1) Pump Works

Topographic Survey

(1) Plane survey (scale 1: 500)	:	0.2 ha
(2) Intake drain longitudinal and cross section survey	:	0.5 km

Geological Investigation

(1) Core drilling and laboratory test	:	20 m
(2) Standard penetration test	:	20 time

2) Drain Works

Topographic Survey

(1) Longitudinal and cross section survey		
- Main drain	:	24 km
- Branch	:	57 km
(2) Plane survey		
- El-Hager feeding canal siphon (scale 1 : 500)	:	1.0 ha
(3) Geological investigation (for above siphon)		
- Core drilling and laboratory test	:	120 m
- Standard penetration test	:	120 time

3) On-farm Development and Subsurface tile drain

- Plane survey (including cadastral map, scale 1 : 5,000)	:22,650 ha
· El-Hager Extension Area	: 6,230 ha
· Nahda Area	: 9,300 ha
· El-Moshtarak Area	: 7,120 ha

4) Soil Survey

- Auger boring	:	2,300 site
- Chemical soil survey	:	460 sample

10. 6 Monitoring and Evaluation for Implemented Project

For the purposes of monitoring and evaluation of the implemented project and management situation, which will lead to find adequate countermeasures for raising project benefits, monitoring and evaluation

activities of the Project should be executed for the Priority Development Area and Project.

The contents of monitoring and evaluation are listed below;

- Depth of groundwater level from ground surface and its water quality at fields provided with subsurface tile drains,
- Soil improvement conditions,
- Improvement situation of water distribution systems and irrigation efficiency,
- Reduction of flood damage,
- Progress of subsurface tile drain provision and its operation and maintenance,
- Increase in agricultural production and farm incomes,
- Progress of farmers' organization establishment and management situation,
- Changes of Mariut Lake's water quality and quantity after Omoum Drain Project, and
- Restoration conditions of deteriorated Mariut Lake.

These monitoring and evaluation works should be undertaken by the following methods;

Monitoring and Evaluation for Implemented Project

Items	Related Agency	Year of Project Review
- Depth of groundwater table and water quality	EPADP, DRI	every 1 year
- Soil improvement conditions	MALRF	3 years
- Improvement situation of water distribution systems and irrigation efficiency	DOI	3 years
- Reduction of flood damage	EPADP	5 years
- Progress of subsurface tile drain provision and its operation and maintenance	EPADP	1 year
- Increase in agricultural production and farm incomes	MALRF	3 years
- Progress of farmers' organization establishment and management situation	MALRF	3 years
- Changes of Mariut Lake's water quality and quantity after Omoum Drain Project	EPADP, DRI	1 year
- Restoration conditions of deteriorated Mariut Lake	EPADP	3 years

CHAPTER XI. PROJECT COSTS

CHAPTER XI. PROJECT COSTS

11.1 Conditions of Cost Estimation

The project costs are estimated under the following conditions;

i) The civil works are to be carried out on a contract basis, and the construction machinery and equipment required for the construction works will be provided by the contractors. Therefore, only depreciation costs of the machinery and equipment are included in the construction costs.

ii) The project costs consist of construction and associated costs. Components of the project costs are shown in Table H-2-1, Annex H. Out of the associated costs, subsurface tile drain costs should be borne by farmers with a repayment period of 20 years.

iii) The exchange rate between Egyptian Pound and U.S. Dollar is fixed as follows;

U. S. Dollar = 3.374 Egyptian Pound (LE)

iv) The physical contingency related to the construction and associated costs is set at 10 percent of the direct costs. The price escalation for foreign currency is predicted applying the international inflation index established by the World Bank as shown below, and on the other hand, for local currency 19 percent inflation index is applied with reference to the index established by the Central Agency for Public Mobilization and Statistics.

Year	Price Escalation Rate	Year	Price Escalation Rate
	(%)		(%)
1994	100	2001	121
1995	103	2002	123
1996	106	2003	126
1997	109	2004	129
1998	112	2005	132
1999	114	2006	135
2000	118		

11.2 Construction Costs

1) Basic Rate

The basic rate for labor, material and construction equipment is estimated considering the prevailing rate in Egypt, as of July 1994.

2) Unit Costs

Unit costs of construction work are calculated in accordance with the proposed items, which are classified by construction methods, since the construction of the project will be executed on a contract basis with the costs of overhead, profit and taxes (30 percent) used in current MPWWR projects.

Unit Costs of Construction Works

Items	Unit	Unit Costs	Rate	
			F/C	L/C
		(LE)	(%)	(%)
Common Labour	day	11	0	100
Skiled Labour	day	21	0	100
Carpenter	day	20	0	100
Driver (Common)	day	20	0	100
Driver (Heavy Equipment)	day	40	0	100
Cement	ton	213	50	50
Reinforcing Bar (Deformed)	ton	1,425	5	95
Sand	cu.m	15	5	95
Gravel	cu.m	25	5	95
Wooden Board	cu.m	800	5	95
Gasoline	ℓ	1	30	70
Construction Equipment Lease	-		90	10
Mechanical and Electrical Equ.	-		100	0

3) Construction Costs

The construction costs are estimated based on the unit costs for individual working items. The construction costs will be divided into foreign and local currency portions. The local currency portion is to be estimated on the basis of prevailing prices in Egypt in 1994, while the foreign portion is estimated on the CIF price in Egypt.

11.3 Associated Costs

Associated costs are composed of on-farm development and subsurface tile drain costs, land acquisition and compensation costs, engineering and administration costs, and operation and maintenance equipment costs. As for the land purchase price, prevailing land values in the vicinity of Project Area were used.

11.4 Project Costs and Disbursement Schedule

1) Project Costs

The project costs are estimated at about 271.1 million Pound (LE) (exclusive of price escalation costs), as shown in Table 11-2, which is equivalent to 7,600 LE/feddan (2,250 US$/ha)

2) Disbursement Schedule

The annual disbursement schedule for the project costs as mentioned above is estimated on the basis of the implementation schedule, and its summary is as follows;

Disbursement Schedule of the Project Costs

(unit: 1,000 L.E)

Year	Foreign Currency	Local Currency	Total
1998	9,550	6,080	15,630
1999	910	920	1,830
2000	39,550	39,330	78,880
2001	49,870	42,700	92,570
2002	45,610	36,620	82,230
Total	145,490	125,650	271,140

Detail estimation is given Table H-2-10, Annex H.

FIGURE 11 - 1 PROJECT COST COMPONENTS (PRIORITY DEVELOPMENT AREA)

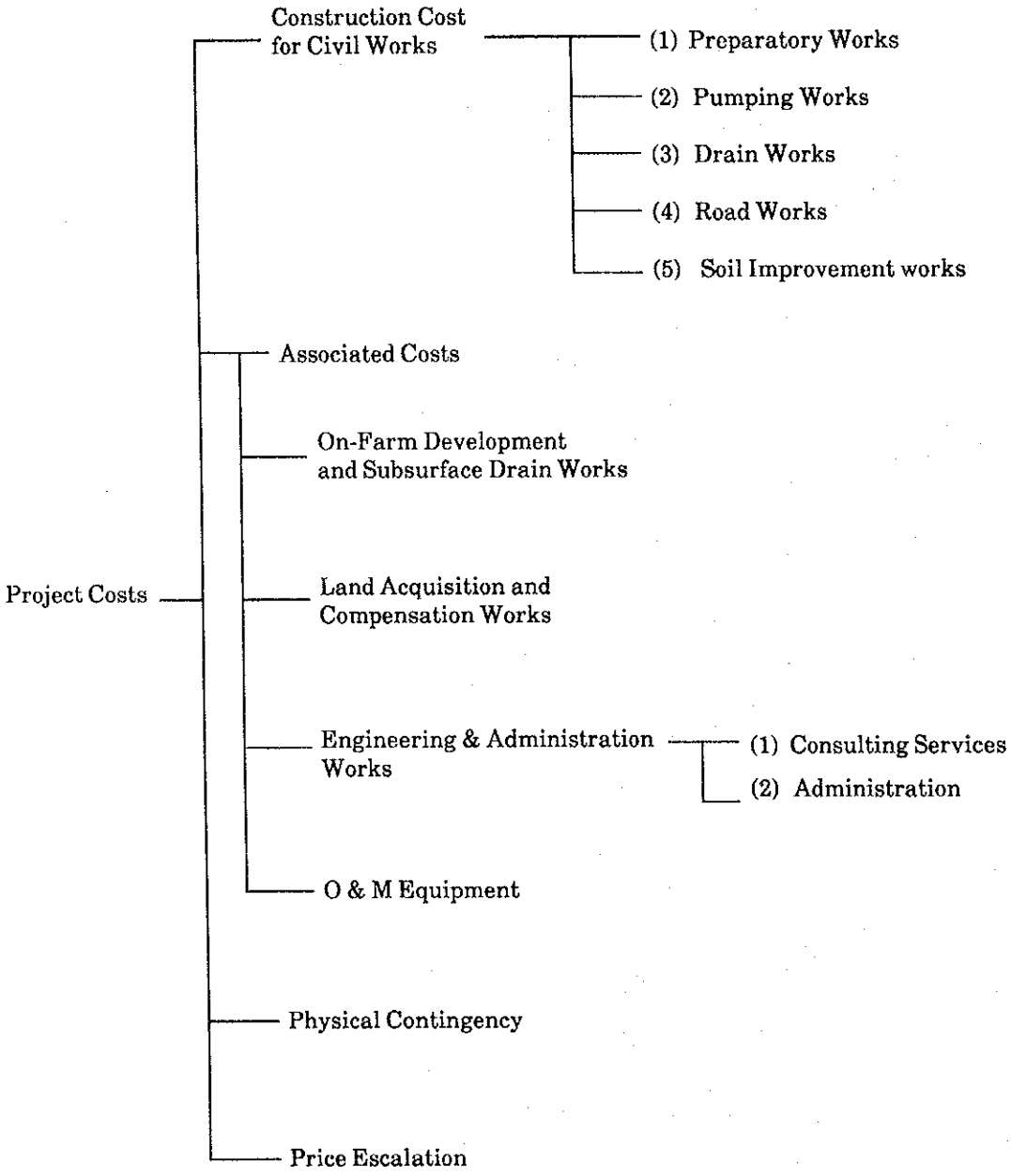


Table 11-1 Project Costs (Priority Development Area)

(unit: '000 L.E)

Descriptions	F/C	L/C	Total
1. Construction Works			
1.1 Preparatory Works	70	2,010	2,080
1.2 Pumping Works	26,640	6,180	32,820
1.3 Drain Works	26,260	7,480	33,740
1.4 Road Works	8,630	12,340	20,970
1.5 Soil Improvement	12,690	13,180	25,870
Sub-total	74,290	41,190	115,480
2. On-Farm Development and Subsurface Tile Drain Works			
2.1 On-Farm Development Works	5,660	2,420	8,080
2.2 Subsurface Tile Drain Works	22,660	9,710	32,370
Sub-total	28,320	12,130	40,450
3. Land Acquisition and Compensation Works	-	640	640
4. Engineering and Administration Works			
4.1 Consulting Services	9,390	8,760	18,150
4.2 Administration	1,420	1,420	2,840
Sub-total	10,810	10,180	20,990
5. O & M Equipment	5,310	800	6,110
6. Total (1 - 5)	118,730	64,940	183,670
7. Physical Contingency (10%)	11,880	6,490	18,370
8. Total (6 - 7)	130,610	71,430	202,040
9. Price Escalation	14,880	54,220	69,100
10. Grand Total	145,490	125,650	271,140

Note; Details of cost estimation are given in Annex H.
Project costs by executing agencies are shown below;
- Ministry of Public Works and Water Resources
  - EPADP : $167,570 \times 10^3$ LE (62%)
  - MED : $57,920 \times 10^3$ LE (21%)
- Ministry of Agriculture, Land Reclamation and Fishery
  - EALIP : $45,650 \times 10^3$ LE (17%)

  Total : $271,140 \times 10^3$ LE (100%)

CHAPTER XII. PROJECT EVALUATION

CHAPTER XII. PROJECT EVALUATION

12. 1 Introduction

The subject Project is the Farmland Environmental Improvement Project in the Omoum Area located in the West Delta Region, emphasizing on the drainage improvement. The Project aims to increase agricultural production, thereby augmenting farmers' cash income, and improving the living standards of the region. The Project Area (Hares Area) has been selected as a top priority area with greater potential for development.

Agriculture in the Area depends on irrigation water and on drainage efficiency that contributes to the reduction of salinity in the soil. With project implementation, the Project Area will benefit from the increase in crop yields and prevention of water quality deterioration in Mariut Lake. Furthermore, practical institutional reorganization in the villages will take place to increase farmers' participation not only in production activities but also in marketing. The overall impact of the Project is considered to be substantial to the region in the light of strengthening agriculture to the national economy.

12. 2 Economic Justification

12. 2. 1 Method of Economic Evaluation

The method of economic evaluation is as follows;

1) Economic benefits and costs of the Project are expressed in monetary terms.

2) The project life is assumed to be 50-years with five years of project implementation. Project benefits will be realized at the end of 9th year.

3) Net present value was estimated at 12 percent social opportunity cost. Financial and economic net present values were calculated.

4) The benefits were evaluated with incremental value on the basis of the difference in value between "without Project" and "with Project". And also flood damage reduction benefits were taken into account in the evaluation.

5) Economic prices were estimated on the basis of data gathered from the World Bank and Ministry of Agriculture, Land Reclamation and Fishery in Cairo.

6) Economic and financial internal rates of return (EIRR and FIRR) were estimated for use as the main indicator of financial and economic evaluation.

7) The foreign exchange rate of US$1.00 = LE 3.374 is used to convert foreign costs into local currency terms.

8) The standard conversion factor (SCF) applicable to the foreign portion of the project components was set at 0.87 to estimate part of foreign components of project cost.

9) No shadow price was applied to the labor component of civil work of the construction. In an Agricultural Strategy Note of January 1985, the World Bank concluded that Egypt has suffered a more severe labor shortage in agriculture than many other middle-eastern countries (except Turkey). Given this situation there is no reason to believe that under employment is not widespread, thereby the prevailing wage rates reflect more or less the real marginal value of labor. The economic labor wage was considered to be the same as the financial wage rate.

12. 2. 2 Prices of Commodities

A summary of selected financial and economic prices of farm inputs and outputs at 1994/95 constant prices is shown below;

Selected Financial and Economic Prices

Crop	Unit	Financial Price	Economic Price
		(LE)	(LE)
Major Crop			
Wheat	ton	639	826
Bean	ton	1,283	1,488
Berseem, Long	ton	61	47
Berseem, Short	ton	61	47
Vegetable (Winter)	ton	520	400
Cotton	ton	2,908	2,814
Rice	ton	350	636
Maize	ton	528	556
Sunflower	ton	1,152	1,280
Vegetable (Summer)	ton	176	300
Citrus	ton	546	450
Fertilizer			
Urea (N)	kg	1.10	1.63
Phosphate (P_2O_5)	kg	1.25	1.55
Potash (K_2O)	kg	1.04	1.35
Farm Labor	hr	1.20	1.20

Note: Details are shown in Tables I-2-19 for major crop prices and Tables I-2-12 to I-2-20, Annex I for fertilizer prices and farm labor costs.

12. 2. 3 Project Benefits

1) Financial and Economic Benefits by Increase of Crop Benefits

Financial and economic benefits of the project will be generated from project implementation. In crop benefits, the full benefits attributable to the implementation of the Project are assumed to begin at the end of the sixth year. Benefits will accrue to the area from year six to year nine and thereafter. In addition to the crop benefit, flood damage reduction benefits are counted in the project benefits, as shown below;

Benefits	Crop Benefits	Flood Damage Reduction Benefits	Total
	(mill. LE)	(mill. LE)	(mill. LE)
- Financial Benefits	52.98	1.65	54.63
- Economic Benefits	62.74	1.65	64.39

Note; Details are given in Table I-2-29 , Annex I.

Net financial and economic present value of crop yields at discount rate of 12 percent became 218.02 and 259.10 million LE.

2) Gross Income, Production Cost and Net Income

Cash flow to farmers was estimated on the basis of a crop production model. Crop yield multiplied by financial price gives gross crop income by major crop. production costs were estimated on the basis of a crop production survey conducted in cooperation with Cairo University Faculty of Agriculture and local administration. Detailed farm inputs were obtained from the survey.

Net income was defined as the difference in value between gross income and production costs. Net financial income without Project in Hares Area was 55.53 million LE or 1,030 LE per feddan.

12. 2. 4 Economic Project Costs

Project costs consist of construction costs, and land acquisition and compensation costs, engineering and administration costs, O&M equipment, and physical contingency. However, price escalation is not counted in project evaluation.

