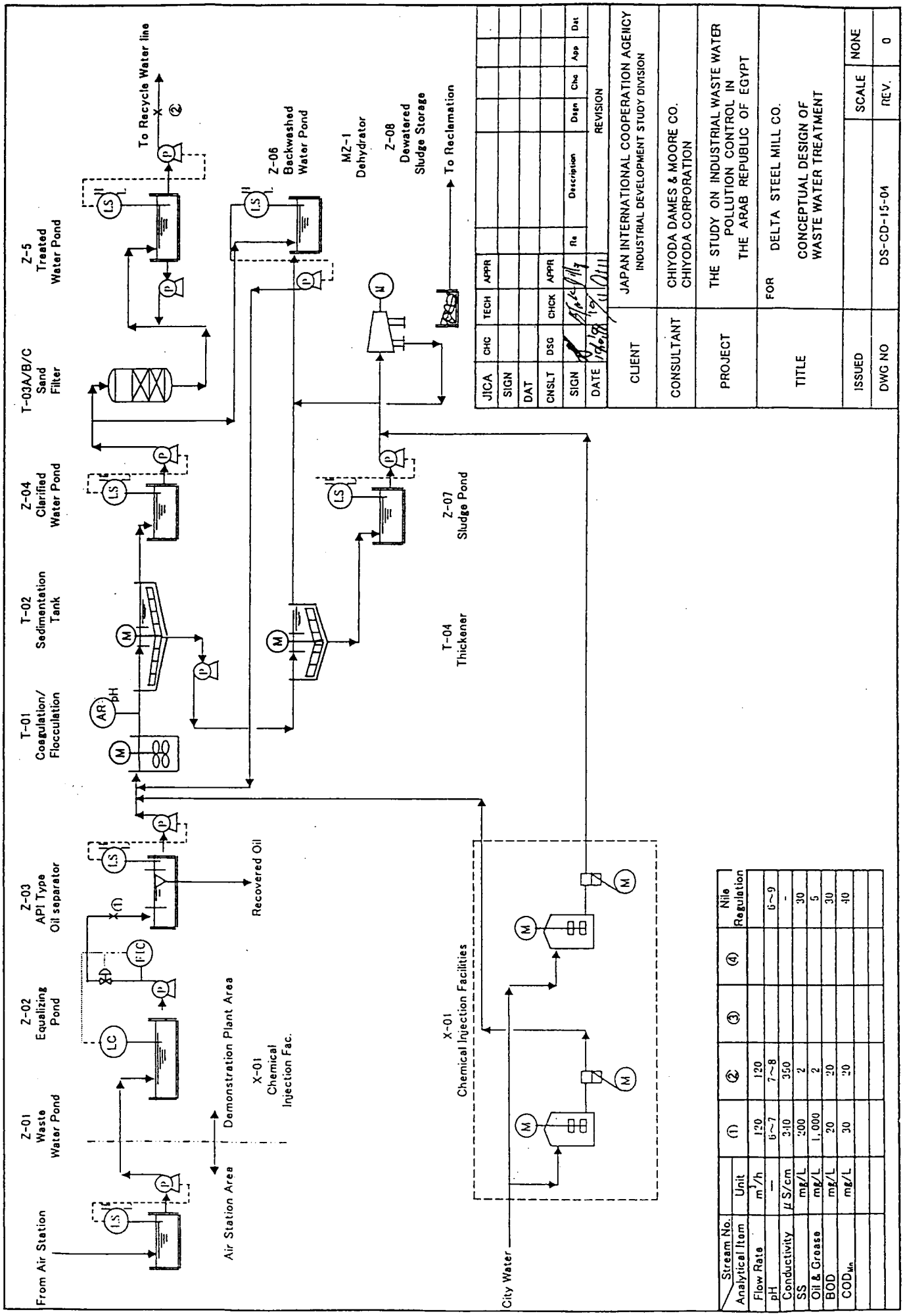
(b) In the basic design (Modified), a sedimentation basin (tank) is not provided at 1st neutralization (pH 3-4). Sludge mixed gypsum and ferric hydro-oxide is discharged from the sedimentation tank at 2nd neutralization (pH 8.5-9), thickened by the sludge thickener and dehydrated by the centrifuges.

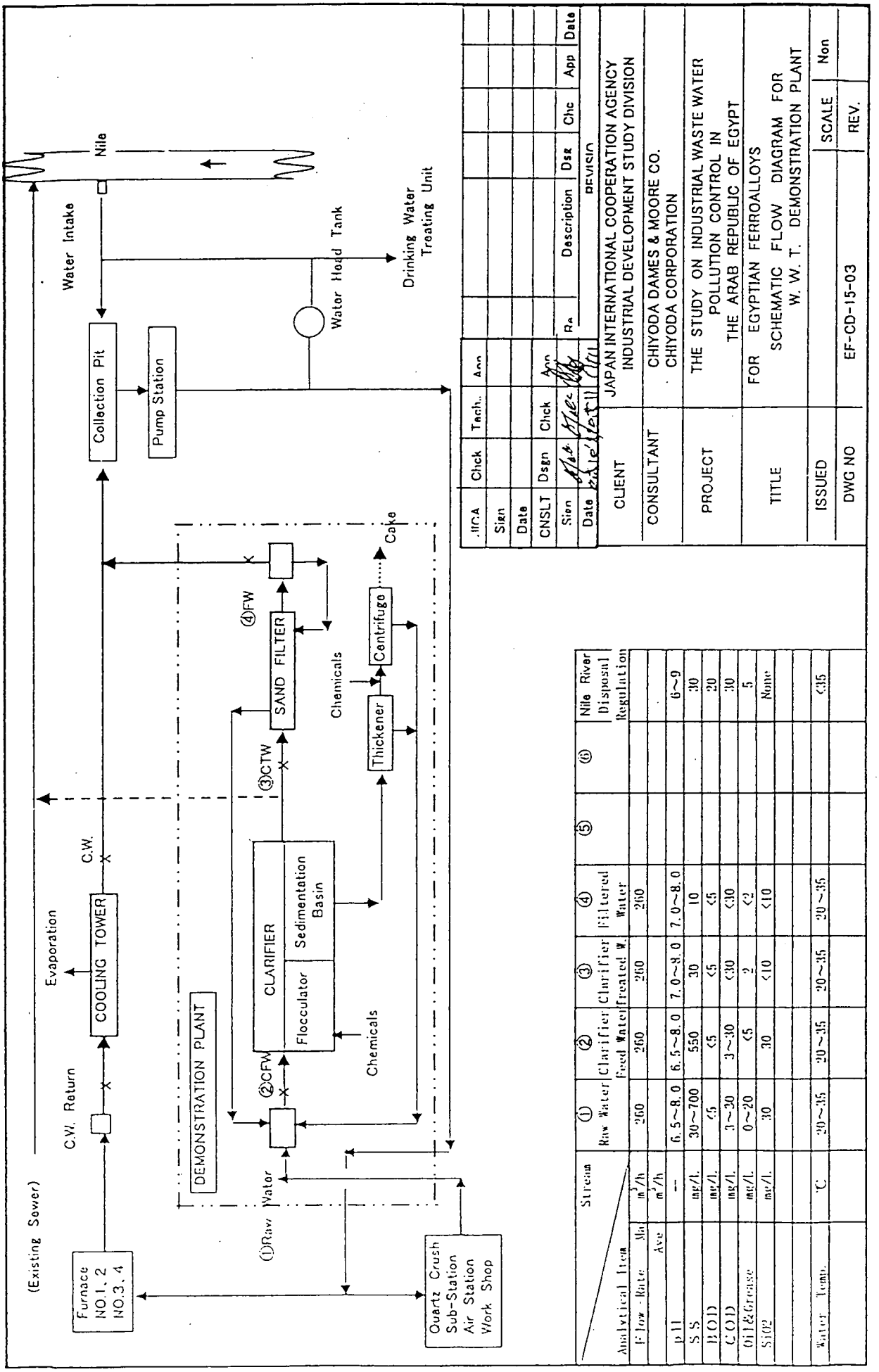
Sludge cake is disposed by a dump truck to the desert under management.