1) Project Costs

The project costs for drainage improvement in the area were estimated on the basis of prevailing rate of July 1994. Project construction is scheduled within five years, 1998 to 2002, and no increase in rates are counted in the estimation. Economic project costs were estimated based on the following procedures;

- Costs related with project evaluation are the priority development area's costs and allocated costs on priority development project to Project Area, which will be allocated in connection with area proportion of 12.5 percent (22,600 ha/180,710 ha) and with drainage discharge sharing between the agricultural sector and others. The objective discharge sharing is given as follows;

- Agricultural discharges from seven blocks : 1,287.0 MCM (70%)
- Waste water discharge from Alexandria city (ETP and WTP) : 206.8 MCM
- Others : 335.3 MCM

  Total 1,829.1 MCM (100%)

- Main objectives of the project are drainage improvement, however in order to increase the agricultural production in the area, improvement works in prevailing irrigation systems are a prerequisite. At present, the Irrigation Department has a plan for West Nubariya Agricultural Intensification Project at the West Delta region. Therefore, the irrigation improvement project is planned to be implemented together with this drainage project during the period 2000 to 2002, and the required irrigation improvement costs of 366 LE/feddan (872 LE/ha) are counted to the project costs. Details of the related irrigation costs are referred in Table I- 2 - 30 , Annex I.

- Financial project costs are converted to economic costs applying Standard Conversion Factor of 0.87 applicable to foreign portion of the project components. Economic costs are presented below;

Economic Project Costs for Hares Area

(unit :million LE)

Description	Total Costs	Implementation Period				
		1998	1999	2000	2001	2002
Foreign Costs	124.04	9.06	0.88	35.36	42.11	36.63
Local Costs	75.54	5.93	0.74	26.34	24.40	18.13
Total	199.58	14.99	1.62	61.70	66.51	54.76

Note; Details are given in Table I-2-31 , Annex I.

2) Operation and Maintenance Costs

Operation and maintenance (O&M) costs for the Project Area consist of salary and wages,administration and general expenditure, and costs for pump operation, equipment repair and maintenance, fuel, drain maintenance, and office maintenance. In addition to this Project Area O&M costs, allocated O&M costs of the priority development project should be counted, that is, agricultural sector of 70 percent and area proportion of 12.5 percent for Project Area. Total economic O&M costs are estimated as shown below;

- O & M costs for Project Area : LE 1,716 thousand (70.3 LE/ha)
- Allocated O & M costs : LE 156 thousand (7.2 LE/ha)

Total LE 1,872 thousand 1/

1/: Details are shown in Table I-2-32 , Annex I.

3) Replacement Costs of Related Equipment

The related equipment such as pumps and gates should be replaced every 25 years, which is the estimated durable period for the equipment. Replacement costs for the Project Area are estimated with the same procedures of O&M costs as shown below;

- Replacement costs for Hares Pump : LE 22,185 thousand
- Allocated replacement costs

El-Max pumping station (new) : LE 3,098 thousand (2022)1/
El-Max pumping station (No.2) : LE 4,426 thousand (2008, 2033)2/
Gates in Mariut Lake : LE 249 thousand (2022)3/
Total LE 29,958 thousand

Details are indicated in Table I-2-33 , Annex I.

1/ : LE 40,700,000×22,600 ha/180,710 ha × 0.7 × 0.87=LE 3,098,000

2/ : LE 58,142,000×22,600 ha/180,710 ha × 0.7 × 0.87=LE 4,426,000

3/ : LE 3,276,000×22,600 ha/180,710 ha × 0.7 × 0.87=LE 249,000

12. 2. 5 Financial and Economic Internal Rates of Return

Economic internal rate of return (EIRR) becomes 19 percent, while 16 percent of financial internal rate of return (FIRR). Details are given in Table I-2-34 , Annex I.

According to this approach, EIRR and FIRR are substantially above the social opportunity costs of the Egyptian Planning Agency (12%).

12. 2. 6 Sensitivity Analysis

The following three cases of sensitivity analysis were performed, whereby, crop benefits will be down by 20 percent, the project implementation will be delayed for two years, and the project costs will increase by 20 percent.

	FIRR	EIRR
	(%)	(%)
- Benefits 20 % down	13.83	15.71
- 2-year delay	13.49	15.04
- Projects costs 20 % up	14.12	16.04

Following table indicates the summary of project evaluation.

Summary of Project Evaluation for Project Area

1. Area coverage	:	53,930 feddan (22,650 ha)		
2. Population	:	104,000 Persons		
3. Net increase of crop yields 1/	:	Year 1	Year 9-50	
Financial value (million LE)		0	52.98	
Economic value (million LE)		0	62.74	
NPV of the increase of crop yields discounted at 12% 2/				
Financial value (million LE)			218.02	
Economic value (million LE)			257.46	
4. Farm household budget (LE)	:	Without Project (1)	With Project (2)	(1) - (2)
3.0 feddan farm	:	1,723	4,096	2,373
4.2 feddan farm	:	2,412	5,734	3,322
5. Internal Rate of Return (%) 3/:		FIRR	EIRR	
		16.41	18.53	
6. Sensitivity Analysis		FIRR (%)	EIRR (%)	
Benefits 20% down	:	13.83	15.71	
2-year delay	:	13.49	15.04	
Project cost 20% up	:	14.12	16.04	

Note; 1/ : see Table I-2-29 , Annex I.
2/ : see Table I-2-34 , Annex I.
3/ : see Table I-2-34 , Annex I.

12. 3 Financial Analysis of Typical Farmers

A representative farm cash budget was analyzed on the basis of three feddan farms following the proposed cropping pattern in the Project Area. Table I-2-35 summarizes annual cash flows for three feddan farms in the area. The annual cash flow was estimated at LE 4,096, compared with LE 1,723 without the project, contributing to a net increase of LE 2,373 per farm household.

For 4.2 feddan farm, net increase of cash budget was LE 3,322 where 4.2 feddan is an average feddan for the Project Area.

The above analysis is based on a farm economic survey of six villages representing 30 farmers in the Project Area. The size of farm household was adjusted to 5.7 persons in comparing farm income with that of all rural areas in Egypt. In 1955, an average farm household income with 5.7 family members was LE 3,192 as compared with LE 3,850 in all rural areas in Egypt. Low productivity land in the Project Area had an average farm household income of LE 2,351, and high productivity areas has LE 3,192.

However, present farm household income is only LE 1,723 that is substantially low should the project not be implemented. It is clear that the drainage improvement project is urgent in contributing to an increase in farm household income in this area. Details of representative farm income are shown below.

Representative Farm Household Income (3 feddan)

Crop	Unit	Without Project	With Project
	(feddan)	(LE)	(LE)
Wheat	1.08	-14	145
Beans	0.33	47	111
Long Berseem	0.63	300	495
Short Berseem	0.51	47	123
Sunflower	0.24	-66	-400
Cotton	0.51	734	1,082
Maize	1.08	-277	-96
Vegetable (W)	0.36	934	1,939
Vegetable (S)	1.11	18	697
Total	5.85	1,723	4,096
Intensity	: 195 %		
Family	: 6		
Adult	: 4		
Working	: 8 hr		
Net Increase of Income	: 3.0 feddan farm : LE 2,373 4.2 feddan farm : LE 3,322		
Crop Pattern	: Wheat 36%, Beans 11%, Long Berseem 21%, Short Berseem 17%, Maize 36%, Cotton 17%, Sunflower 8%, Vegetable (W) 12%, Vegetable (S) 37%.		

Source; Survey data obtained in 1995.

12. 4 Other Project Benefits

In addition to the above-mentioned tangible benefits of crop incremental and flood damage reduction benefits, the following benefits are also expected to be realized with the Project.

12. 4. 1 Benefits at the Project Area Level

- The project realization will improve the farmers living standards through an increase in farm income. The increase in the farm economy from the increase of agricultural income means the increase in consumption and saving. The increase in farm income will improve the villagers living standards in terms of quantity and quality (nutrition, education, health and others).

- With the project implementation, to make good use of irrigation water and adequate drainage discharge of excess water at farm level, it will be necessary to establish and strengthen the water and drainage user's associations among the beneficiary farmers. These cooperative systems will certainly improve communication among farmers influencing the technical up-grading of crop cultivation and farm management of the farmers in and around the Project Area.

- With the drainage improvement in the area, it will be expected to a considerable extent, to reduce water-borne disease such as diarrhea, paratyphoid and skaris, which are afflicting the population in large numbers.

- Many villagers will have employment opportunities not only in the construction and O & M of the Project, but also in the farming works for upland crop cultivation.

- The improved operation and maintenance road along the main and lateral drains will function also as a connecting road network among villages and between villages and urban areas for various purposes such as communication, communication among employees, students and pupils, public services and commerce. It will benefit not only the farmers but also the whole population of

the Project Area, improving the social and economical environment.

12. 4. 2 Benefits at the National Level

- The Project will introduce and encourage upland cropping in the area, and a staple supply of fresh and cheap farm products to Alexandria and other cities throughout the year could be expected.

- Implementation of the Project is for effective socio-economic development, not only for promoting rural welfare but also alleviating the disparity in living standards between the regions.

CHAPTER XIII. PROJECT ENGINEERING, IMPLEMENTATION AND PROJECT EVALUATION FOR PRIORITY DEVELOPMENT PROJECT

CHAPTER XIII. PROJECT ENGINEERING, IMPLEMENTATION AND PROJECT EVALUATION FOR PRIORITY DEVELOPMENT PROJECT

13.1 Project Engineering

In relation to the priority development project, the facilities which have been proposed for improvement are the Omoum main drain, discharge channel from El-Max pumping station and El-Max (No.1) pumping station.

13.1.1 Omoum Main Drain

1) Project Facilities

For the improvement of Omoum main drain the following project facilities are proposed;

i) Construction of separation dike for the part within Mariut Lake(L=10 km)
ii) Provision of gates (with attached weirs) in the dike (7 places)
iii) Improvement of Nubariya siphon including a settling basin

Descriptions of each project facilities are given below;

2) Separation Dike within Mariut Lake

a) Basic Criteria for Planning

Proposed length of Omoum main drain to be improved with separation dike in Mariut Lake will be decided on the basis of a hydraulic analysis, and the conditions for the analysis were set as follows;

- The suction water level of El-Max pumping station would be (-) 3.25 m.MSL at the time of maximum design discharge of 150 cu.m/sec. According to the proposed plan, the discharges from Hares pumping station (Q=30.0 cu.m/sec) and Abis pumping station (Q=4.0 cu.m/sec) will be directly drained to the Mariut Lake.

- Head-loss for Nubariya siphon will be 0.12 m.
- Water surface profile of Omoum main drain in principle should not topple the suction water levels of each pumping station.
- In principle, widening of present cross section could not take place due to the settlements on the embankments, deepening of drain bed would be preferred instead.
- The crest width of embankment will be 10 m, and crest elevation will be (-) 0.90 m.MSL considering the Mariut Lake operation water level of (-) 2.40 m.MSL with a wave height of 1.5 m.
- Provision of gates and weirs will be made in the separation dike in order to conserve the Mariut Lake water level and quality.
- An appropriate cross section at the railway bridge(upstream of El-Max pumping station) will be proposed for smooth water flow.
- Pavement of gravels will be proposed on the embankments of separation dike for use as a maintenance roads.

b) Design Drainage Discharge

Design drainage discharges (maximum) for each section are as follows.

Design Drainage Discharge of Omoum Main Drain

Section			Design Drainage Discharge (Proposed)	Design Drainage Discharge (Existing)
			(cu. m/sec)	(cu. m/sec)
El-Max	-	Nubariya Siphon	150	102
Nubariya Siphon	-	Abis	86	102
Abis	-	Hares	82	102
Hares	-	Dishudi	82	102
Dishudi	-	Truga	71	71.2
Truga	-	Shereshera	45	46.3
Shereshera	-	Abu Hommos	16	11.07

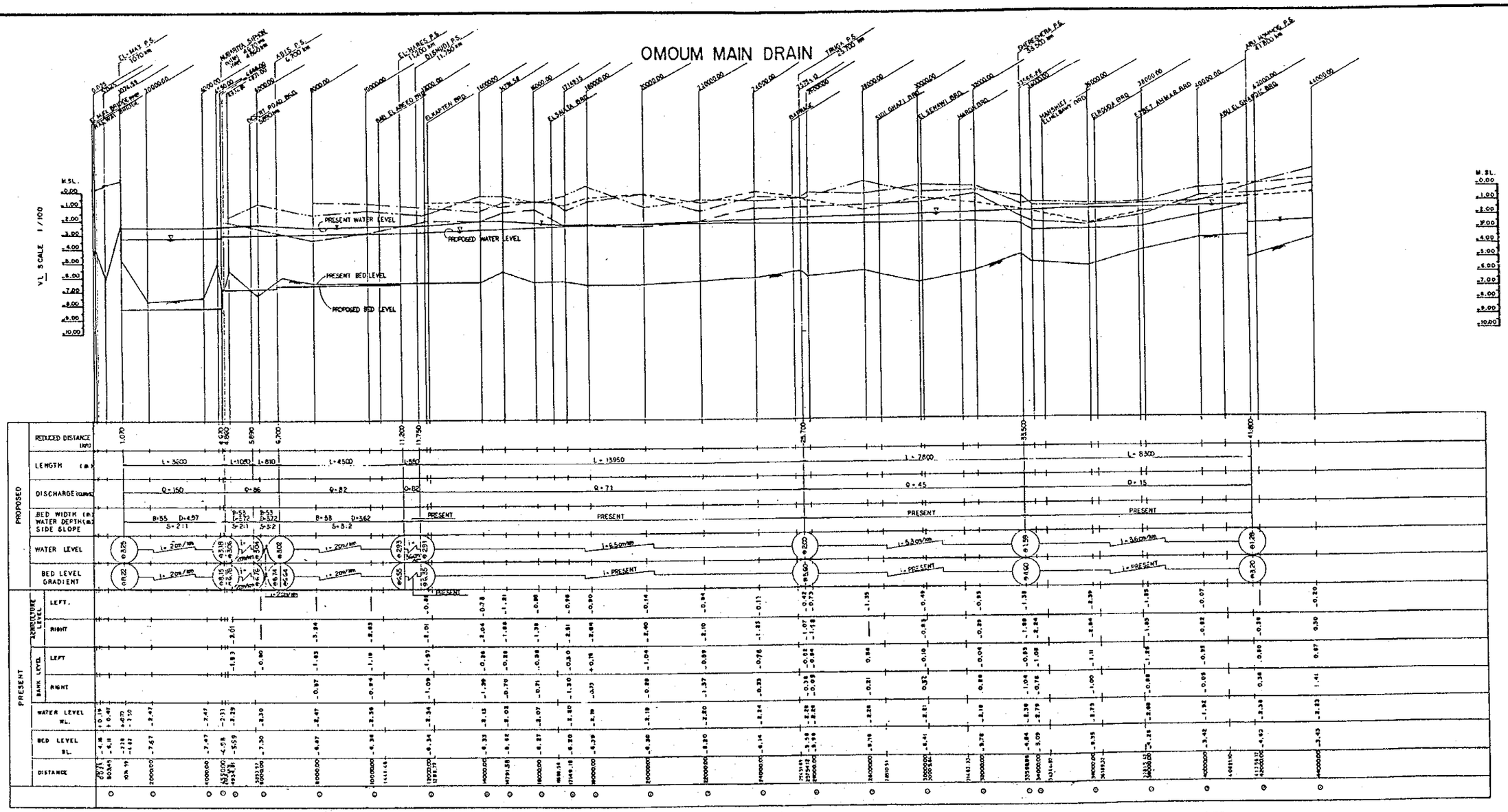


FIGURE 13-1 PROPOSED LONGITUDINAL SECTION OF OMOUM MAIN DRAIN

ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT
IN OMOUM AREA
OMOUM MAIN DRAIN
LONGITUDINAL SECTION
DATE | DRAWING NO. 2/2
JAPAN INTERNATIONAL COOPERATION AGENCY

FIGURE 13-2 PROPOSED CROSS SECTION OF OMOUM MAIN DRAIN

DIMENSION TABLE of OMOUM MAIN DRAIN

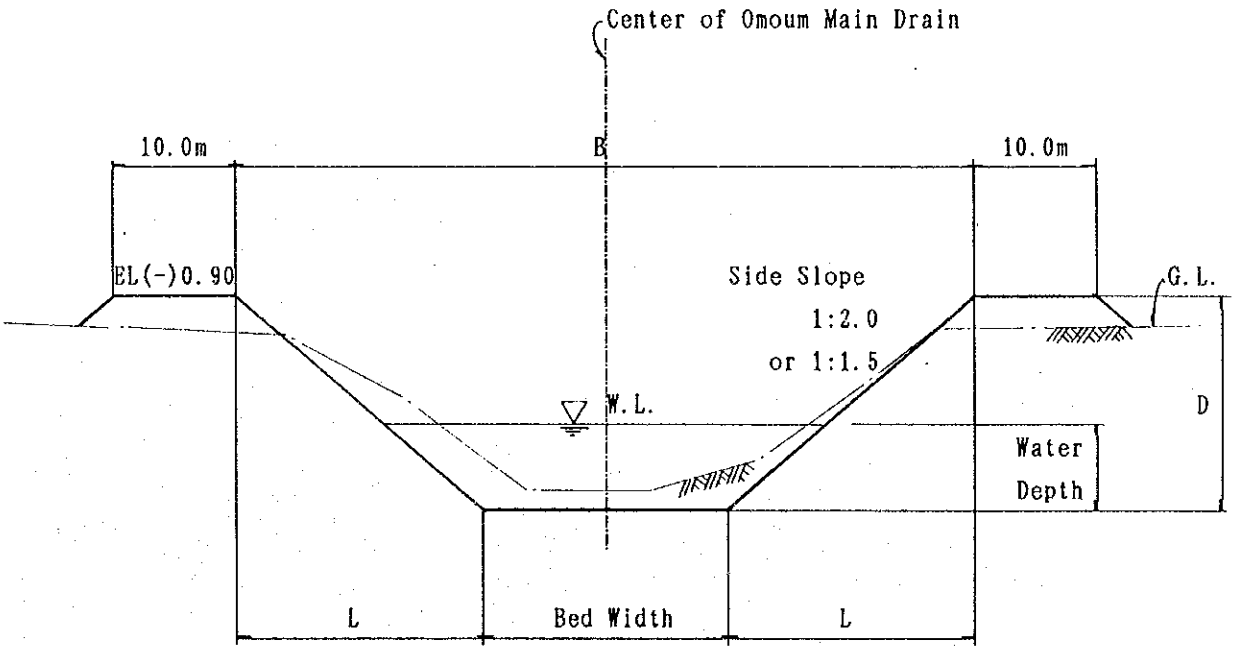
Type	Discharge (cum/sec)	Bed Width (m)	Side Slope	Bed Slope	Water Depth (m)	Velocity (m/sec)	B Av. (m)	L Av. (m)	D Av. (m)
Type-1	150	55	1:2.0	2cm/km	4.97	0.464	84.2	14.6	7.3
Type-2	86	53	1:2.0	2cm/km	3.72	0.383	76.6	11.8	5.9
Type-3	86	53	1:1.5	2cm/km	3.72	0.395	70.8	8.9	5.9
	82	53	1:1.5	2cm/km	3.62	0.388	70.2	8.6	5.7

Remark

Type-1 ; El-Max P.S. ~ Nubariya Siphon Outlet

Type-2 ; Nubariya Siphon Inlet ~ Desert Road Bridge(5.89Km Point from Mediteranean Sea)

Type-3 ; Desert Road Bridge ~ Abis P.S. & Abis P.S. ~ Hares P.S.



c) Design Sections of Omoum Main Drain

The improvement of Omoum main drain (the section within Mariut Lake) will take place on the basis of hydraulic analysis. Main features of the sections and water levels at each pumping station are presented below (ref. Table G-3-7, Annex G).

Main Features of Proposed Omoum Main Drain

Drain Type	Section	Length	Slope	Width	Flow Depth	Velocity
		(km)	(cm/km)	(m)	(m)	(m/sec)
Type-1	El-Max - Nubariya Siphon	3.60	2	55	4.97	0.464
Type-2	Nubariya Siphon - 5.89 km1/	1.03	2	53	3.72	0.383
Type-3	5.89 km - Abis	0.81	2	53	3.72	0.395
	Abis - Hares	4.50	2	53	3.62	0.388

1/ : 5.89km point is the inter-section of Omoum main drain and desert road.

Proposed Water Level of Omoum Main Drain

Point	Design Delivery Water Level	Proposed Water Level After Improvement	
	(m. MSL)	(m. MSL)	
El-Max P. S. (suction)	(-) 3.25	(-) 3.25	(-) 3.25 1/
Abis P. S.	(-) 2.70	(-) 3.02	(-) 3.09
Hares P. S.	(-) 2.80	(-) 2.93	(-) 3.03
Dishudi P. S.	(-) 2.63	(-) 2.92	(-) 3.02
Truga P. S.	(-) 2.00	(-) 2.00	(-) 2.35
Shereshera P. S.	(-) 1.60	(-) 1.60	(-) 2.09
Abu Hommos P. S.	(-) 0.80	(-) 1.28	(-) 1.93

1/ : Water levels considering future reuse plan

d) Roads on Separation Dikes

To maintain separation dikes and gates in the dikes roads on both banks are proposed. The width will be five meter with 20 cm crushed stone pavement. Total length will be 20 km(L=10 km×2).

3) Gates in the Separation Dikes (Section within Lake)

a) Basic Criteria for Planning

- In order to make a passage for water from Mariut Lake to Omoum main drain and also to mitigate floods during the winter season, gates with attached weirs are proposed.

- According to the results of water balance simulation the number of gates would be ten (2 gates/place × 5 places) and operation would be on monthly basis. Construction place would be between El-Max pumping station and Nubariya siphon (Figure 5-4), three places on the left bank and two places on the right bank(from the viewpoint of environmental conservation, two additional gates will be provided).

- Connecting bridges are proposed at the places where gates will be constructed. These will act as connecting bridges between upstream and downstreams and will help in maintenance work.

b) Main Features of the Facilities

Gates

-	Gate type	: Roller gate
-	Dimension	: B3.0 m × H2.0 m × 2 vents/place
-	Design W.L. of Omoum main drain	: (-)3.25 m.MSL
-	Design W.L. of Mariut Lake	: (-)2.40 m.MSL
-	Elevation of gate sill	: (-)3.60 m.MSL

Weir

-	Width	: 10 m x 2 places(both sides of gate)
-	Crest elevation	: (-)2.50 m.MSL

Bridge

-	Type	: Reinforced concrete
-	Length	: 35 m
-	Width	: 4.5 m

Riprap and Revetments

-	Places	: Side slope and apron part

- Structure : Wet masonry of 50 cm thickness

4) Improvement of Nubariya Siphon including Construction of Settling Basin

a) Basic Criteria for Planning

Except for some parts its main structure, the siphon is considered to be in good condition. Therefore, partial improvement especially manholes, and construction of a settling basin with cleaning facilities will be proposed.

b) Design Discharge and Head-loss

Hydraulic features of the design discharge that will pass through the siphon are as follows;

Design Drainage Discharge	Cross Sectional Size	Flow Area	Inside Velocity	Entrance Water Level	Exit Water Level
(cu.m/sec)		(sq. m)	(m/sec)	(m. MSL)	(m. MSL)
86	3.2 m×3.2 m×8	81.92	1.05	(-) 3.06	(-) 3.18

The head-loss due to the siphon is assumed as follows (refer Table G-3-8, Annex G).

- Friction loss (hf)	=	0.062 m
- Entrance loss (hgc)	=	0.023 m
- Exit loss (hge)	=	0.026 m
- Screen loss (hs)	=	0.002 m
- Bend loss (hbe)	=	0.004 m
Total loss	=	0.117 m ≒ 0.12

c) Improvement of Settling and Maintenance Facilities

In order to prevent sand and other sediment material from entering the siphon, a settling basin at the siphon entrance will be proposed. This facility will be built in Omoum main drain expanding its bed width and deepening the bed level where suspended materials will be deposited. Major features of the settling basin are given below (refer to Table G-3-9, Annex G).

Design Criteria for Settling Basin

Design Discharge	Design Particle Size and Critical Velocity for Suspended Materials		Settling Basin			Remarks
			Width	Depth	Length	
(cu.m/sec)	(mm)	(m/sec)	(m)	(m)	(m)	
67 1/	0.3	0.20	70	5.1	65	riprap, revetments 2/

1/: Discharge is assumed as maximum after reuse

2/: For riprap and revetments, wet masonry of 50 cm thickness will be used.

At present there is no stop-log gate for maintenance work and manholes have become old with fractures in the structure. Therefore, construction of gates, screen and improvement of some manholes are proposed.

Major Features for Maintenance Facilities

Item	Size
1) Stop-log gate	· Wooden gate eight vents (one vent = 3.2 m × 0.5 m × 11) · Manually operated stop-log crane one set
2) Manhole	· Reinforced concrete · B = 1.2 m × W = 1.2m × H = 3.85 m × 16 places
3) Screen bar	· 3.2 m × 3.2 m × 8 vents (dia. = 9 mm)

13. 1. 2 Discharge-Channel and Resettlement Works

1) Project Facility

The following items regarding discharge-channel improvement are proposed;

i) Improvement of discharge-channel(L = 600 m)

ii) Resettlement of inhabitants (135 households)

2) Improvement of Discharge-Channel

a) Basic Plans

From the field survey and hydraulic analysis it was found that the existing capacity of this discharge-channel is insufficient, which is about 60 cu.m/sec only. In other words it has a shortage of 90 cu.m/sec in relation to the proposed drainage discharge of 150 cu.m/sec. In the analysis, the delivery

water level of the El-Max pumping station was set at 0.76 m.MSL with water level at the outfall at 0.19 m.MSL. If the on-going plan of EPADP to resettle the inhabitants on the banks is implemented smoothly, then expansion of this discharge-channel is possible. In the improvement section, safe revetments works are proposed. The places intersected by oil pipes will be excluded from the improvement plan.

A comparative study using non-uniform flow analysis has taken place. In the study delivery water level of El-Max pumping station was set at (-)0.75 m.MSL and the best sections for safe passage of discharges were selected. The results of the analysis are presented below (refer to Figure G-3-2, Annex G).

Improvement Plan of Discharge-Channel

Section	Design Discharge	Improvement Plan			Water Level
		Width	Side Slope	Length	
	(cu.m/sec)	(m)		(m)	(m. MSL)
Outfall to 0.32 km	109 1/	20	1 : 1.5	320	0.50 2/
0.32 km to 0.53 km	109	same as existing section			
Left Bank					
0.53 km to 0.725 km	109	same as existing section			
0.725 km to 0.855 km	109	20	1 : 1.5	130	
0.855 km to 1.007 km (El-Max P. S)	109	same as existing section			
Right Bank					
0.530 km to 0.720 km	109	same as existing section			
0.720 km to 0.870 km	109	20	1 : 1.5	150	
0.870 km to 1.070 km (El-Max P. S)	109	same as existing section			0.73
			Total	600	(0.88) 3/

1/: Normal maximum discharge in July after reuse
2/: Average sea water level at outfall
3/: Maximum water level considering maximum discharge of 150 cu.m/sec during design flood

c) Revetments Works

In order to protect side slopes of the improved sections provision of revetments works is proposed. The thickness of the revetments should be 50 cm of commonly used wet masonry.

d) Removal and Replacement of Existing Bridges

For the implementation of discharge-channel improvement work, two bridges in the extreme downstream area need to be removed. Therefore, proper discussion should be conducted with related agencies while making sure of their replacement.

3) Resettlement Plan

Resettlement of the inhabitants living on the banks of the discharge-channel is a prerequisite for any improvement works. Only after smooth execution of the present plan will expansion become possible. According to the plan, 135 households will be resettled and each household will be paid compensation of LE 2,000. Resettlement land has already been prepared by EPADP at an adjacent area of the El-Max pumping station.

13. 1. 3 El-Max (1) Pump Facilities

1) Design Policy

The existing El-Max pumping station consists of two pumping stations, namely (1) and (2). Six units including one stand-by unit of inclined shaft axial flow pump with 2,300 mm in pump diameter, having total capacity of 125 cu.m/sec, are provided in each station. However, the existing El-Max (1) pumping station is currently facing a shortage of pump capacity resulting from overage (operation started 32 years ago) and the increase of drainage discharge due to new area development in the Study Area.

The new pumping station with a total capacity of 87.5 cu.m/sec, is to be constructed as the present design standards of drainage development in the Study Area will be revised in the proposed plan.

- Overall El-Max pumping station : 150.0 cu.m/sec
- Existing El-Max (2) pumping station : 62.5 cu.m/sec
- New El-Max (1) pumping station : 87.5 cu.m/sec

2) Design Dimension and Design Criteria

a) Design Dimension

- Drainage Area : A = 430,260 feddan (180,710 ha)
- Design Discharge : Q = 87.50 cu.m/sec (1/10-year probability)
- Design Suction Water Level : NWL. (-) 3.25 m. MSL
  LWL. (-) 3.70 m. MSL
- Design Delivery Water Level : NWL. (+)0.75 m. MSL
- Location of Pumping Station : North-east side of the existing El-Max (2) pumping station

b) Number of Pumps

Generally, the number of pumps is fixed, considering the design conditions like discharge, discharge characteristics, capacity of drainage channels, etc., economy (construction costs and O/M costs) and operation/ maintenance. Moreover, the smaller the number of pumps, the cheaper the construction costs become. On the other hand, it is necessary to adjust the pump operation hours following the fluctuation of flow in case the smaller number of pumps are fixed. Six units of pumps have been provided in El-Max (2) pumping station at present, so that it is presumed that there are no significant differences in the efficiency of pumps due to the selection of the number of pumps. Generally, the relationships between the drainage discharge and the number of pumps are as follows :

Discharge	No. of Pump
Less than 30 cu.m/sec	2~4 units
30~100	4~6
100~200	5~7

EPADP requested the introduction of a combination of different pump sizes, while the employment of the same pump size are prevailed for the selection of the number of pumps by MED for the convenience of both the procurement of equipment parts and management. A comparative study is carried out for six to nine units with a combination of different pump sizes.

c) Pump Type

The inclined shaft axial flow pump is adopted for the some reasons as mentioned in the case of Hares pumping station.

d) Pump Diameter

The following pump diameter will be adopted based on the current practice in the Study Area.

Discharge (cu.m/sec)	Diameter (mm)	Velocity (m/sec)	Discharge (cu.m/sec)	Diameter (mm)	Velocity (m/sec)
6.00~7.50	1,650	2.81~3.51	11.00~15.00	2,300	2.81~3.51
7.50~9.00	1,800	2.95~3.54	15.00~17.50	2,500	2.95~3.54
9.00~11.00	2,000	2.86~3.50			

3) Selection of Required Pump Numbers and Pump Diameter

The following two cases are examined from viewpoints of the maximum drainage discharge, the characteristics of drainage discharge and drainage canal, the size of the pump house and other structures including the construction costs and the O/M costs (refer to Appendix G).

- Case A : Overall improvement plan, new pumping station with new equipment
- Case B : Partial improvement plan, existing pumping station with overall replacement of equipment.

The expansion of pumping station will be required in order to cope with the increased drainage capacity from the viewpoint of the restrictions of space of the existing structures and also there are structural uncertainties in the existing pumping station in Case B as mentioned in paragraph 7.5.3.

a) Comparative Plan

Case	Pump Capacity (cu.m/sec/unit)	Number of Pumps (unit)	Remarks
A-1-1	17.5	6 (including 1 stand-by)	
A-1-2	14.6	7 (- do -)	
A-1-3	12.5	8 (- do -)	
A-2-1	17.5	5 (- do -)	
	8.75	2	
A-2-2	14.6	6 (including 1 stand-by)	
	7.3	2	
A-2-3	12.5	7 (including 1 stand-by)	
	6.25	2	
B-1-1	17.5	6 (including 1 stand-by)	Without expansion
B-1-2	14.6	7 (- do -)	1 unit in the additional pumping station
B-1-3	12.5	8 (- do -)	2 units in the additional pumping station
B-2-1	17.5	5 (- do -)	Without expansion
	8.75	2	
B-2-2	14.6	6 (including 1 stand-by)	
	7.3	2	In the additional pumping station
B-2-3	12.5	7 (including 1 stand-by)	1 unit in the additional pumping station
	6.25	2	In the additional pumping station

b) Design Discharge

The discharge in the El-Max pumping station is mainly the normal discharge from excess irrigation water except the rainy season in winter. The maximum design discharge of 150 cu.m/sec has an occurrence probability of once every ten years, while a normal year's maximum discharge is 128.3 cu.m/sec (in July), but when reuse is considered the value becomes 96.5 cu. m/sec. The difference between the design discharge and the maximum discharge are as follows;

Without the reuse condition : 21.7 cu.m/sec (14.5 percent of the design discharge)

With the reuse condition : 53.5 cu.m/sec (35.6 percent of the design discharge)

The maximum discharge is taken into consideration for the selection of the number of pumps with the same pump diameter.

c) Characteristics of Drainage Discharge

The maximum and minimum monthly discharges are 128.3 cu.m/sec in July and 44.1 cu.m/sec in October without considering reuse of water, while the maximum monthly discharge is 96.5 cu.m/sec in July in conditions of reuse water.