3) Total Dissolved Solids (TDS)

The solubility of gypsum ($CaSO_4$) produced at neutralization is around 2,000 mg/L in normal conditions. TDS limitation of specified by Wastewater Discharge Regulations in Egypt is less than 2,000mg/L.

There are many industries to use strong acid and/or strong alkali liquid. Even if such wastewater is neutralized at pH 6-9, TDS regulation can not be satisfied. That is the problem for all factories using strong acid and alkali liquid.

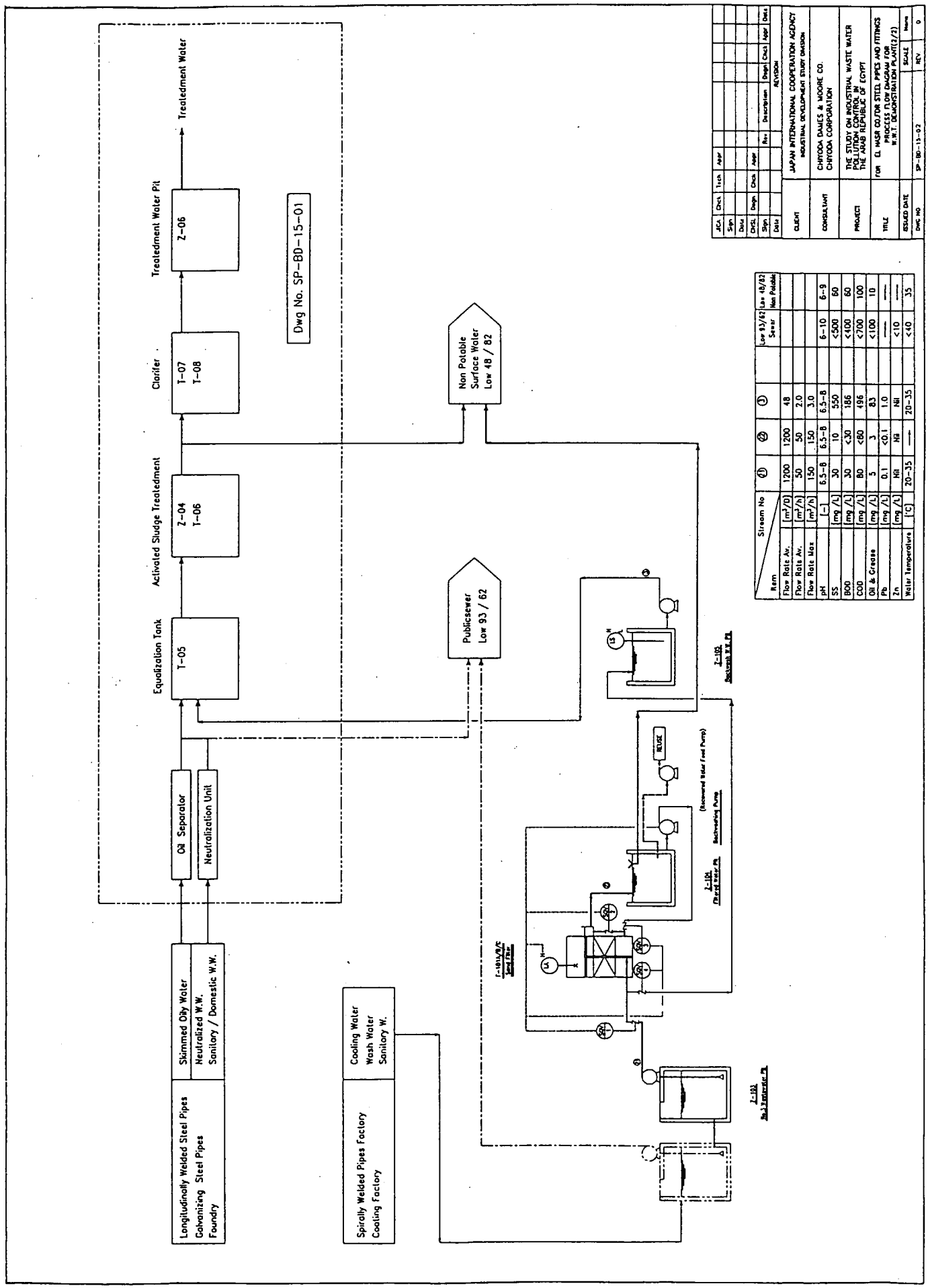

From Air Station
Z-01 Waste Water Pond
Z-02 Equalizing Pond
Z-03 API Type Oil separator
Recovered Oil
T-01 Coagulation/ Flocculation
T-02 Sedimentation Tank
Z-04 Clarified Water Pond
T-03A/B/C Sand Filter
Z-5 Treated Water Pond
To Recycle Water line
Z-06 Backwashed Water Pond
MZ-1 Dehydrator
Z-08 Dewatered Sludge Storage
To Reclamation
T-04 Thickener
Z-07 Sludge Pond
Air Station Area
Demonstration Plant Area
X-01 Chemical Injection Fac.
X-01 Chemical Injection Facilities
City Water
JICA
CLIENT
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT
CHIYODA DAMES & MOORE CO.
CHIYODA CORPORATION
PROJECT
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE
FOR DELTA STEEL MILL CO.
CONCEPTUAL DESIGN OF WASTE WATER TREATMENT
ISSUED
SCALE NONE
DWG NO DS-CD-15-04
REV. 0
REVISION
Stream No. / Analytical Item
Flow Rate
pH
Conductivity
SS
Oil & Grease
BOD
COD Mn
Nile Regulation