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Design Flood
Discharge A (cu.m/sec)	69.6	68.6	59.1	65.8	72.4	81.9	128.3	116.1	72.0	44.1	62.6	89.4	150.0
Discharge B (cu.m/sec)	53.2	62.4	24.8	32.9	42.9	49.1	96.5	74.7	26.2	-	42.7	66.6	

Note Discharge A: Without the conditions of reuse water
Discharge B: With the conditions of reuse water

From the above table, the minimum discharge is 29 percent of the maximum discharge without the condition of reuse water and from this it can be seen that the four-unit plan is the most advantageous. The effectiveness for each plan is examined in relation to the operation costs as shown in the table of item g). The higher value in the table shows a more economical use of power of reuse water.

d) Drain Characteristics

The drain is directly connected to the pump-house without the flood storage basin in the El-Max pumping station. Moreover, the bottom elevation of the existing canal inlet is equal to the bottom elevation of the inlet of the suction pit, so that it is necessary to deepen the inlet canal and the problems arise on the improvement of the existing canal and the prevention of sedimentation in case bigger pump size will be adopted. Accordingly, it is desirable that the new pump has the same pump size as the existing one.

e) Size of Structures

Width of Inlet Canal

The cross-sectional area of the inlet canal is fixed, considering the standard flow velocity of the canal (0.75 m/sec in front of the trashrack), the required submerged depth of the suction mouth (2×pump diameter) and the

required width occupied by a pump. The standard width of inlet canals are as follows;

Pump Diameter (mm)	Width (m)	Pump Diameter (mm)	Width (m)
1,100~1,650	3.00	2,300	4.00
1,800	3.30	2,500	4.50
2,000	3.50		

Length of Each Structures

The length of each structure is fixed, considering the required space for equipment, the required length of transition and the allowance for maintenance.

Approach Canal	:	Min. 3.00 m for the trashracks and min. 6.0 m for the stop-log
Pump Room	:	Space for mechanical and electrical equipment and operation/maintenance activities
Outlet basin	:	12.0 m in total, consisting of the spaces for flap valve, stop-log and operation/ maintenance platform

Elevation

The floor elevation of the pumping room is fixed at EL (-) 2.00 m. MSL (EL 1.30 m. MSL : existing) considering the ground level of surrounding area (EL 1.60 m. MSL), while the top elevation of concrete wall of the inlet canal is fixed at EL (-) 2.00 m. MSL (EL (-)2.00 m. MSL : existing).

Pump Building

The space for the entrance and the disassembly/repair with a span of four meter is provided on the both sides of pump room.

f) Construction Cost

The construction cost of civil/architectural structures in each case are preliminarily estimated based on rough estimates of quantities such as earth works and concrete works.

The unit prices are the same as those applied for the project cost estimates in the case of Hares pumping station, while the percentage of the direct construction costs are applied for the estimates of temporary and appurtenant work.

g) Comparison Results

Results of Comparison Study

Case	Pump			Pump Room			Effectiveness of Pump	Construction Cost	Remarks
	Diameter	Discharge	No. of Pump	Width	Length	Height			
	(mm)	(cum/s/unit)	(unit)	(m)	(m)	(m)		('000LE)	
A-1-1	2,500	17.5	6 (1)	31.0	18.7	12.0	0.95	49,400	
A-1-2	2,300	14.6	7 (1)	32.5	18.3	11.6	0.96	52,000	
A-1-3	2,300	12.5	8 (1)	37.0	17.6	11.0	0.91	56,400	
A-2-1	2,500	17.5	5 (1)	33.6	18.7	12.0	0.98	53,400	
	1,800	8.75	2						
A-2-2	2,300	14.6	6(1)	35.0	18.3	11.6	0.98	55,600	
	1,650	7.3	2						
A-2-3	1,500	6.0	5 (1)	25.2	13.5	8.7	0.91	59,600	
	1,200	3.0	2						
B-1-1	2,500	17.5	6 (1)	-	-	-	0.95	-	
B-1-2	2,300	14.6	7 (1)	5.5	18.3	11.6	0.96	45,300	1 unit in the additional p.s.
B-1-3	2,300	12.5	8 (1)	10.0	17.6	11.0	0.91	50,000	2 units in the additional p.s.
B-2-1	2,500	17.5	5 (1)	-	-	-	0.98	-	
	1,800	8.75	2						
B-2-2	2,300	14.6	6(1)	8.0	16.3	10.0	0.98	46,600	2 units in the additional p.s.
	1,650	7.3	2						
B-2-3	1,500	6.0	7 (1)	12.5	17.6	11.0	0.91	51,200	3 units in the additional p.s.
	1,200	3.0	2						

Note: The pumps in Case B-1-1 and Case B-2-1 can not be accommodated in the existing pump room because their diameters are bigger than that of the existing one.

From the above table, the following can be seen:

- The effectiveness of pumps are rather high in each case because the El-Max (2) pumping station is included in the comparative studies and it is not advantageous to select the number of pumps with the different pump diameters.
- The greater the number of pumps, the more expensive the construction costs become.
- Case B-1-2 is the most economical plan and the difference of the construction cost between Case A and Case B is about 25 percent, excluding Case A-2-3.

From the above-mentioned cases, Case A-1-2 is finally selected, considering Case A-1-1 has a problem on the bottom elevation of the inlet canal

(eg. sedimentation) and Case-B has the problem of the future of the existing structures. etc.. On the other hand, Case C, which utilize the existing pumping station and replaces only the deteriorated parts of existing equipments, can be considered as the most favorable plan; however, it was rejected for the reasons mentioned in Case B.

4) Specification of Selected Pump

- Pump
  - · Type/Number : Inclined shaft axial flow pump/seven units
  - · Design Capacity : 14.60 cu.m/sec/unit
  - · Static Head : 4.10 m
  - · Total Head : 4.50 m
- Motor
  - · Output/Number : 900kw/unit×7 units
- Ancillary Equipment : Overhead crane, flap valve, trashracks, stop-log, floor drainage pump etc..
- Electrical Facilities : Equivalent or more than the existing facilities

13. 2 Project Implementation

1) Executing Agency and Project Implementation Organization

Major components for Priority Development Project are Omoum main drain in Mariut Lake, El-Max pumping station and discharge-channel as mentioned previously. Therefore, the executing agency of the project will be EPADP and MED as the same as that of the Priority Development Area. The proposed organization chart for project implementation of the Priority Development Project is referred to Figure 10-2.

2) Project Construction Mode and Consulting Services

Construction of the project facilities will be carried out on a contract basis by selected qualified contractors, and EPADP and MED will employ

consultants to assist the executing agencies in the fields of detailed design, cost estimate, preparation of bid documents, tendering, construction work, and supervision of project implementation.

3) Preparatory Works

Construction of site facilities for the project implementation and additional survey and investigation for the detailed design constitute the major preparatory work. Detailed descriptions of additional survey and investigation are given in Table 13-1.

13.3 Implementation Plan

13.3.1 Omoum Main Drain

1) Outline of Construction Work

The improvement works of Omoum main drain include the following items;

- Construction of separation dike within Mariut Lake
- Construction of gates in the dike
- Construction of settling basin and partial improvement of Nubariya siphon

During construction work, attention should be paid to for the safety of the houses on the right embankment, especially in the section between desert road and Hares pumping station. Care should also be given to the electric posts on the left embankment.

As for access to the site, Nubariya navigation canal should be avoided, since interruption to traffic will have an adverse effect on the social and economical activities. Therefore, the following alternatives can be taken into consideration.

Table 13 - 1 Additional Survey and Investigation (Priority Development Project)

1) Pump Works

Topographic Survey

(1) Plane survey (scale 1: 500)	:	- ha
(2) Intake drain longitudinal and cross section survey	:	1.0 km

Geological Investigation

(1) Core drilling and laboratory test	:	20 m
(2) Standard penetration test	:	20 time

2) Omoum Main Drain Works

(1) Longitudinal and cross section survey	:	11.0 km
(2) Plane survey	:	0.7 ha
(3) Geological investigation		
- Core drilling and laboratory test		
· Siphon	:	30 m
· Gate	:	30 m
· Separation dike	:	20 m
- Standard penetration test		
· Siphon	:	30 time
· Gate	:	30 time
· Separation dike	:	20 time
(4) Embankment material test		
- Test pit excavation	:	5 place
- Soil laboratory tests		
· Physical test	:	15 sample
· Mechanical test	:	15 sample

3) Discharge-Channel

- Longitudinal and cross section survey	:	1.0 km
- Plane survey	:	10.0 m
- Core drilling	:	60 m

- For the work site between El-Max pumping station and Nubariya siphon, access from El-Max pumping station should be used.
- For the work site between Nubariya siphon and Hares pumping station, access from desert road point to the both embankments of the Omoum main drain should be used.

The major quantity of construction works are given below;

Separation Dike within Mariut Lake

- Civil Works
  - Crest width and elevation : B = 10 m, (-)0.90 m.MSL
  - Excavation : 1,895,000 cu.m
  - Embankment : 196,000 cu.m
  - Temporary work : 410,000 cu.m
- Road Pavement Work
  - Gravel pavement : 64,000 sq.m

Gates (7 places)

- Civil Works
  - Foundation : Reinforced concrete pipe dia. = 500 mm, L = 20 m, n = 280 nos
  - Excavation : 18,000 cu.m
  - Back filling : 6,000 cu.m
  - Reinforce concrete : 5,000 cu.m
- Gate Facilities
  - Gate-post size : Width = 8.6 m, Height = 5.7 m
  - Gate size and elevation : Width = 3.0 m, Height = 2.0 m, El = (-)3.60 m.MSL
- Weir
  - Width and elevation : B = 10.0 m, EL = (-)2.50 m.MSL

Nubariya Siphon Settling Basin

- Civil Works
  - Excavation : 64,000 cu.m
  - Embankment : 14,000 cu.m
  - Back filling : 3,000 cu.m

- Others
  - Manually operated stop-log gate : 1 set
  - Manholes : 16 nos.

In the improvement work of Omoum main drain and its related structures, the civil works including temporary work seem to be the main subjects, and they are described below.

(2) Construction Methods

- In general, construction of submerged structures be carried out with temporary coffer-dam provided around the work site, so as to prevent water from entering. In this particular case, two coffer-dams will be constructed and temporary embankment along the existing one will also be provided. The length of work site shall be 500 m at maximum. The material for coffer-dam and embankment shall be the excavated materials from Omoum main drain and Mariut Lake.

- Dewatering shall be carried out by operating shallow pumps.

- Excavation of Omoum main drain will be done with back hoe and bulldozer, and excavated materials shall be transported outside the construction site by dump truck.

- Materials for embankments will be the excavated material from Omoum main drain and Mariut Lake after drying.

- Construction of gate facilities will take place after the compaction of embankments sufficiently.

- Construction of settling basin and related structures shall take place in the same manner as described above.

13. 3. 2 Discharge-Channel and Resettlement Works

1) Outline of Construction

The construction work to improve the discharge-channel will start after the resettlement plan is satisfactorily completed. It seems that noise and vibration will not create problems in the area. Access to the site is possible from the extreme downstream on both sides.

The major items of the work may be described as follows;

- Civil Works
  - Excavation : 33,000 cu.m
  - Embankment : 200 cu.m
  - Temporary work : 19,000 cu.m
  - Steel sheet pile : 2,500 ton
  - Revetments : 12,000 cu.m

Of the construction work for the discharge-channel, temporary work, which is an essential subject in the work is described below.

2) Construction Methods

- It is unacceptable to interrupt the operations of El-Max pumping station and due to unfavorable topographical conditions it is difficult to construct a diversion channel.

- In this regard, the working place will be secured by closing half of the discharge-channel.

- Length for one work will be as long as 100 m, and work shall be started from downstream side.

- Special care should be given to the oil pipelines crossing the discharge-channel to protect them from damages during the work.

- Two bridges in the extreme downstream area need to be removed, therefore, proper discussion with related agencies should be done making sure of replacement.

13. 3. 3 El-Max (1) Pump Facilities

1) Outline of Construction

The El-Max pumping station is located on the lower reaches of the Omoum main drain and the new El-Max (1) pumping station is constructed on the north-east side of the existing El-Max (2) pumping station. The old pumping station is located at the rear side of the new El-Max (1) pumping station and is to be demolished after the completion of the new El-Max (1) pumping station. Construction work will encounter no problems nor cause any naissance for public. The only inconvenience is the rather narrow size of the construction site itself.

The main items of the works are as follows;

-	Mechanical works	: ø2,300 mm, inclined shaft axial flow pump, 7 units
-	Electrical works	: 900 kw, three phase wound rotor type induction motor, 7 units
-	Civil/architectural works	
	Dimensions of sub-structures	: Width 32.5 m, Length 47.1 m, Height 11.6 m in maximum
	Ground level	: The existing = EL (-) 1.60m. MSL the excavated = EL (-) 10.00m. MSL
	Groundwater level	: Delivery water level = WL 0.80m. MSL Omoum Main Drain = WL (-) 2.80m. MSL
	Excavation volumes	: 28,800 cu. m
	Back fill	: 14,400 cu. m
	Concrete	: 5,500 cu. m
	Dimensions of super-structure	: 40.5 m × 18.3 m = 741 sq. m

The construction of sub-structures is an important issue during the execution of the above-mentioned works. Therefore, the construction methods of sub-structures are described below.

2) Construction Methods and Sequence

The high ground water level is the most serious problem to be dealt with in the construction work.

- The soils involved are mainly composed of classic sandy soils with soft clay layers 1.0 m deep at around GL (-) 5.0 m. The soils deeper than GL (-) 6.0 m are composed of sand layers and N-value is more than 30.
- The sheet pile method will be introduced as counter-measures against ground water and earth sheathing (Top elevation of sheet pile EL (-) 2.00 m, Length of sheet pile : 15.0 m). The dewatering pump with pits will be employed for the temporary drain. A hydraulic vibro-hammer will be employed for the pile-driving.
- The back-hoe will be employed for the upper layer excavation, while the dragline will be used for the lower layer excavation. The excavated materials will be transported to the designated spoil bank by dump trucks.
- The ready-mixed concrete will be employed and poured by the truck crane with buckets.
- The remaining portion of the old El-Max pumping station will be demolished during or after completion of the new pumping station.

3) Construction Schedule

The overall construction period is about 18 months. The preliminary estimated time for each activity is as follows:

Site preparation work	:	1 month
Sheet piling work	:	1 month
Excavation work	:	4 months (42,800 cu.m ÷ 500 cu.m/day)
Concrete work	:	5 months (5,300 cu.m ÷ 40 cu.m/day)
Super-structure work	:	4 months
Equipment installation work	:	2 months
Site cleaning/removal	:	1 month
Total	:	18 months

13. 4 Implementation Schedule of the Project

The project will be implemented over seven years from 1996 to 2002, consisting of such works as the evaluation of the project by the Egyptian Government, economic viability, loan procedures, detailed design and civil construction work. The implementation schedule of the project is given in Figure 13-3.

The implementation ranking for facility improvement would be as follows; the El-Max pumping station (No.1) be first implemented, followed by discharge-channel and Omoum main drain, from view point of urgency and necessity for facility improvement. It is worth to mention that MED is preparing all formalities in order to replace the El-Max pumping station (No.1)

13. 5 Operation and Maintenance Plan

1) Operation and Maintenance Organization

Operation and maintenance works of project facilities will be carried out by the EPADP and MED as same as those of Priority Development Area. Its organization is shown in Figure 13-4.

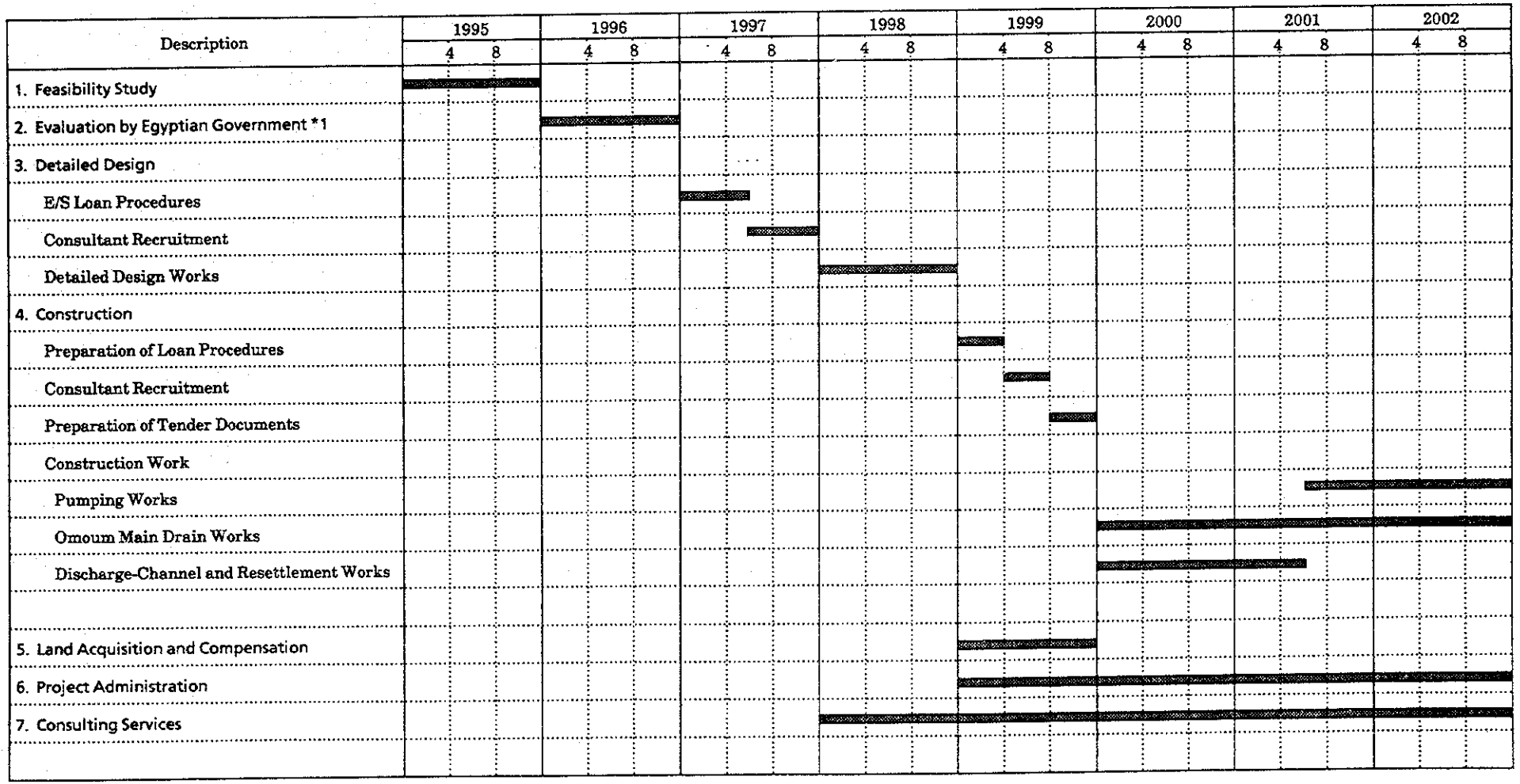
2) Operation and Maintenance Plan

Major operation and maintenance works of the project are the operation and maintenance of project facilities such as pumps and gates to be provided on the separation dike of the Omoum main drain. In these works, due attention should be paid to the El-Max pump operation considering the proposed maintained water level of Omoum main drain of (-) 3.25 m below mean sea level.

3) Operation and Maintenance Costs

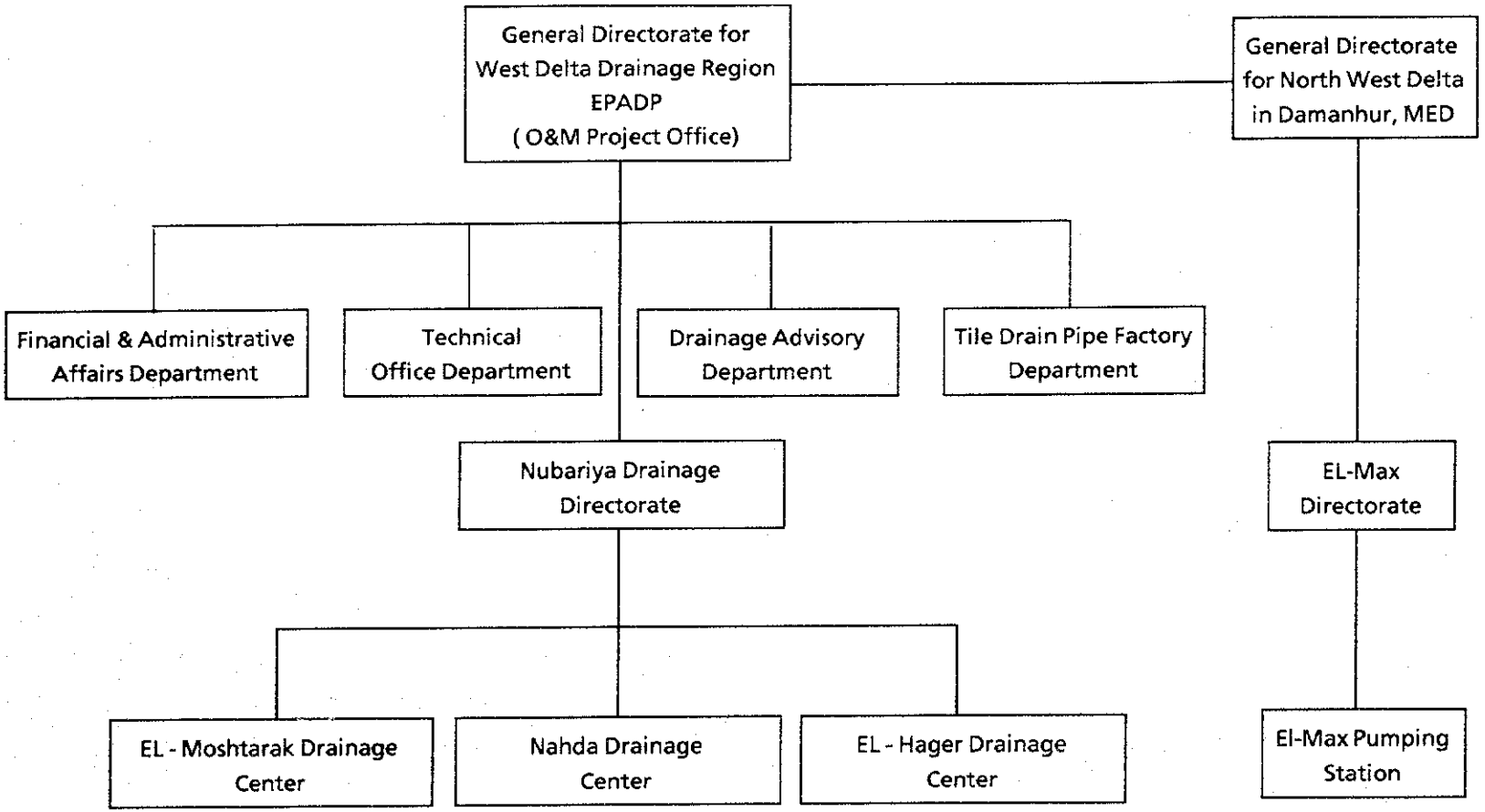
Operation and maintenance costs are estimated at about 1.83 million Egyptian Pound (LE) per annum, as shown below;

FIGURE 13 - 3 IMPLEMENTATION PROGRAM FOR THE PROJECT (PRIORITY DEVELOPMENT PROJECT)



*1 Including environmental aspects and economic viability

FIGURE 13 - 4 PROPOSED ORGANIZATION CHART FOR O & M OF PROJECT FACILITIES



Operation and Maintenance Costs

Description	Annual O & M Costs
	('000 LE)
Salary and wage	230.8
Administration and general expenditure	23.1
Pump operation cost	779.3
Equipment repair and maintenance cost	368.0
Fuel cost	9.6
Omoum main drain maintenance cost	402.2
Office maintenance cost	20.1
Total	1,833.1

Note: Details are shown in Table H-2-22, Annex H..

13. 6 Project Costs

The project costs exclusive of price escalation are estimated at 151.8 million Egyptian Pound (LE) on the basis of the same cost estimation conditions mentioned in the priority development area. Detailed cost estimation and components of the project costs are given in Table 13-2 and Figure 13-5.

The annual disbursement schedule of the project costs is shown below;

Disbursement Schedule of the Project Costs

(unit : '000 LE)

Year	Foreign Currency	Local Currency	Total
1998	6,990	3,310	10,300
1999	900	460	1,360
2000	26,880	13,080	39,960
2001	39,370	21,230	60,600
2002	55,490	30,470	85,960
Total	129,630	68,550	198,180

Detail estimation is given in Table H-2-21, Annex H.

FIGURE 13 - 5 PROJECT COST COMPONENTS (PRIORITY DEVELOPMENT PROJECT)

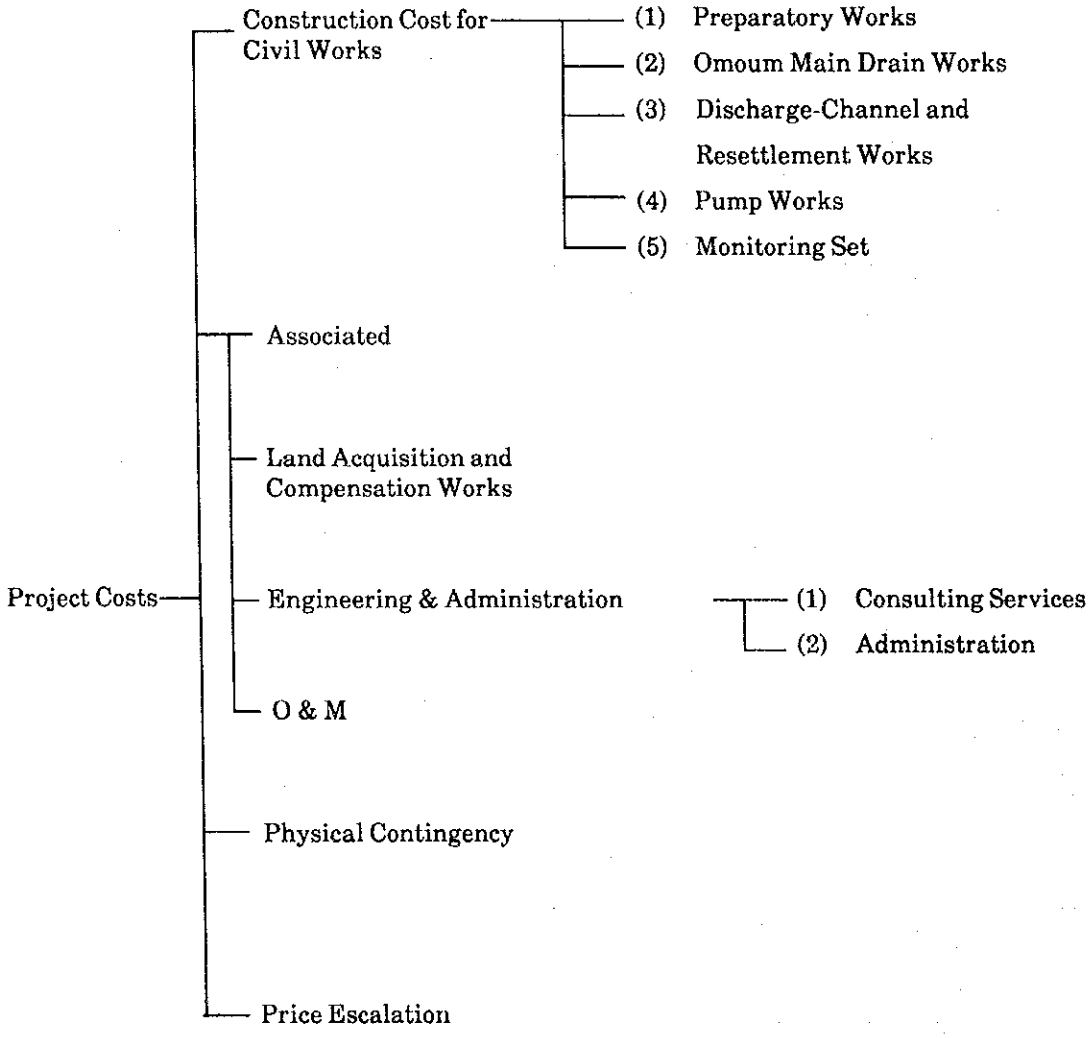


Table 13-2 Project Costs (Priority Development Project)

(unit: '000 L.E)

Descriptions	F/C	L/C	Total
1. Construction Works			
1.1 Preparatory Works	70	410	480
1.2 Omoum Main Drain Works	32,970	10,830	43,800
1.3 Discharge-Channel and Resettlement Works	15,510	2,770	18,280
1.4 El-Max Pumping Station	41,700	10,330	52,030
1.5 Monitoring Set	250	100	350
Sub-total	90,500	24,400	114,940
2. On-Farm Development and Subsurface Drain Works	-	-	-
3. Land Acquisition and Compensation Works	-	-	-
4. Engineering and Administration Works			
4.1 Consulting Services	9,070	7,470	16,540
4.2 Administration	1,420	1,420	2,840
Sub-total	10,490	8,890	19,380
5. O & M Equipment	3,200	480	3,680
6. Total (1 - 5)	104,190	33,810	138,000
7. Physical Contingency (10%)	10,420	3,380	13,800
8. Total (6 - 7)	114,610	37,190	151,800
9. Price Escalation	15,020	31,360	46,380
10. Grand Total (8 - 9)3	129,630	68,550	198,180

* Details of cost estimation are given in Annex H.
Project costs by executing agencies are shown below;
- Ministry of Public Works and Water Resources
  - EPADP : $108,090 \times 10^3$ LE
  - MED : $90,090 \times 10^3$ LE
  Total : $198,180 \times 10^3$ LE

13.7 Project Evaluation

As mentioned in the previous paragraph, the Major project facilities of the priority development project are improvement of El-Max pumping station, Omoum main drain within Mariut Lake, which involves a separation dike and control structures such as gates/weirs to be provided on the dike, and discharge-channel. Since these project facilities are located in the extreme downstream reaches of the Study Area, project evaluation should be analyzed based on the expected project benefits obtained from the whole Omoum Area and the required project costs for drainage improvement in the Area.

13.7.1 Project Benefits

The Priority Development Project is scheduled to be implemented by the end of 2002, the same time as the Priority Development Area. Through project implementation, the water level of Omoum main drain will be lowered to around 50-60 cm compared with present water level. The construction of major project facilities will also lower the water level of the main drain in each block, which will surely result in partial drainage improvement at farm level.

Although project benefits are basically planned to reach its full target within four year after project implementation, it is proposed in the study that partial project benefits will be realized at the beginning of 2003, taking into account the situation mentioned in the above. Figure 13-6 shows the project implementation schedules in each block and their target year to reach full benefits.

Financial and economic benefits during the project life of 50-years are estimated as shown below;

Project Benefits

Benefits	Crop Benefits	Flood Damage Reduction Benefits	Total
	(mill. LE)	(mill. LE)	(mill. LE)
- Financial Benefits	208.56	3.17	211.73
- Economic Benefits	242.89	3.17	246.06

Note; Details are given in Table I-2-49, Annex I.

FIGURE 13 - 6 PROJECT IMPLEMENTATION FOR SHORT-TERM DEVELOPMENT IN STUDY AREA

Drainage Block	Drainage Area		Implementation Period								
			1998	1999	2000	2001	2002	2003	2004	2005	2006
	(ha)	(feddan)									
Priority Dev. Project	9,410	(22,440)									
Qalla Area	5,880	(14,000)									
Abis Area	3,780	(9,000)									
Hares Area	26,600	(63,330)									
Dishudi Area	15,330	(36,500)									
Truga Area	43,080	(102,570)									
Shereshera Area	56,720	(135,060)									
Abu Hommos Area	19,910	(47,400)									
Total	180,710	(430,260)									

Note; Above annual disbursement costs are estimated based on the following implementation schedule

Drainage Block		Start of Generating Benefits	Reach of Full Benefits
Qalla Area	:	2003	2008
Abis Area	;	〃	2009
Hares Area	;	〃	2007
Dishudi Area	;	〃	2009
Truga Area	;	〃	2010
Shereshera Area	;	〃	2014
Abu Hommos Area	:	〃	2014

13. 7. 2 Economic Project Costs

1) Economic Project Costs

Construction works for the overall project in the Omoum Area inclusive of priority development area will be implemented during a period of nine years from 1998 to 2006 as shown in Figure 13-6. The procedures and ways to estimate the economic project costs are the same as those of priority development area with due attention being paid to the following points.

- As mentioned previously, major project facilities of the priority development project are situated at the extreme downstream reaches of the Study Area, so that implementation of the priority development project will certainly bring benefit to the whole Omoum Area. Therefore, regarding project costs for project evaluation, necessary project costs concerning drainage improvement in the area should be counted. In this connection, results of cost estimation for priority development area and project are utilized for estimating such project costs for Omoum Area (see Table I-2-52 , Annex I).

- As same with the Priority Development Area, costs for irrigation improvement are counted in the project costs applying a unit cost of 366 LE/ha (872 LE/ha), which is an average cost of West Nubariya Agricultural Intensification Project (see Table I-2-54 , Annex -I).

- Economic costs are estimated multiplying the Standard Conversion Factor (SCF) of 0.87 by financial costs of the project, as shown below;

Economic Project Costs for Omoum Area

(unit : mill.LE)

Description	Total Costs	Implementation Period								
		1998	1999	2000	2001	2002	2003	2004	2005	2006
Foreign Costs	568.83	15.29	3.46	63.54	86.33	102.97	87.45	128.13	78.56	3.10
Local Costs	243.80	6.56	1.48	27.23	37.00	44.13	37.48	54.92	33.67	1.33
Total	812.63	21.85	4.94	90.77	123.33	147.10	124.93	183.05	112.23	4.43

Note; Details are given in Table I-2-55 , Annex I.

2) Operation and Maintenance Costs

Operation and maintenance (O&M) costs in each drainage block are estimated based on the Project Area O&M costs, and O&M costs for priority development project are allocated to the agriculture sector on the basis of sharing ratio of drainage discharge, that is, 70 percent for agricultural sector. Estimated O&M costs are converted to economic O&M costs, and total 12,262 thousand LE, equivalent to 30 LE/feddan (72 LE/ha) (see Table I-2-56, Annex I.)