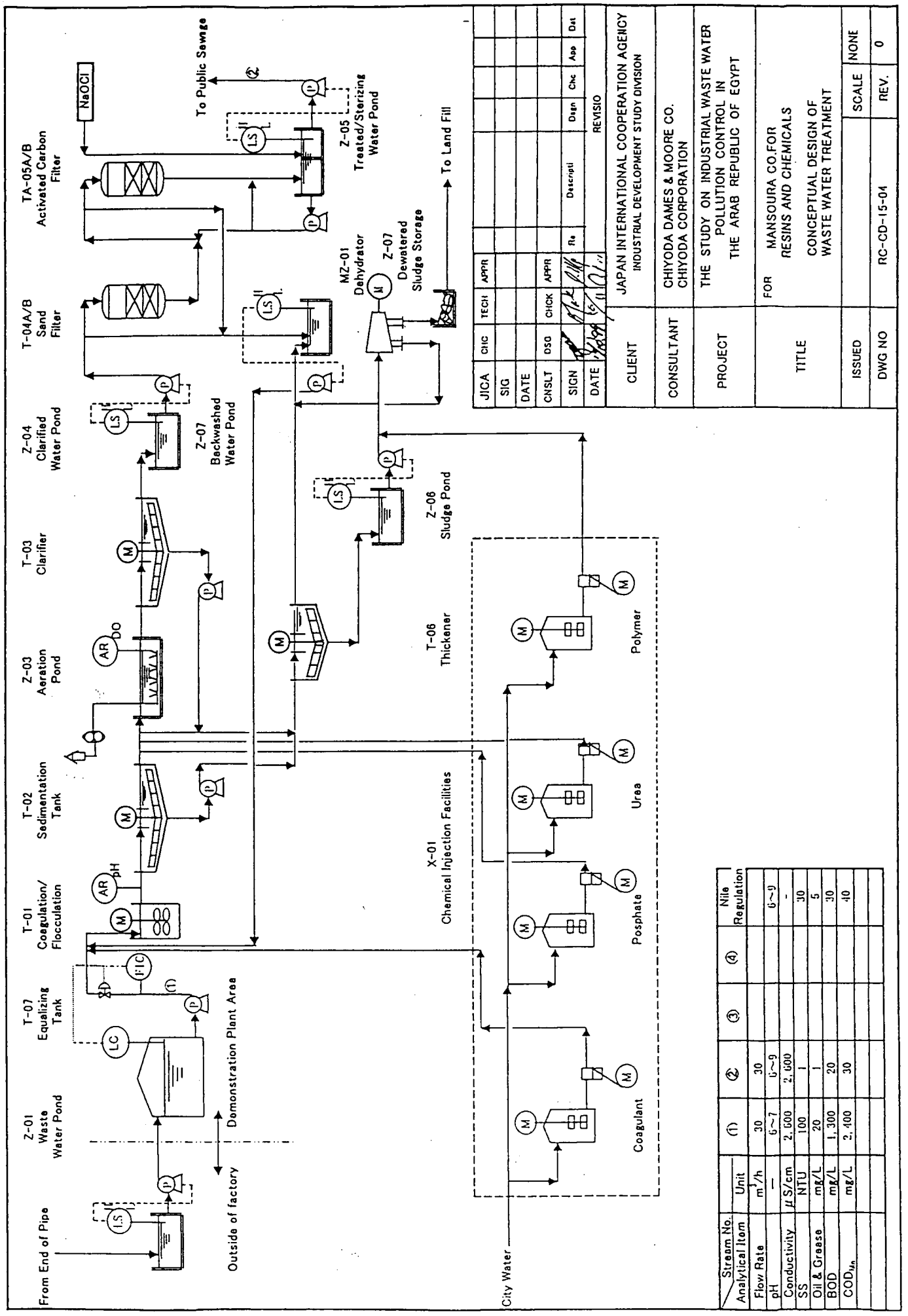


Stream / Analytical Item			① Raw Water	② Clarifier Feed Water	③ Clarifier Treated W.	④ Filtered Water	⑤	⑥	Nile River Disposal Regulation
Flow Rate	Max	m³/h	260	260	260	260			
	Ave	m³/h							
pH		—	6.5~8.0	6.5~8.0	7.0~8.0	7.0~8.0			6~9
S.S		mg/l	30~700	550	30	10			30
BOD		mg/l	<5	<5	<5	<5			20
COD		mg/l	3~30	3~30	<30	<30			30
Oil & Grease		mg/l	0~20	<5	2	<2			5
SiO2		mg/l	30	30	<10	<10			None
Water Temp.		℃	20~35	20~35	20~35	20~35			<35

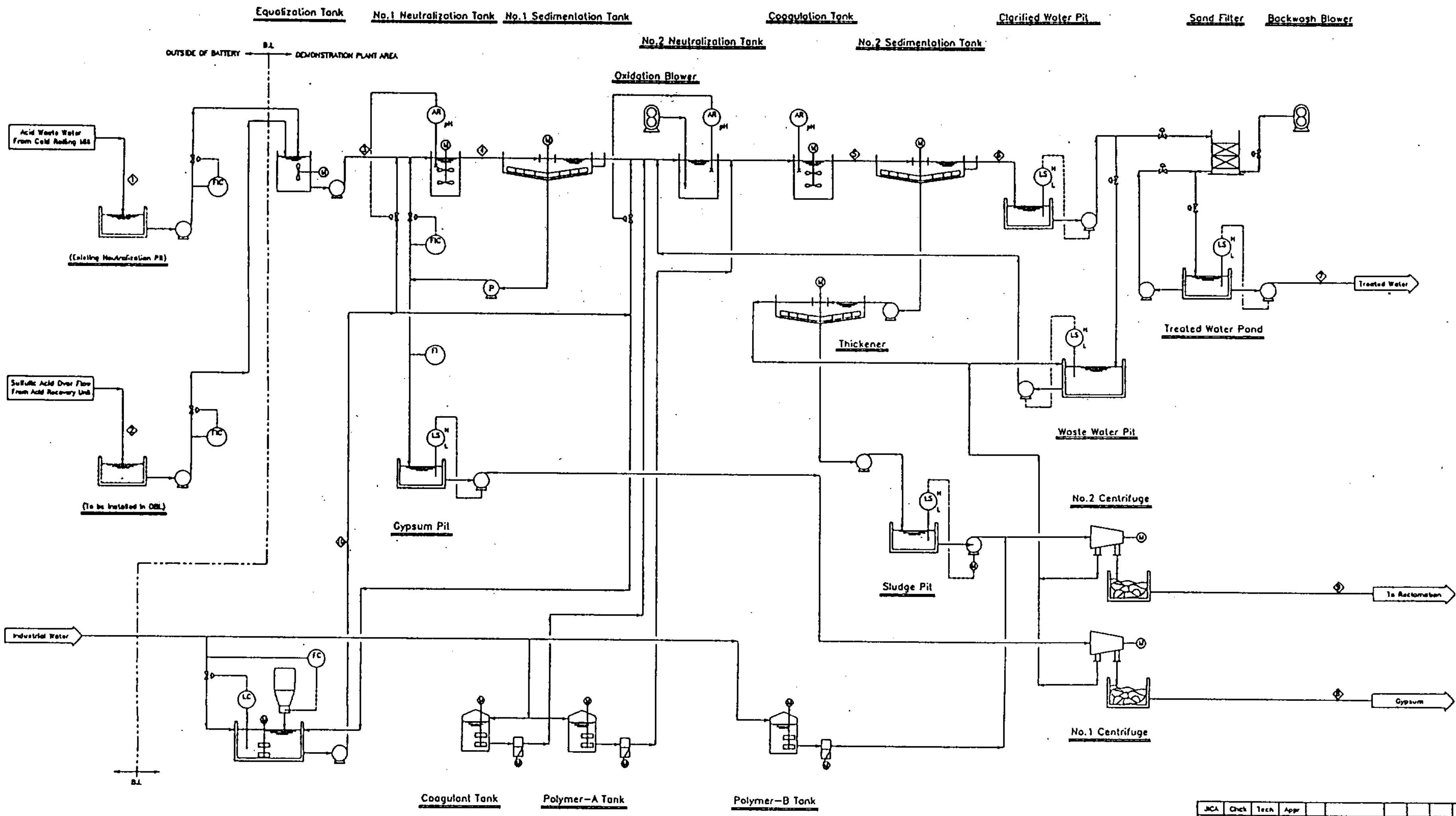
JICA	Chck	Tech.	Apv						
Sign									
Date									
CNSLT	Dsgn	Chck	Apv						
Sign									
Date				No.	Description	Dsg	Chc	App	Date
					REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN FERROALLOYS SCHEMATIC FLOW DIAGRAM FOR W. W. T. DEMONSTRATION PLANT
ISSUED	SCALE: Non
DWG NO	EF-CD-15-03 REV.


Longitudinally Welded Steel Pipes
Galvanizing Steel Pipes
Foundry
Skimmed Oily Water
Neutralized W.W.
Sanitary / Domestic W.W.
Spirally Welded Pipes Factory
Cooling Factory
Cooling Water
Wash Water
Sanitary W.
Oil Separator
Neutralization Unit
Equalization Tank
T-05
Activated Sludge Treatement
Z-04
T-06
Clarifer
T-07
T-08
Treatedment Water Pit
Z-06
Treatedment Water
Dwg No. SP-BD-15-01
Publicsewer
Low 93 / 62
Non Potable
Surface Water
Low 48 / 82
Stream No
Item
Flow Rate Av.
Flow Rate Av.
Flow Rate Max
pH
SS
BOD
COD
Oil & Grease
Pb
Zn
Water Temperature
Low 93/62 Sewer
Low 48/82 Non Potable
6-10
6-9
<500
60
<400
60
<700
100
<100
10
<10
35
20-35
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CHIYODA DAVIES & MOORE CO.
CHIYODA CORPORATION
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
FOR EL NASR CO.FOR STEEL PIPES AND FITTINGS
PROCESS FLOW DIAGRAM FOR W.W.T. DEMONSTRATION PLANT(1/2)
SP-BD-15-02



Stream No. / Analytical Item	Unit	①	②	③	④	Nile Regulation
Flow Rate	m^3/h	30	30			
pH	—	6~7	6~9			6~9
Conductivity	μS/cm	2,600	2,600			-
SS	NTU	100	1			30
Oil & Grease	mg/L	20	1			5
BOD	mg/L	1,300	20			30
COD_{Mn}	mg/L	2,400	30			40

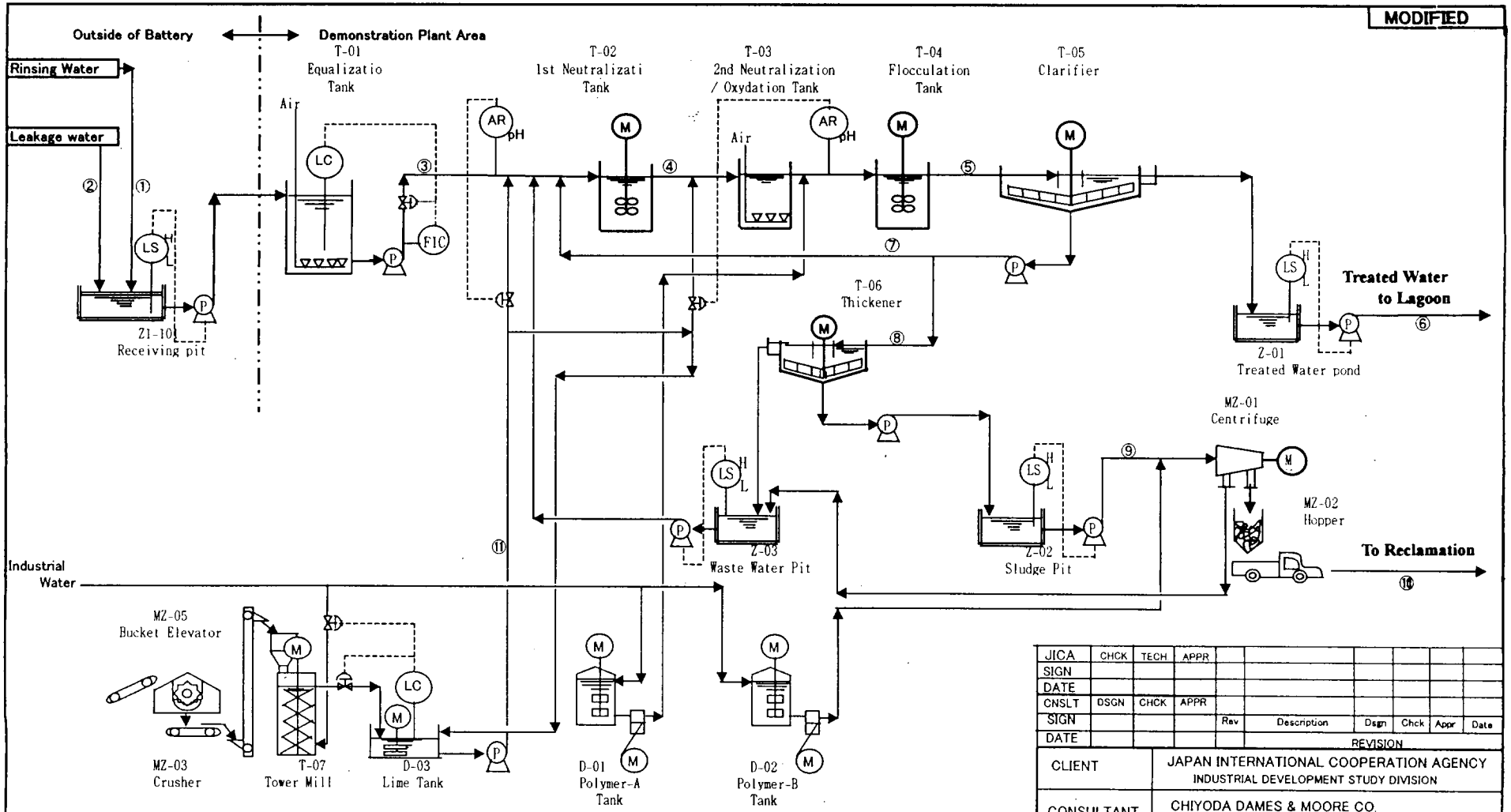


Item \ Stream No		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	Nile Branch Regulation
Flow rate Ave.	(m³/h)	150	1.67	151.67	182.07	225.48	159.17	151.21	1.18	7.65	8.37	—
Flow rate Max.	(m³/h)	170	40(m³/D)	171.67	182.07	246.53	180.22	171.21	2.36	7.65	8.37	6~9
pH	(s/cm)	0~2	0~2	0~2	4	7	7	7	4	7		—
SS	(mg /L)								600000	200000		30
Oil & Grease	(mg /L)	<5	<5					<5				5
BOD	(mg /L)	<20	<20					<20				20
COD	(mg /L)	<30	<30					<30				30
TDS	(mg /L)	4000	18000					>2000				800
											10% Ca(OH)₂ Slurry	