3) Replacement Costs of Related Equipment

The related equipment such as pumps and gates in the whole Omoum Area should be replaced at every 25 years, which is assumed to be the durable period of the equipment. However, installation year of each pumping facility is different from pumping station. And also since construction costs of the facility are not clear at present, replacement costs of each pumping facility are estimated based on the Hares and El-Max pumping facility costs.

Regarding replacement costs of El-Max pumping facilities, the costs are allocated to agricultural sector depending on the sharing of drainage discharge, and converted to economic costs applying a Standard Conversion Factor of 0.87. Estimated economic replacement costs are shown below;

Economic Replacement Costs

(unit: '000 LE)

- Priority development project				
El-Max pump (new)	:	LE	24,786	(2022) 1/
El-Max pump (No.2)	:	LE	17,705	(2008, 2033)
Gate	:	LE	1,995	(2022)
- Qalla pump	:	LE	7,395	(2015, 2044)
- Abis pump	:	LE	3,993	(2015, 2044)
- Hares pump	:	LE	22,185	(2022)
- Dishudi pump				
Dishudi pump(old)	:	LE	11,832	(2014, 2039)
Dishudi pump(new)	:	LE	2,958	(2022)
- Truga pump				
Truga pump(old)	:	LE	26,622	(2014, 2039)
Truga pump(new)	:	LE	2,958	(2022)
- Shereshera pump	:	LE	29,580	(2002, 2027)

- Abu Hommos pump : LE 18,488 (2015, 2040)

Note; Figure in parentheses shows the year of replacement.

13. 7. 3 Internal Rate of Return

Economical internal rate of return (EIRR) for the priority development project became 17 percent, while 15 percent of financial internal rate of return (FIRR).

Both rates of return are substantially higher than the social economic opportunity cost of the Egyptian Planning Agency.

13. 7. 4 Sensitivity Analysis

Three cases of sensitivity analysis were performed, namely crop benefits will be down by 20 percent, the project implementation will be delayed for two years, and the project costs will be increased by 20 percent.

A summary of these analyses is shown below;

	FIRR (%)	EIRR (%)
- Benefits 20 % up :	11.9	13.7
- Two year delay of construction :	11.9	13.3
- Project costs 20 % up :	12.3	14.1

13. 8 Improvement Plan for the Most High Priority Project

As described in the paragraph of 13.4 "Implementation Schedule of the Project", out of the Priority Development Project such as improvement of El-Max pumping station (No.1), discharge-channel, and Omoum main drain, improvement of El-Max pumping station is currently under progress by the MED. Therefore, the drainage facilities to be improved with the most high priority could be described as follows;

Namely, regarding discharge-channel it should be improved with the first priority since its flow capacity is absolutely deficient with only 60 cu.m/sec, while the design flood discharge of discharge-channel is 150 cu.m/sec. Furthermore, Omoum main drain of about 10 km within Mariut Lake should be separated from Mariut Lake by means of embankment dikes along with the Lake, in order to expect not only the improvement of farmland drainage conditions in the Study Area and living environment in rural area, but also water quality conservation of Mariut Lake.

On the other hand, Hares pump facilities in the Priority Development Area should also be improved with a replacement of new pumping station because of its serious deterioration of pump facilities.

Following gives the outline of improvement plan for the most high priority development project in the Area.

Outline for the Most High Priority Improvement Project

Items	Priority Development Project	Priority Development Area
1. Project Facility	Improvement of discharge-channel and Omoum main drain · Discharge-channel (L=0.6 km) · Omoum main drain (L=10 km)	Improvement of Hares pumping station · Q=30 cu.m/sec
2. Objective Area	180,710 ha	26,600 ha
3. Benefited Person	1,138 thousand	96 thousand
4. Related Agency	EPADP	MED
5. Project Costs	198 million LE	65 million LE
6. Expected Benefits	17 million LE	

In the above table, project costs for the Priority Development Project include the required improvement costs for El-Max pumping station.

On the other hand, estimation of the expected benefits mentioned above was conveniently made by multiplying the expected increasing ratio (8.0 percent) of drainage discharges to be caused by lowering water level of Omoum main drain by the estimated financial benefits of 211.73 million LE, which will be created by drainage improvement in the whole Study Area mentioned in the paragraph of 13.7.1.

Estimation of increasing ratio of drainage discharges was made based on the following considerations;

Pumping Station	Present Delivery Water Level (1)	Proposed Delivery Water Level (2)	Difference (1) - (2)
	(MSL.m)	(MSL.m)	(m)
Abis Pumping Station	(-) 2.70	(-) 3.09	0.39
Hares P.S	(-) 2.80	(-) 3.03	0.23
Dishudi P.S	(-) 2.63	(-) 3.02	0.39
Shereshera P.S	(-) 2.60	(-) 2.35	0.35
Truga P.S	(-) 1.60	(-) 2.09	0.49
Abu Hommos P.S	(-) 0.80	(-) 1.93	1.13
			Ave. 0.50 m

Note; Proposed delivery water level at each pump station shows the water level in case of the with-reuse plan

An average increasing ratio of drainage discharge owing to the lowering water level of Omoum main drain can be estimated at 8.0 percent applying Hares pump's performance curve as shown below;

Items	Actual Pump Head	Pump Discharge
Present Pump Discharge	Ha = 3.2m	Q = 8.0 cu.m/sec (100%)
Proposed Pump Discharge	Ha = 2.7m	Q = 8.6 cu.m/sec (108%)

CHAPTER XIV. ENVIRONMENTAL STUDY FOR HARES AREA

CHAPTER XIV ENVIRONMENTAL STUDY FOR HARES AREA

14. 1 Present Conditions of Hares Area

The Hares Area, located on the left bank, downstream of the Omoum main drain, is required to be developed urgently by overcoming unfavorable environmental conditions from excessive water. Under the circumstances, the Project has taken up this area with high priority for development, and the major characteristic features of the Area can be shown below;

- The Hares Area, topographically, a plain and mostly covered with sandy loam soil, is suitable for farming, but agricultural development of the Area has been left behind with low productivity due to water-logging and salinization because of high groundwater table.

- The land-use of the total Area of about 63,330 feddan (26,600 ha) consists of 53,920 feddan (22,650 ha, 85 %) of arable land and 9,410 feddan (3,950 ha, 15 %) of village and other area.

- Most of the Area is below mean sea level, and all drainage or elimination of water is fully dependent on pumping operations. The areas provided with subsurface tile drains for drainage is only about 500 feddan (210 ha), which is below one percent.

- The Area is in the arid zone with annual mean temperature of over 20 degrees Celsius and annual rainfall below 200 mm, so that the agriculture cannot be carried out without providing irrigation and drainage facilities.

- The Area extends in the low-lying land and is prone to flood damage requiring urgent provision of an efficient drainage system.

- The road networks in the Area are very low in density, and production activity is very poor; particularly, no vehicles, apart from tractors are available during the winter season between December and February.

- Development of the Area began only about 25 years ago, which may be considered as very late in comparison with the other areas as there were only a few villages located sporadically in the Area.

- Poor-drainage has caused stagnant water in the Area which has caused an endemic disease called Bilharzea.

14. 2 General Descriptions of the Project

Farmland Environment Improvement Project in Hares Area aims at upgrading of the rural living standard through improvement of the rural environment with drainage systems and to activate the farming productivity. The Project contains the following features.

- Project Area : 63,300 feddan (26,000 ha)
- Pumping facility improvement : one site.
- Main and lateral drain improvement
  - . Main drain : 24.0 km
  - . Lateral drain : 112.6 km
- Subsurface tile drain : 53,330 feddan (22,400 ha)
- Road improvement
  - . Gravel road : 99.0 km
  - . Asphalt road : 26.0 km

14. 3 Future Environmental Conditions with the Project

The Project will have a considerably effect on the rural environment to vitalize not only farm productivity but also the living standards in the rural area. The major effects can be outlined as follows;

- The improvement of both the main and lateral drains in the Area will enable surplus water to be smoothly drained to keep the groundwater table low, and the water environment of the Area will be greatly improved.

- The installation of a subsurface tile drain system will enable the farm land in the area to be improved; especially, the subsurface tile drain system will allow the farmland improvement to be maintained including soil salinity elimination together with keeping the groundwater level adequate.

- Capacity increase of the pumping facilities will enable the surplus water collected through open drains or subsurface tile drains to be

drained smoothly, the flood damages to be mitigated, and the groundwater table to be controlled along with proper plan through an effective operation of the facilities.

- Improvement of the road networks can increase local farm productivity as well as transportation of daily necessitities, commuting to offices and schools to be convenient, so that the rural social life can be favorably affected.

14.4 Environmental Study

As mentioned in the above paragraphs, the impacts on the local environment by the Project are those which are absolutely positive and favorable and will never give adverse effects to the natural and social environment in the locarity.

The effects on the water quality resulting from soil salinity elimination are considered not so serious, in taking into consideration the fact that the salinity concentration in the Hares Area is currently found as high as the between 11 and 13 mS/cm and Mariut Lake water is as brackish with the same level of salinity.

Although the Project as a whole will have a positive impact, there exist some problems to be solved in the field of the environment outside the Project works. They are;

- Control of endemic disease of Bilharzea and Schistosomiasis,
- Effects on irrigation water quality by reuse of drainage water and the relationship with Mariut Lake water quality, etc.

The proposals prepared herein will not accelerate the aforesaid negative factors, but help to correct these problems. According to the Appraisal Report by the World Bank (Irrigation Improvement Project, December 1994), the responses to the above matters are given as follows;

Control of Bilharzea and Schistosomiasis

The patients with Schistosomiasis are about 30 percent of the inhabitants in Behera Governorate. Ministry of Health (MOH) has been taking countermeasures in dosing oral medicines as chemical control, destruction of the related shellfish, and thorough education for improved sanitation.

Chemotherapy is most familiar in very many countries in the world, and the MOH has received an amount of contribution from various parts of the world to obtain a success rate of 95 percent and over by this oral dosing of pills. And the environmental control plan does not include the necessary budget for this activity. Because the MOH considers that the adverse effects of the chemicals for destruction of the parasite shellfish will be serious to the local environment, and had drastically reduced the amount of chemicals dosed from 300 tons in 1980 to 30 tons in 1993.

The dosing of the destructive chemicals will be resumed only when the patients' rate of the disease becomes over 30 percent of the inhabitants in the Area. Further thorough control is desired, although chemical control has been carried out for the other items as fertilizers and agro-chemicals.

Problem of Reuse of Drainage Water

At present, about 400 MCM of drainage water have been reused as irrigation water in the Area. MPWWR has been promoting new reuse plan for drainage water, and in the year of 2000, it is planned to reuse about 1,000 MCM of drainage water .

Although the reuse programme for drainage water will increase water availability for irrigation in quantity, it will lead to a decrease in quality level. Since, however, the objective areas for the reuse programme extend downstream from the existing and proposed reuse pumping station sites, the plan will not give any serious effects to the irrigation water.

In other respects, DRI has been keeping a continuous monitoring on salinity contents and SAR in the irrigation and drainage water based on the records available through the observation networks arranged in the wide

region. And recently, DRI has started observation, monitoring, etc. on the quality of water drained from factories and sewerage.

Problems on Polluted Water by Factories and Kitchen Sewerage

The drain running north of Kafr El-Dawar town receives waste water from factories and kitchen sewerage. The factories draining waste water are spinning factories. It is important in view of maintenance of clean water as well as the public sanitation to treat untreated factory waste water and kitchen sewerage. Although such monitoring and treatment of the this waste water has no direct relations with the irrigation and drainage project works, the treatment work has a deep relation with environmental problem in the future development plans in the downstream areas.

Therefore, the monitoring results are considered important in playing a vital role as environmental indices as the first step for the future development works. MPWWR has agreed the environment assessment including recommendations and persuasions that the waste from the factories and kitchen sewerage should be treated before discharging to the drains. The environmental assessment should be carried out based on a variety of results available by monitoring and analysis of drainage water for two years.

From the viewpoint of the reuse of drainage water, waste water treatment at District such as Abu El-Matameer, Hosh Esa, etc. located upstream from the water intake for the reuse pumping facilities, is indispensabe.

CHAPTER XV. RECOMMENDATIONS

CHAPTER XV RECOMMENDATIONS

15. 1 Recommendations for Master Plan Study

1) Improvement of Water Management

The inefficient irrigation system along with inadequate drainage, causes many problems such as shortage of water, water-logging, increased salinization and increased O&M costs in the Study Area. Therefore, an urgent need to improve this situation is essential. In this regard, recommendations are made to work in close cooperation with the relevant Government agencies inclusive of farmers and to establish/strengthen the farmers' organizations even up to the on-farm level, and prepare technical guidelines for land-use, crop husbandry, water distribution and O&M of drainage facilities.

2) Reuse of Drain Water

The present annual amount of reuse water is 570 MCM, which is mixed with Nubariya canal water and used for Omoum and Western Desert areas. After the completion of the Omoum Drain Project this amount will become 1,650 MCM, which will mean a 73 percent use of total available drain water. However, in the future, in a situation of possible water scarcity, the reuse of drain water must be managed paying close attention to quantity and quality.

3) Improvement of Subsurface Drainage Facilities and Their Design Criteria

In about 44 percent of the Study Area, mainly upstream, installation of subsurface drainage has been completed. But it was reported that some areas are still not getting the expected benefits due to the ineffectiveness of the drainage. At present, a Pilot Project has been taken up by DRI of MPWWR and research is being conducted on appropriate design criteria and their effectiveness, installation costs and suitable envelop materials etc. Based on the outcome of this research, improvement of subsurface drainage including existing facilities is recommended.

4) Selection of Salinity Tolerant Crops

From the viewpoint of efficient use of water sources, reuse of drain water is taking place, maintaining salinity level after mixing of 700 ppm (EC is 1.1 mS/cm). From which a conclusion may be drawn that this level has no adverse effects on the crops that are currently be grown. However, crops such as onion, carrot, etc. need an EC value less than 1.0 mS/cm for healthy growth. Therefore, selection should be made excluding the above mentioned crops.

5) Improvement of Farming Technology, Crop-husbandry and Supporting Services

From the viewpoint of more arable land and intensified agriculture followed by increased crop production, activities such as drainage improvement, farmland consolidation, an efficient water management system, training for O&M of drainage facilities and research through the establishment of farmers' organization are recommended.

6) Urgent Improvement of Drainage Facilities

In order to obtain the fruitful results from the Farmland Environmental Improvement Project in Omoum Area, the improvement of pumping stations, Omoum main drain and drains in the blocks, on-farm drainage facilities and improvement of subsurface drainage facilities are involved from the viewpoint of hardware, along with the improvement of water management technology mentioned above from viewpoint of software. However, due to the following reasons, the El-Max pumping station, Omoum main drain and descharge-channel are recommended for urgent improvement work as a package project (Priority Development Project).

- It is assumed that the separation of Omoum main drain from the Mariut Lake is necessary from the viewpoint of a suitable water level in the drain that will ensure a smooth passage for drainage water from the area, conservation of water quality and better fishery activities in the Lake.

- In fact, the El-Max pumping station is the only facility that deals with such a huge amount of water coming from the Study Area by pumping out to the Mediterranean Sea. Out of two pumping stations, No.1 and No.2, No.1 pumping station was installed 31 years ago i.e. in 1963 and it was reported that the maintenance costs have become a burden for the related Department. From the view stated above and for the following vital roles, the importance of improving of No.1 pumping station will be realized.

    - The importance may be realized from the necessity of 24 hours-operations for draining water to Mediterranean Sea. In winter, especially, from November to February, drainage of runoff generated in the Study Area is solely dependent on this pumping station. In case of floods, to protect public facilities such as railway roads, water supply lines, gas lines etc., safe and effective operation of drainage capability will be essential.

    - Another important function which is draining of water stored in Mariut Lake is also performed by this pumping station which helps to keep the water quality reasonable.

7) Phased Development

The implantation of the Farmland Environmental Improvement Project in Omoum Area should take place in a phase-wise manner. The components of the Project should be categorized as Short-term, Middle-term and Long-term on the basis of their urgency, quantity and scale of works, economy etc.

8) Environment

At present, the major inflows to Mariut Lake are drainage water from surrounding farmland and primarily treated sewage and industrial waste water from Alexandria city. The major pollutant of the Lake is the sewage water from Alexandria city.

To conserve the environment of Mariut Lake, eradication of pollution sources, elimination of accumulated sludge and some biochemical treatments are recommended. In this connection, the worst part of the Lake, especially the eastern part of the Lake, may be declared abandoned and restrictions on eating

fish from that part of the Lake should be imposed. It is also desirable for the Government to execute overall environmental countermeasures for the successful environmental conservation in the vicinity of the Study Area.