JICA	Chck	Tech	Appr						
Sign									
Date									
CNSL	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date					REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. PROCESS FLOW DIAGRAM OF W.W.T. DEMONSTRATION PLANT
ISSUED DATE	SCALE: None
DWG NO	IS-DG-13-01 — REV. 0

MODIFIED

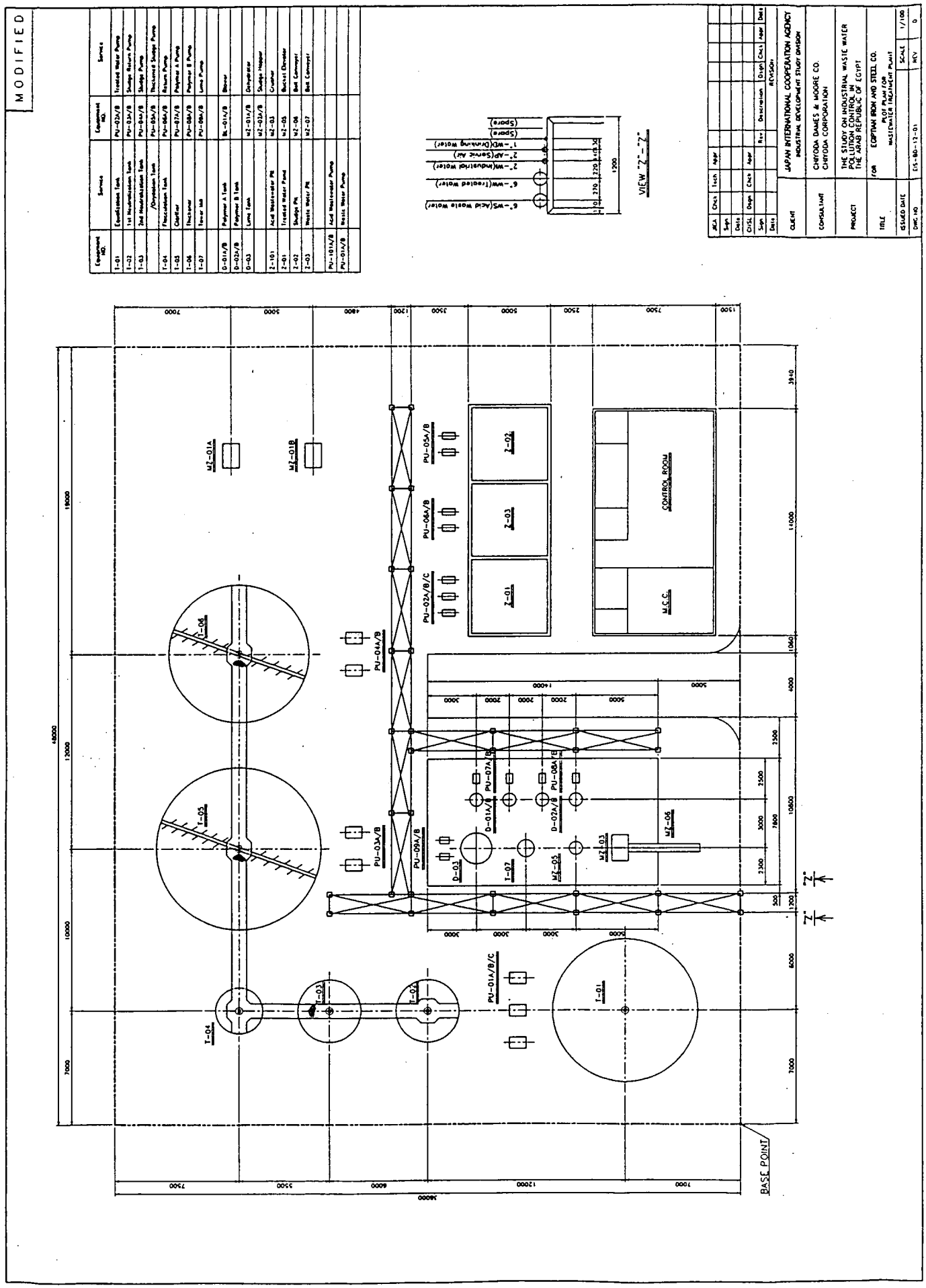


Stream No. / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	Law48/82 Regulation
Flow Rate(Max)	m^3/h	80	10	90	113	115	91	4	24	15	4 ton/h	5	-
Flow Rate(Nor)	m^3/h	35	5	40	63	65	41	4	24	15	4 ton/h	5	-
pH	—	0.5 - 2		0.5-2.0	4.0-5.0	8-8.5	8-8.5	8-8.5	8-8.5	8-8.5	8-8.5	-	6~9
H_2SO_4	mg/L	2,025	21,800	4,300	≒ 0	≒ 0	≒ 0	-	-	-	-	-	-
$FeSO_4$	mg/L	2,025	21,800	4,300	4,300	≒ 0	≒ 0	-	-	-	-	-	-
$CaSO_4 \cdot 2H_2O$	mg/L	-	-	-	6,000	9,700	2,000	38,750	38,750	62,000	930 kg/h	-	-
$Fe(OH)_3$	mg/L	-	-	-	-	2,400	≒ 0	11,250	11,250	18,000	270 kg/h	-	-
$Ca(OH)_2$	mg/L	-	-	-	-	-	-	-	-	-	-	100,000	-
SS	mg/L			-	4,000	10,100	<30	50,000	50,000	80,000	30 wt%	-	30

JICA	CHCK	TECH	APPR						
SIGN									
DATE									
CNSLT	DSGN	CHCK	APPR						
SIGN				Rev	Description	Dsgn	Chck	Appr	Date
DATE				REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. PROCESS FLOW DIAGRAM OF WASTEWATER TREATMENT PLANT (without Spent Sulfuric Acid)
ISSUED DATE	SCALE
DWG NO	EIS-BD-15-01 REV.

Attached Figure 9.5-9


MODIFIED
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CHIYODA DAMES & MOORE CO.
CHIYODA CORPORATION
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
FOR EGYPTIAN IRON AND STEEL CO.
PLOT PLAN FOR WASTEWATER TREATMENT PLANT
CLIENT
CONSULTANT
PROJECT
TITLE
ISSUED DATE
DWG. NO
SCALE 1/100
REVISION
Description
Equalization Tank
1st Neutralization Tank
2nd Neutralization Tank
Flocculation Tank
Clarifier
Thickener
Town Tank
Polymer A Tank
Polymer B Tank
Lime Tank
Acid Wastewater Pit
Treated Water Pond
Sludge Pit
Waste Water Pit
Acid Wastewater Pump
Basic Water Pump
Treated Water Pump
Sludge Return Pump
Sludge Pump
Thickened Sludge Pump
Return Pump
Polymer A Pump
Polymer B Pump
Lime Pump
Blower
Dehydrator
Sludge Hopper
Crusher
Bucket Elevator
Belt Conveyor
Belt Conveyor
CONTROL ROOM
M.C.C.
BASE POINT
VIEW "Z"-"Z"

10.0 Survey Results on Current Pickling Line and Waste Acid Regeneration System in EIS and Proposal for Improvement

In this chapter, the survey results on current pickling line and waste acid regeneration system in Egyptian Iron and Steel Co.(EIS) and proposal for improvement are described.

Contents of description are as follows;

(1) Analysis of current situation on operation and equipment of Pickling Line

(2) Analysis of current situation on operation and equipment of Acid Recovery System

(3) Analysis of current situation from acid concentration

(4) Comments on the EIS's plan for revamping of Acid Recovery System

(5) Recommendation for improvements on operation and equipment of current Pickling Line and Acid Recovery System

In this description,

(a). Indirect liquor heating system

(b). Brain type Acid Recovery System are included.

10.1 Results of field survey

The Pickling Line in EIS is old styled H_2SO_4 system, and involving many issues such as problem on products quality, law reliability of operation and problem on treatment of waste water and acid. For the radical modernization of process, revamping of the pickling Line with HCl system should be required, but in this report we describe the analysis of existing line and recommendation that can be adopted.

10.1.1 Analysis of current situation and Recommendation for Pickling Line (including Rising Unit)

Item	Issue	Current Situation→Recommendation
1.Operatopn Management	a. Acid Concentration Control	・ Acid analysis : 1time/shift→More than 2times/shift ・ Liquor Supply:Inadequate concentration due to batch and non-feed control operation.→Feed control by inverter control of the supply pump..
	b. Acid Temperature Control	・ Temperature Control : Non quantitative control without thermometer. Unstable steam pressure is one of the cause. →Execution of quantitative control by installation of instrumentation.

Item	Issue	Current Situation→Recommendation
	c. Pickling Operation	· Threading Speed Control : No installation of speed meter, so, no quantitative operation control for 3 essential parameters of "Concentration" "Temperature" "Pickling Time" →Execution of quantitative control by installation of instrumentation. · Dart of acid by re-pickling of oiled coil→Inspection of coil at pickling delivery
	d. Operation at Line Stop	· Utility Control : No utility(Water、Air、Warmed air) Stop at line stop invites big energy loss.→Making the proper operation manual and execution.
	e. Deviation of Pickling Cascade	· Deviation from designed figure causes decrease of pickling efficiency. · Flow Rate of Spent Acid:Current value is twice of designed figure of $5m^3/Hr.$→Expected to be caused by item a～d, so, creation of operation manual and execution are required.
	f. Side Water	· Flow rate control : Water volume to be neutralized is increased due to no control and much consumption. →Adequate consumption control of side water.
2.Equipment Management	a. Acid Heating Method	· Acid leaning and increase of acid treatment volume due to direct steam injection method. This causes quality problems of sheet as well.(**Very serious issue**) →Improvement to in-direct heating system
	b. Wringer Roll	· Mechanism · Maintenance : Inadequate function due to improper mechanism and poor maintenance invites much amount of acid carry over into rising tank. This is the cause of increase of neutralize load and acid consumption.→Double raw of wringer roll and improvement of roll gap adjustment mechanism. Installation of air blow is effective as well.
	c. Acid Over Flow Pipe	· Closer location to steam injection pipe and no-flow control valve invites much over flow of acid by meniscus waving. →Control of over flow rate by installation of flow control valve and change its location.
	d. Dryer	· Too much dryer air blowing. →Adjustment according to the coil surface condition
	e. Main Steam Piping	· Huge amount of steam is wasted due to no drain trap.(Serious situation)→Save energy by installation of drain trap and insulation for piping.

10.1.2 Analysis of current situation of existing Spent Sulfuric Acid Recovery Unit(SSARU)

Item	Issue	Current Situation→Recommendation
1. Operation Management	a. Low Operation Availability of SSARU	· Expected cause : Unstable supply steam pressure, Old system of SSARU, Insufficient maintenance.→ Investigation of steam balance in the Works and elimination of un-useful consumption. Establishment of maintenance manual/procedure.
	b. Decrease of Reaction Efficiency	· Decrease of crystallization due to cooling efficiency of the #20-#31 reactor.(Water injection into the reactor to keep meniscus induces decrease of efficiency) → Countermeasure for decrease of vacuum generation(maintenance for ejector, keep steam pressure)
	c. Issue of the Mother Liquor Make Up	· Unstable concentration : Unstable flow rate control for recovered acid and new acid on make up.→ Concentration control by flow rate control into reactor tank #30.
	d. Control of Steam Ejector	· Un-matching between Fe_2SO_4 concentration and crystallization temperature is occurred due to improper control of steam flow rate and pressure for steam ejector.
	e. Higher Temperature of Cooling Water	· Low cooling efficiency due to 29℃ of high temperature of cooling water. → Investigation of circulation water balance and proper usage. Capability of circulation water cooler shall be checked.
	f. Acid Leakage into Circulation Water	· Acid leakage into circulation water is expected because 50ppm of Fe^{+}, and lowering of PH were observed.→Leakage from ejector will be expected, so, operation condition shall be reviewed.
	g. Disadvantage of on-off Operation	· On-off operation is executed frequently for thermal-fluid plant and this invites unstable and low efficient operation. → Cause of operational stop and countermeasure shall be investigated. (Cause on operation and equipment)
2. Equipment Management	a. Inadequate Maintenance	· Main cause for low efficiency of operation : Scale clogging in the condenser tube, Poor sealing of SSARU, Lowering of steam ejector function, Lowering of reactor tanks and so on.→Reestablishment of maintenance manual and procedure. (Inadequate maintenance activity is common issue in all of EIS)
	b. Lack of Instrumentation	· Lack of instrumentation on each reactors and tanks causes non quantitative operation.→Installation of required instrumentation and execution of quantitative operation.

10.1.3 Analysis of current situation from the point of waste acid concentration:

Item	Issue	Current Situation→Recommendation
1. Rinse Water	a. Supply Water; H_2SO_4:20mg/l, $FeSO_4$:6mg/l	· Existence of H_2SO_4 and $FeSO_4$ means existence of corrosive components on the strips, and these situation cannot be allowable. → Change wash water source from re-circulation water to fresh water in recommendable.
	b. Return Water; H_2SO_4:0.33% $FeSO_4$:0.17%	· Concentration of H_2SO_4 and $FeSO_4$ are high. (Recommendable level=$H_2SO_4 \leqq 0.1\%$,$FeSO_4 \leqq 0.01\%$) This seems wash water volume is insufficient. →Recommendable flow rate is 100～150m^3/Hr
2. Waste Acid	a. Waste Acid; H_2SO_4:12-20% $FeSO_4$:1.4-13%	· Higher H_2SO_4, lower $FeSO_4$ and large deflection of return acid flow rate cause unstable operation and poor quality of strip→Improvement to indirect heating system and control of return flow rate of waste acid.
3. Leakage Water	a. Leakage Water; H_2SO_4:2-7% $FeSO_4$:0.6-4%	· Due to dilution by side water, deflection of concentration and flow rate seems to be unavoidable, but concentration of H_2SO_4 and $FeSO_4$ are high.→Study to treat by SSARU.
4. Mother Liquor	a. Mother Liquor; H_2SO_4:25.4% $FeSO_4$:2.6%	· Almost designed figure→Stable concentration control of H_2SO_4 and $FeSO_4$ in the pickling tank and return flow rate control can be obtained by meniscus control of pickling tank and supply control. Waste acid flow rate ;18 m^3 / Hr of current→12 m^3 / Hr of revised

10.2 Comments on existing EIS's study for Acid Recovery System

Item	Comment
1.Desigh Specification	No quantitative specification is described, so, technical evaluation is difficult.
2.Material Balance	No description of material balance. New acid consumption and recovery rate of acid shall be guaranteed at least.
3.Flexibility of capacity	Flexibility for deviation of flow rate and concentration of returned acid is not clear. It is quite important issue under direct heating system.
4.Acid leakage into water	There are some possibility of H_2SO_4/$FeSO_4$ leakage into condenser water from ejector.
5.Capability down	There are some possibility to decrease the vacuum level by crystal clogging on the steam jet(D1-D4)
6.Skill for operation	Operation skill is required by unstableness of vacuum and concentration at start point.
7.Influence of Steam pressure	Deviation of vacuum is directly influenced by steam pressure and easily to decrease the capability.
8.System flow	System flow is complicated and don't suit to operation and maintenance.

10.3 Recommendation for improvement of the plant :

10.3.1 Study for Indirect Heating System of Pickling Tank

Item	A: Outer Heat Exchanger Type	B : Inner Heat Exchanger Type	Note
Device Type	Outer type by carbon tube	Inner type by Teflon tube	
Device Cost	55,000,000	70,000,000	Japanese ¥
Maintenance	Easy check & parts change	Strip guard is necessary	
Installation	Line stop=1 day	Line stop=10 days	
Temp.Uniformity	Uniform temp. by circulation	Lower temp at center area	
Leakage Check	By visual and pressure	Check is done at line stop	
Running Cost	Power for pump is consumed	Power for pump is not necessary	
Total Evaluation	More Recommendable	Base	

10.3.2 Study for improvement of Spent Sulfuric Acid Recovery Unit(SSARU)

Note : ◎ : Best, ○ : Better, △ : Base, DH:Direct Heat, IDH:In Direct Heat

Item		Case - A	Case - B	Case - C	Case - D
Method		SSARU repair + IDH	Additional 1x SSARU&DH	EIS's Plan & DH	Brain type + IDH
Picklin g Line	Strip Quality	◎	△	△	◎
	Spent Acid Volume	◎	△	△	◎
	Concentration Deflection	◎	△	△	◎
	New Acid Consumption	◎	△	△	◎
	Maintainability	○	◎	◎	○
	Running Cost	○	○	○	○
	System Cost	△	○	○	△
SSARU	Cooling Method	Evaporation	Evaporation	Evaporation	Evaporation + Brain
	Capability	All	Not All	Not All	All
	Quality of Crystal	○	○	○	○
	Maintainability	○	○	○	◎
	Running Cost	○	○	○	○
	System Cost	◎	○	△	○
Total Evaluat ion	Evaluation	◎	○	△	◎
	Priority	2	3	4	1

11.0 Recommendations on Environmental Management Policy of Egypt

In this chapter, the water quality control administration in Japan, especially the history of fighting with the pollution problems caused by industrial wastewater is reviewed, with aim of discussing both suitable administration systems and effective measures for water pollution control in Egypt.

11.1 Current Status and Problems of Industrial Water Pollution Control in Egypt

The purpose of this section is as follows:

a. To describe the current situation,
b. To discuss problems faced by the administrative and industrial sectors of Egypt relating to industrial wastewater control, and
c. To provide a comparison to the key wastewater control issues in Japan.

11.1.1 Problems in Administrative Sector

(1) Ambient Water Quality Standards

Ambient water quality standards of Egypt are legislated in Law No. 48/1982. The standards are classified into two categories: non-potable and potable surface water. However, the standards are not set for each category of water use purposes such as fishery, agriculture and industry. Accordingly, it is recommended to set ambient water quality standards in Egypt for each categorized water area by introduction of a similar system to that of Japan.

(2) Regulation of Industrial Effluent

In Egypt water area is divided into coastal area, sewer system, branches of the Nile River, mainstream of the Nile River and other area, and a different effluent standard is applied to each area. In this classification, the purpose of water uses in each water area and type of industry are not considered. Although the effluent standard of Egypt applied to the Nile River is more stringent than Japanese effluent standard, judging from the results of the studies, it must be mentioned that many factories in Egypt are not following the regulation.

(3) Administrative Organization

1) Unification of Environmental Administration and Cooperation with Local Governments

Egypt should unify the administrative system and execute effective and comprehensive environmental conservation measures. This is required since many organizations participate in the water environment administration. Local governments have played important roles to solve

the environmental problems in Japan. However, in considering the fact that administrative capability of local government in Egypt is not so high, transfers of authority and responsibility to local government should be made step- wisely. In this sense, Egypt should set up the 8 Regional Branch Offices (RBOs) as the first step and should utilize them as key stations for the environmental conservation administration reflecting local conditions.

2) Lack of Administrative Resources

In Egypt it must be pointed out that comprehensive and effective measures are not taken because sufficient amounts of budget and sufficient numbers of staff are not allocated to the environmental conservation under the limited administrative resources. In an environmental administration, the officers of central government in charge of policy making are important. At the same time, recruitment and training of technical staff of local governments, who check the quality of wastewater at factories and provide technical advice to them, are also very important.

(4) Monitoring and Analysis of Water Quality

The Egyptian Environmental Affairs Agency (EEAA) has undertaken the project of Egyptian Environmental Information System (EEIS) to establish a network in EEAA. However, information to be collected by EEIS is limited to the information from EEAA. At present, the water quality data in the Nile River monitored by MPWWR and MOHP are not linked with EEIS. Egypt should also come up with effective environmental administrations by the concentration of environmental administration resources through measures such as promotion of better mutual understanding between relevant public organizations, mutual utilization of monitoring data, development of common data base system, and active utilization of data and information.

(5) Incentives for the Introduction of Environmental Protection Technologies

European countries and the USA have been providing financial and technical support to Egypt for the introduction of facilities and technologies for pollution control. However, these loans are designed for the public enterprises and/or relatively large-scale factories, and the terms and conditions of the loans are not suitable for small and medium scale local companies. In addition to the cement fund, Egypt should also create politically favorable circumstances for enterprises to install pollution control facilities by establishing a system of special loans with long-term of repayment and low interest rate to be used for the installation of wastewater pollution control facilities.

(6) Development of Organization for Pollution Control at Factories and Enterprises

Many factories including those with wastewater treatment facilities have been discharging the

wastewater exceeding the effluent standards. This is due to the insufficient capacity of wastewater treatment facilities and/or inappropriate operation and maintenance work. It is reported that education and training of technical staff, operators and other employees are not sufficient in many factories. Egypt should create good pollution control management system and improve the capability of employees by introducing systems and measures such as the qualification system of technical staff, enforcement of development of organization for environmental protection against factories and enterprises, etc. with reference to the systems that worked successfully in Japan.

(7) Environmental Education and Awareness

In Egypt, for increasing public awareness about the importance of environmental protection, EEAA and Ministry of Education have been executing the educational measures including preparation of instruction materials and education of students by using them under the assistance of Overseas Donors. Since close cooperation between industrial sectors, administrative sector and citizens is indispensable for effective execution of the environmental protection measures, projects and programs aimed at creation of public awareness should be implemented.

11.1.2 Problems in Industrial Sectors

(1) Development of Wastewater Management System

Many factories and enterprises of Egypt have not been complying with the effluent standards. As for the aspects of software, the inappropriate maintenance, management and operation of wastewater treatment facilities is the biggest problem. By taking the following measures under the recognition that business enterprise is a member of society, enterprises should work earnestly toward pollution control along with administrative sector and citizens, and should disclose the results of their efforts.

- To develop organization for pollution control in every factory or enterprise
- To develop the system for appropriate maintenance and repair of total facilities of the factory including wastewater treatment facility
- To provide environmental and technical education to operators and engineers
- To keep operational records including volume and quality of discharge wastewater
- To prepare operation and maintenance manuals
- To prepare emergency response manuals

(2) Spread of Environmental Management System

The important task of administrative sector is to emphasize the importance of water quality

conservation to enterprises through educational and enlightenment activities. Further, administrative sector should support the seminars for the popularization of the ISO-14000 series, and invite actively enterprises to the seminar.

(3) Joint Research and Development for Water Pollution Control

Enterprises of Egypt should take measures, which can be executed at relatively low cost, like research and development or investment jointly with other enterprises. Technical and financial assistance of administrative sector is indispensable for the continuation and effectuation of ongoing activities of private sector such as development of technology or capital investments. It is therefore desirable to create a scenario where private sector and central government engage jointly in the development of wastewater pollution control technologies.

11.2 Recommendation of Policies and Institutions

This section describes the measures that should be taken by administrative sector and industrial sector of Egypt for executing industrial wastewater pollution abatement programs. Figure-4 shows the scheme of this description.

11.2.1 Strengthening of Administrative Organization for Water Pollution Control

In order to strengthen the capability of administrative organization, it is necessary to reexamine the procedures for budget allocation and the functions of relevant organizations, and to buildup the organizations and systems required for the smooth implementation of administrative works for pollution control. Further, to promote the unification of pollution control administration and the cooperation with local governments, joint project(s) to be executed by governmental organizations related with administration of water pollution control and major local governments should be planned and executed. The formation of project team and the co-works at the execution stage are very useful for solving institutional problems and for creating closer relationships.

The JICA study team recommends the initiation of a joint project for the establishment of the target value of water quality.

< Objective of Joint Project for Establishment of Water Quality Target Value >

The Nile River has no big incurrent rivers, and intakes and discharges of water have been carried out many times from Aswan to Mediterranean Sea. Drinking water is taken from this river, and industrial effluent water is discharged to this river. Some water areas are important as sources of drinking, agricultural and/or industrial water. Water quality of some specific area

such as a scenic spot must be carefully conserved. In considering the characteristics in each water area and differences of local conditions, water area should be divided into categories, and different target or standard should be applied.

A joint study team consists of organizations concerned with water uses should establish the water quality target value after studying the natural environment and social and economic situations at the Nile River basin, with reference to the ambient water quality standards of other countries. In reviewing the standards of other countries, various aspects such as location, climatic conditions, and social conditions should also be investigated, in addition to the values itself. The following organizations should be included in this joint study:

a. The Egyptian Environmental Affairs Agency (EEAA): leading authority for pollution control,
b. The Ministry of Public Works and Water Resources (MPWWR): organization responsible for water pollution control and water quality monitoring,
c. The Ministry of Health and Population (MOHP),
d. The Ministry of Industry (MOI),
e. The Ministry of Home and Utilities (MHU).
f. Local governments that have water area important for water quality conservation.

In considering the financial difficulties of the central government and shortage of manpower, Egypt should:

a. Find the most suitable administrative system for water pollution control and the best assignment of roles and functions between relevant organizations through a joint project such as the one recommended in this study, and
b. Execute administrative works more effectively.

11.2.2 Capacity Building of Management for Industrial Wastewater

(1) Improvement of Administrative Capability to Inspect and Lead Factories

In Egypt, RBO manages environmental inspection of enterprises competent. The role of Environmental Management Units (EMUs) is execution of necessary tasks in cooperation with RBO, and EMUs actually conduct guidance and competence inspection of each enterprise.

In order to educate administrative officials who have a special knowledge, it is required to consolidate the education systems. This is not only for actual persons in charge of managing regional factories and enterprises but also administration engineers who can educate and lead these actual persons in charge of the organization under jurisdiction of industrial wastewater treatment technology.

More concretely, a strengthening of RBO is recommended. This is especially required to ensure a competent inspection of the pollution source and the enforcement of a clear statement for training of RBO officials. Secondly, strengthening the capacity of EMUs of each governorate for supplementing the limited number of personnel is recommended. Further, a consolidation of pollution source inventory is important. The consolidation includes adding information on pollution source to the constituting elements of environmental information system which is already under construction, constructing database of results of pollution source monitoring, and enabling to see relation between environmental monitoring data and pollution source data. An effective administrative guidance can be taken by integrating various kinds of information together.

(2) Spread of CP (Cleaner Production) Technologies

The education of technical experts in administration is desired to introduce the concept of CP (Cleaner Production) technologies which reduce volume of wastewater and pollutant load to be treated, combining with EOP (End Of Pipe) technologies, and aiming at environmental load reduction and treatment cost reduction at the same time. One method to spread the water pollution control technology based on these CP and EOP technologies is to establish an organization that provides and demonstrates information on CP and EOP technologies.

11.2.3 Assistance for Introducing Environmental Management System to Industries

If in Egypt, appropriate management of wastewater treatment facilities at factories and enterprises is done, the pollution load will be drastically reduced. Therefore, it is necessary for the government to follow a policy to introduce environmental management system to enterprises. The system to be introduced should be worldwide prevailing ISO14000 series, especially the environmental management system ISO14001, which is most appropriate. In order to introduce and propagate the system, seminars held on ISO14000 series would lead to acknowledgement of its importance in environmental management by enterprises, and would give them incentives for obtaining ISO14000 certification as mentioned below:

- Official commendation of enterprises which have obtained certification for ISO14000 and public announcement of the company name
- Green Consume by the government or NGOs (purchase products of enterprises voluntarily obtaining environmental management certification)
- Incentive in investment and tax related subjects

11.2.4 Other Policy Measures to Promote Management for Industrial Wastewater

- Financial Support

In order to increase the pace of introduction and subsequent implementation of wastewater treatment

technologies in Egypt, it is necessary to give enterprises economical incentives for execution of thorough inspection and regulation under the penal provisions of the administration. These would include political consideration of incentives on taxation and long term loan facilities for upgradation of old production facilities, installation of new wastewater treatment facilities and introduction of the technology. Further, it is desired to expand the application of financial assistance of oversea donors for the investment in pollution control, especially to small and medium enterprises.

- Raising Awareness about Environmental Issues

The "Green Consume" would criticize enterprises that lack environmental friendly operations and would provide support to those with positive attitudes towards environmental concerns. In order to develop "Green Consume" culture in Egypt, the government should try to increase awareness about environmental issues among the citizens. In addition to this, the government should educate general public on important environmental issues. At present education on environmental issues in Egypt is based on the support of European and American donors. In order to maintain and develop good quality of the water environment, cooperation of the people is mandatory. Positive political measures also need to be taken to raise awareness of citizens about the environment.