15. 2 Recommendations for Feasibility Study

1) Recommendations for Project Implementation

- Justification of the Project

  It is clear that the construction of project facilities for the Priority Development Area and Project will impact positively on the rural environment, crop production, farmers' income and regional economy. On the other hand, EIRR of these Projects are 19 and 17 percents respectively, and are also higher than 12 percent, the Egyptian opportunity cost of capital. From the above mentioned facts the Projects are justified to be feasible from technical and economical viewpoints. Therefore, an early implementation of the Project is recommended.

- Urgency of Priority Development Project

  In order to realize project benefits, construction of the separation dike within Mariut Lake is a prerequisite. Therefore, implementation of Priority Development Project should be considered as a first priority. It is noteworthy to mention that MED is preparing all formalities in order to replace El-Max pumping station (No.1).

2) Recommendations for Detail Design and Construction of the Project

The subject Feasibility Studies have been carried out based on the topographic map with the scale of 1/50,000 and various data/information collected during the field works. The detail design and implementation of the Project should be carried out emphasizing on the following matters;

- Coordination among the Implementing Agencies

  EPADP and MED are the two main implementing agencies for the subject Projects. For an efficient implementation of detail design and construction, close coordination of these two agencies as well as Ministry of Agriculture, Land Reclamation and Fishery is very essential.

- Additional Survey, Investigation and Data Collection

  During the detail design stage, additional survey, investigation and more data collection will be required. A brief list of them is given below;

Preparation of Maps

- Plane survey (scale 1/500), longitudinal and cross-section survey at Hares pumping station site,
- Longitudinal and cross-section survey for Hares main drain,
- Plane survey (scale 1/500) at El-Hager feeder canal siphon site,
- Plane survey (scale 1/5,000) for on-farm development and subsurface tile drain,
- Plane survey (scale 1/500) and longitudinal and cross-section survey at El-Max pumping station site,
- Longitudinal and cross-section survey for Omoum main drain,
- Plane survey (scale 1/500) for gates and weir in separation dike,
- Plane survey (scale 1/500) for discharge-channel

Geological Investigation

- Core-drilling, laboratory and standard penetration tests at Hares pumping station site,
- Core-drilling, laboratory and standard penetration tests at El-Hager feeder canal siphon site,
- Core-drilling, laboratory and standard penetration tests at Nubariya siphon, gate and separation dike site,
- Borrow pit survey and embankment material tests for separation dike,
- Core-drilling for discharge channel,

Soil Survey

- Auger boring and chemical tests in the Project Area

- Design of Subsurface Tile Drains

  The design of subsurface tile drains such as spacing of lateral drains, location of collector drains and selection of suitable envelopment materials should be made based on the research results at Hares Pilot Area under DRI.

- Implementation of West Nubariya Agricultural Intensification Project

  In order to achieve targeted agricultural crop production increase in the Project, it is essential that effective water utilization and appropriate water management in the Area should be performed together with the drainage improvement. Under the circumstances, implementation of West Nubariya Agricultural Intensification Project aiming at improvement of irrigation systems in the area should be implemented simultaneously during the drainage improvement period of the Project.

- Improvement of Discharge-Channel

  The improvement of discharge-channel immediately downstream of El-Max pumping station will require the resettlement of 135 households living on the banks of the channel. In order to implement the resettlement works smoothly and effectively, understandings by these inhabitants on the banks are essential, which will be obtained through sufficient explanation of the objectives of the Project.

3) Recommendations on Raising Project Benefits

During and after implementation of the Project, the following conditions should be fulfilled for raising the project benefits smoothly and steadily.

- Effective Utilization of Irrigation Water Sources

  The areas covered by Nubariya main irrigation canal, in which the Project Area is included, are considered to have periodical water shortage area even in future, so that it is essentially required to improve irrigation facilities inclusive of the on-farm level such as subsurface tile drains for reaching the target of agricultural production through successful water source utilization under effective and efficient water management. Regarding the training these water management, relevant farmers' groups should also be involved.

- Type of Discharge Control Facilities and Operation Rule

  For the purposes of discharge control for water level and water quality conservation of the Mariut Lake, seven discharge control facilities are proposed in the Project. The structures of the facilities are orifice type equipped with gates and weirs considering their easy operation and

maintenance. Although seasonal operation rules of these facilities are proposed as a basic criteria applicable for normal year, according to circumstances such as abnormal flood and drought years, more frequent operation should be done on the basis of 10-day or bi-weekly.

- Development of Upland Farming Technology

Following items for upland farming technology should be developed to attain project target effectively.

- Improvement of salinized and sodicated soils with monitoring the progress of improvement,
- Fertilizer requirements on the basis of nutrient deficiency and improvement of cultivation method,
- Crop rotation systems for cultivation of vegetable and other crops to avoid growth retardation by continuous cropping.

- Provision of Agricultural Supporting Services

Egyptian Authority of Drainage Project (EPADP) and Ministry of Agriculture, Land Reclamation and Fishery (MALRF) have to provide/organize the following agricultural supporting services;

- Farmers' participation in drainage improvement project by establishing and managing Drainage Users' Associations from the planning stage of subsurface tile drains,
- Training of MFLRF agricultural extension staff on the technology to develop farm production through improvement of drainage and soil conditions,

- Monitoring of Water Quality of Omoum Main Drain and Mariut Lake

According to the Omoum Drain Project, which is one of the major reuse project in the vicinity of the Project Area, about 996 MCM of drainage water from the Omoum main drain will be utilized as irrigation water sources in the West Nubariya area. In that case, it will be necessary to monitor the volume and quality of the reuse drainage water.

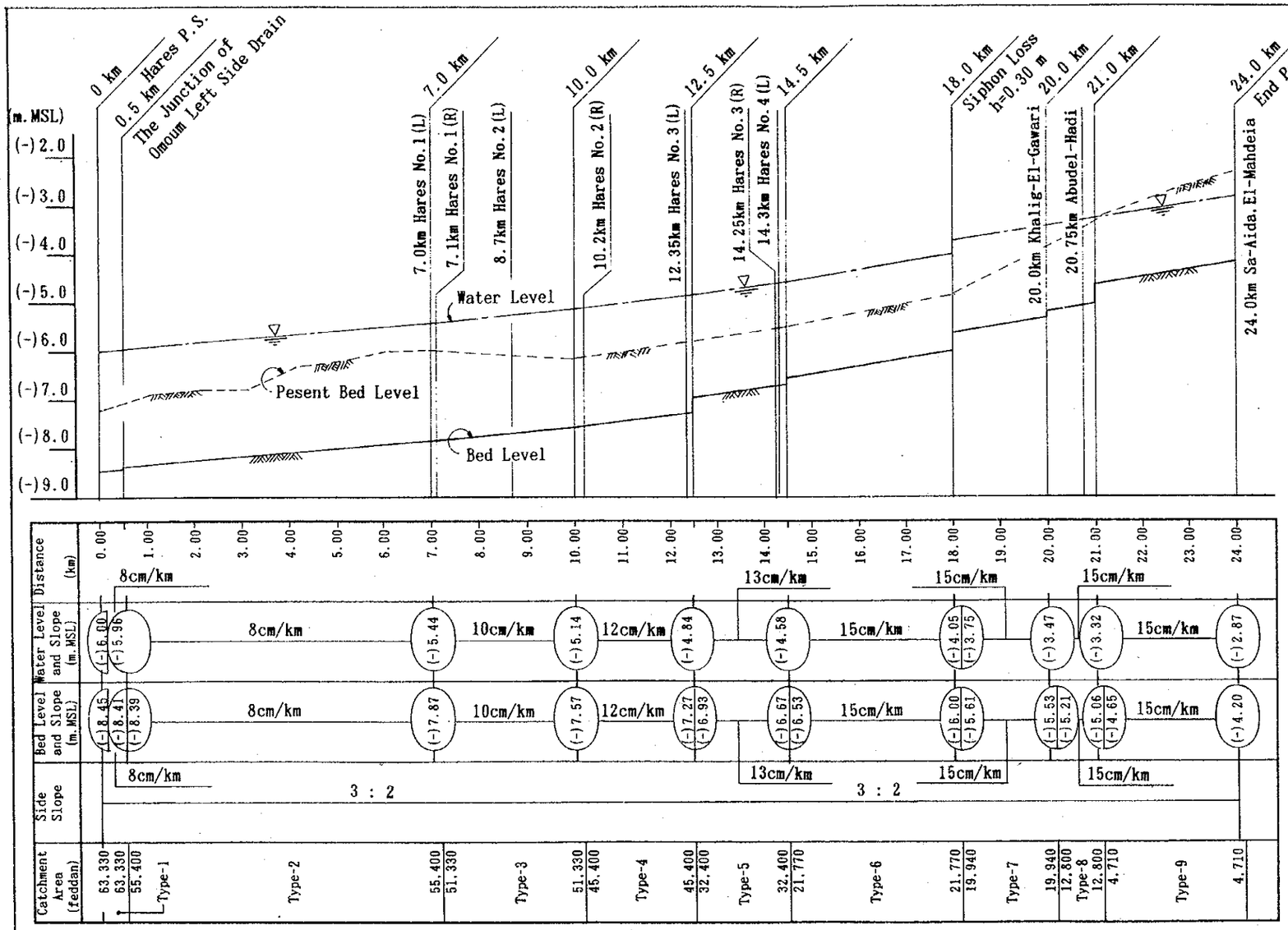
LIST OF DRAWINGS

Priority Development Area

PDA-1001	HARES MAIN DRAIN PROPOSED LONGITUDINAL AND CROSS SECTION
PDA-1002	TYPICAL DRAWING OF EL-HAGER FEEDING CANAL SIPHON
PDA-1003	TYPICAL DRAWING OF BRIDGE
PDA-1004	ON-FARM DEVELOPMENT PLAN OF TILE DRAIN AND DRAINAGE DITCH IN SAMPLE AREA
PDA-1005	HARES NEW PUMPING STATION GENERAL PLAN
PDA-1006	HARES NEW PUMPING STATION PLAN
PDA-1007	HARES NEW PUMPING STATION PROFILE

Priority Development Project

PDP-1001	OMOUM MAIN DRAIN PROPOSED LONGITUDINAL SECTION
PDP-1002	OMOUM MAIN DRAIN PROPOSED CROSS SECTION
PDP-1003	OMOUM MAIN DRAIN TYPICAL DRAWING OF GATE FACILITIES
PDP-1004	NUBARIYA SIPHON PLAN OF SETTLING BASIN
PDP-1005	DISCHARGE CANNEL PROPOSED LONGITUDINAL AND CROSS SECTION
PDP-1006	EL-MAX NEW PUMPING STATION GENERAL PLAN
PDP-1007	EL-MAX NEW PUMPING STATION PLAN
PDP-1008	EL-MAX NEW PUMPING STATION PROFILE



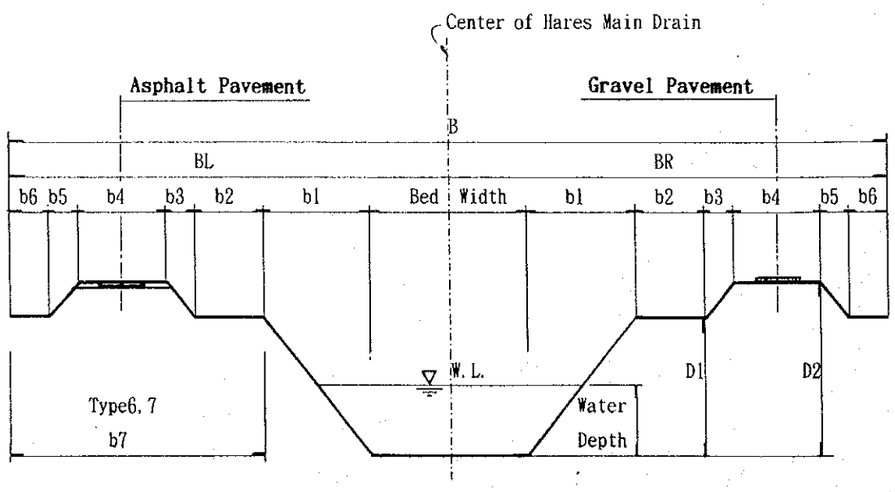
DIMENSION TABLE of HARES MAIN DRAIN

Type	Discharge (cum/sec)	Bed Width (m)	Side Slope	Bed Slope	Water Depth (m)	Velocity (m/sec)
Type-1	30.0	18	1:1.5	8cm/km	2.45	0.564
Type-2	26.3	16	1:1.5	8cm/km	2.43	0.553
Type-3	24.4	13	1:1.5	10cm/km	2.43	0.604
Type-4	21.5	10	1:1.5	12cm/km	2.43	0.643
Type-5	15.4	9	1:1.5	13cm/km	2.09	0.607
Type-6	10.3	6	1:1.5	15cm/km	1.95	0.594
Type-7	9.5	6	1:1.5	15cm/km	1.86	0.580
Type-8	6.1	4	1:1.5	15cm/km	1.74	0.529
Type-9	2.2	2	1:1.5	15cm/km	1.33	0.415

0 5 m
Vert. 1/100

0 5 Km
Hori. 1/100,000

Scale of Longitudinal Section



Type	B (m)	BR (m)	BL (m)	b1 (m)	b2 (m)	b3 (m)	b4 (m)	b5 (m)	b6 (m)	b7 (m)	D1 (m)	D2 (m)
Type-1	68.0	34.0	34.0	8.55	5.00	1.50	6.00	1.50	2.45	—	5.70	6.80
Type-2	64.0	32.0	32.0	8.10	5.00	1.50	6.00	1.50	1.90	—	5.40	6.40
Type-3	62.0	31.0	31.0	7.80	5.00	1.50	6.00	1.50	2.70	—	5.20	6.20
Type-4	56.0	28.0	28.0	7.30	5.00	1.50	6.00	1.50	1.70	—	4.85	5.85
Type-5	52.0	26.0	26.0	6.50	5.00	1.50	6.00	1.50	2.50	—	4.35	5.35
Type-6, 7	54.0	27.0	27.0	7.70	5.00	1.50	6.00	1.50	2.30	—	5.15	6.15
Type-8	39.0	23.0	16.0	6.30	5.00	1.50	6.00	1.50	2.70	2.75	4.20	5.20
Type-9	39.0	22.5	16.5	6.45	5.00	1.50	6.00	1.50	3.05	4.05	4.30	5.30

ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES

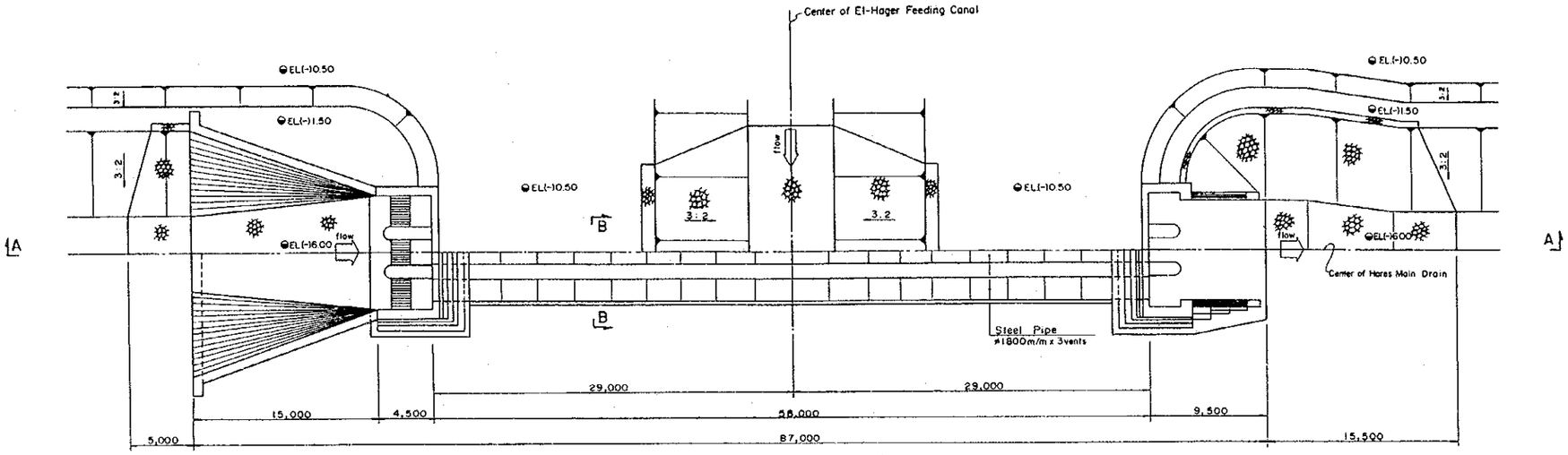
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA

HARES MAIN DRAIN
PROPOSED LONGITUDINAL AND CROSS SECTION

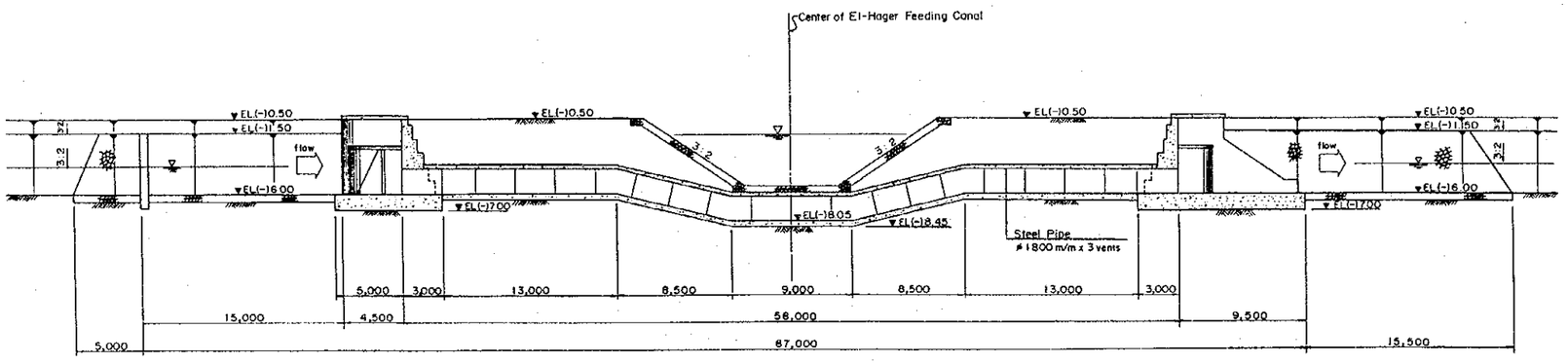
DWG. NO. PDA-1001

JAPAN INTERNATIONAL COOPERATION AGENCY

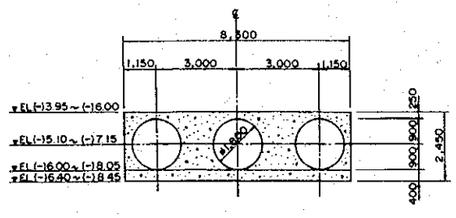
PLAN



A – A



B – B



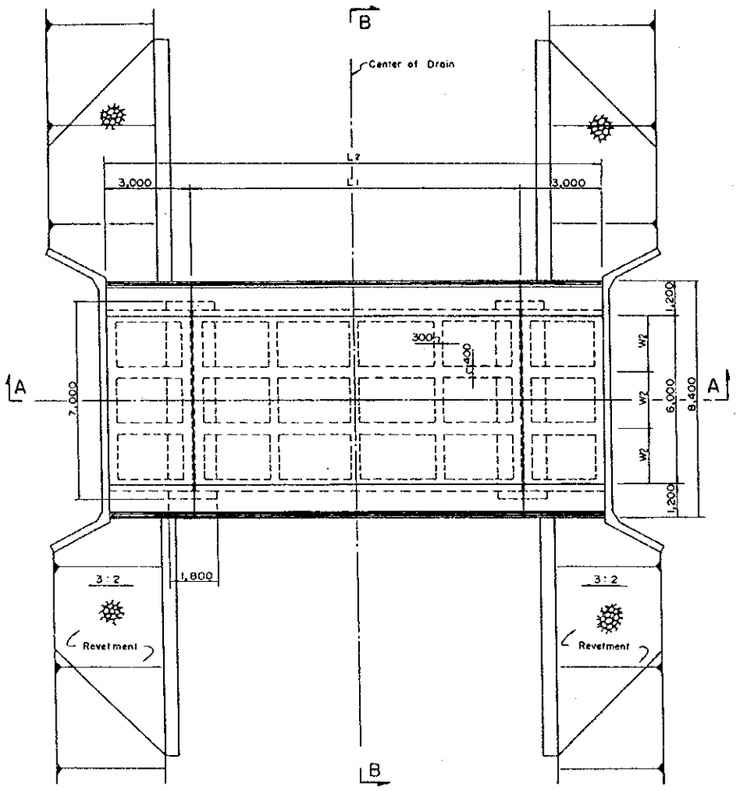
All dimensions are in milli meter.
All elevations are in meter, MSL.

0 5 0m
PLAN, A-A SCALE 1/200

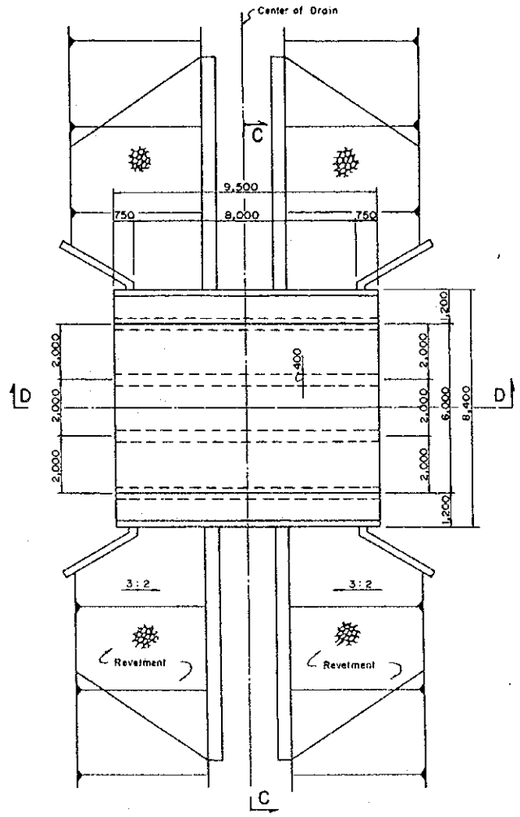
0 1 2 3 4 5m
B-B SCALE 1/100

ARAB REPUBLIC OF EGYPT MINISTRY OF PUBLIC WORKS AND WATER RESOURCES	
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA	
TYPICAL DRAWING OF EL-HAGER FEEDING CANNAL SIPHON	
	DWG. NO. PDA-1002
JAPAN INTERNATIONAL COOPERATION AGENCY	

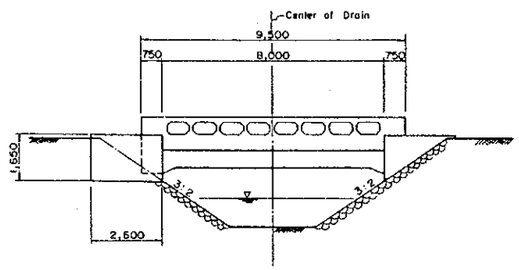
TYPE : A , TYPE : B , TYPE : C



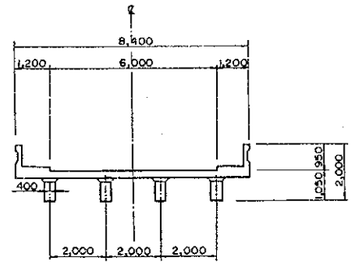
TYPE : D



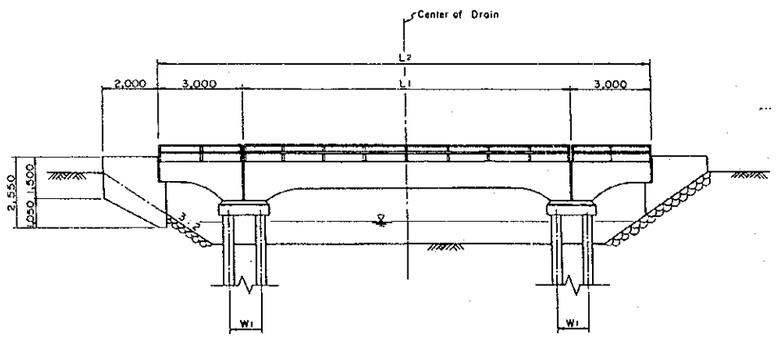
C — C



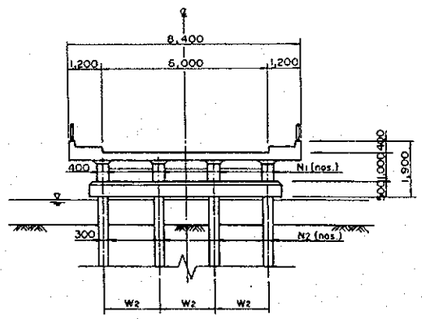
D — D



A — A



B — B



Dimension / Type	L1 (mm)	L2 (mm)	W1 (mm)	W2 (mm)	N1 (Nos.)	N2 (Nos.)	Remark
A	8,000	14,000	1,150	2,000	8	8	(3-8-3) m
B	10,000	16,000	575	1,000	11	11	(3-10-3) m
C	12,000	18,000	575	1,000	11	11	(3-12-3) m

All dimensions are in milli meter.

0 1 2 3 4 5m

SCALE 1/100

ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES

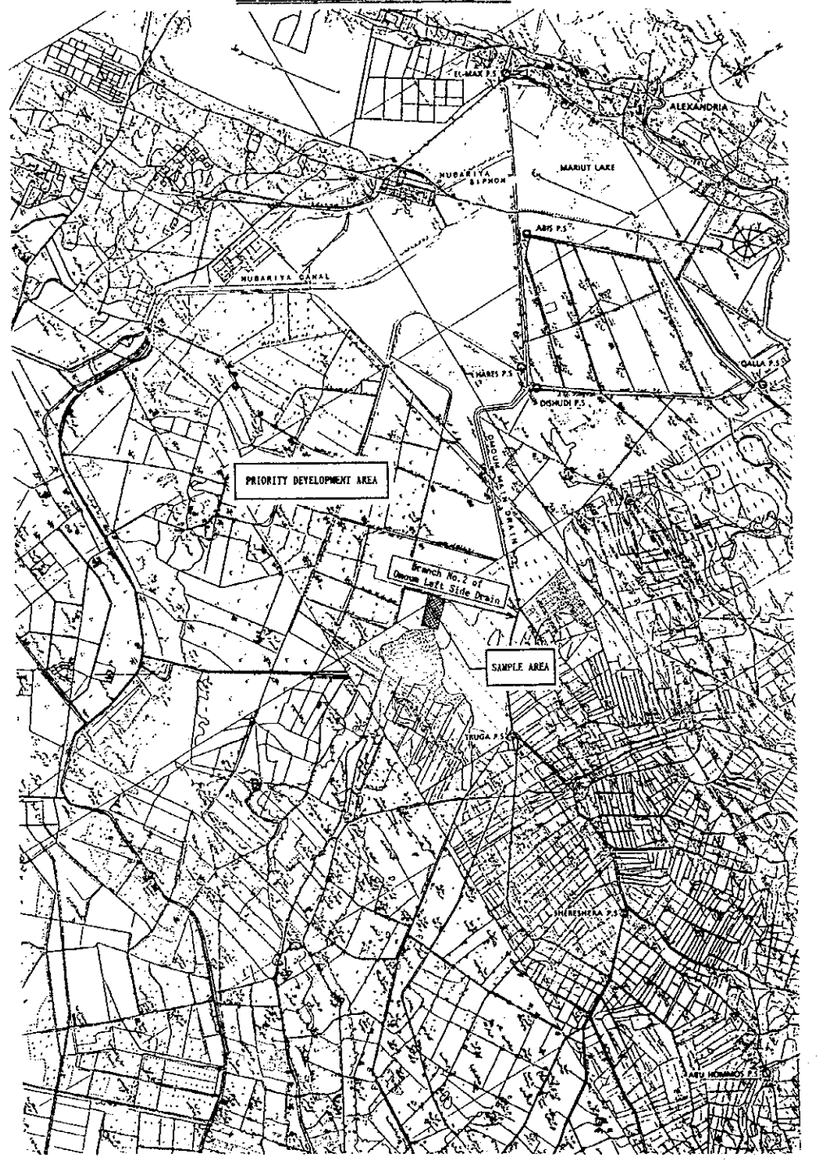
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA

TYPICAL DRAWING OF BRIDGE

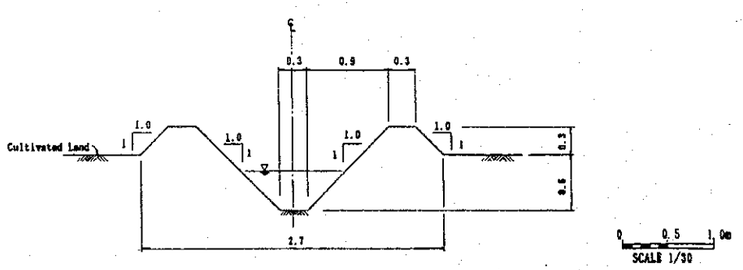
DWG. NO. PDA-1003

JAPAN INTERNATIONAL COOPERATION AGENCY

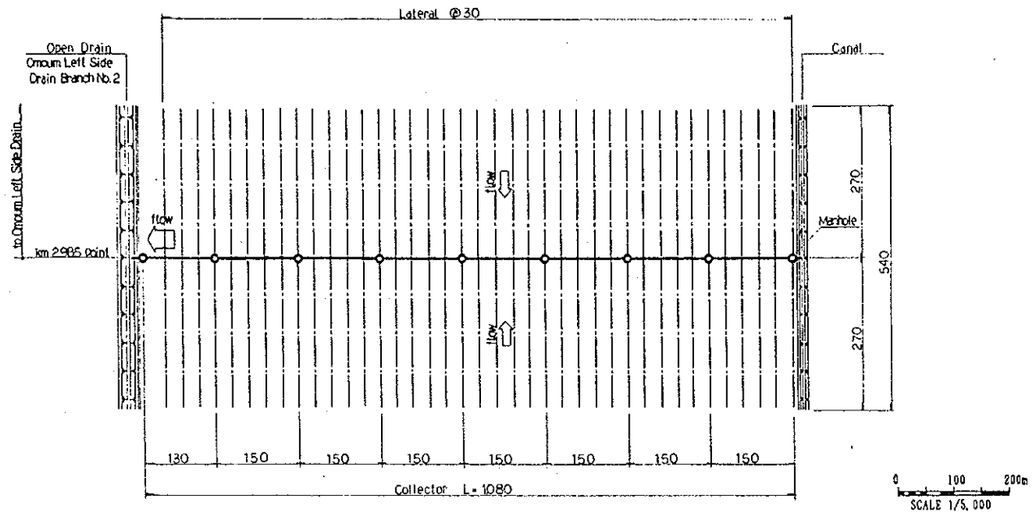
LOCATION MAP of SAMPLE AREA



TYPICAL CROSS SECTION of DRAINAGE DITCH

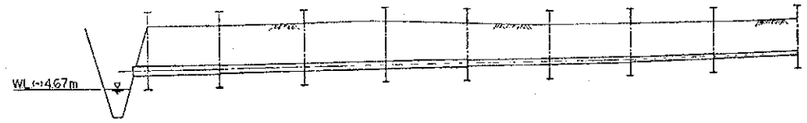


PLAN of TILE DRAIN



Collecter No.12-Right Side of EL OMOUN LEFT SIDE DRAIN-Branch No.2

Point km 2.985 / Catchment Area 151(fed) / Collector Length 1180(m)



Kilometric Distance (km)		0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.18	
Surface Levels (m)		-2.65			-2.58		-2.48			-2.64				-2.61	-2.55
Diameter of Pipes (cm)			35 (14inch)			30 (12inch)				25 (10inch)			20 (8inch)	15 (6inch)	
Slopes in cm/100m			3			3				3			4	6	
Length of Pipes (m)			130			450				300			150	150	
Bottom Level Collectors (EL.m)		-4.38		-4.34		-4.29		-4.25	-4.20		-4.16	-4.11		-4.04	-3.96
Distance of Manholes (m)			130		150		150	150		150		150	150	150	
Bottom Levels Manholes (EL.m)		-4.88		-4.84		-4.79		-4.75	-4.70		-4.66	-4.61		-4.54	-4.45

Spacing of Lateral	Collecter No.	Distance from Open Drain	Catchment Area of Collector	Collector Pipe																				Pipe for Flashing	Pipe for Out Let	Manhole of above Ground
				ø15cm (6inch)				ø20cm (8inch)				ø25cm (10inch)				ø30cm (12inch)				ø35cm (14inch)						
				Leng	Elevation			Leng	Elevation			Leng	Elevation				Elevation				Elevation					
				-th	B.P.	E.P.	Slope	-th	B.P.	E.P.	Slope	-th	B.P.	E.P.	Slope		B.P.	E.P.	Slope		B.P.	E.P.	Slope	R.C. ø 15cm	R.C. ø 35cm	place
@ m		km	feddan	m	m.MSL	m.MSL	cm/100m	m	m.MSL	m.MSL	cm/100m	m	m.MSL	m.MSL	cm/100m	m	m.MSL	m.MSL	cm/100m	m	m.MSL	m.MSL	cm/100m	m	m	m
30	No.12	2.985	151	150	(-)3.95	(-)4.04	6	150	(-)4.04	(-)4.13	4	300	(-)4.11	(-)4.20	3	450	(-)4.20	(-)4.34	3	130	(-)4.34	(-)4.38	3	15	20	9

ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES

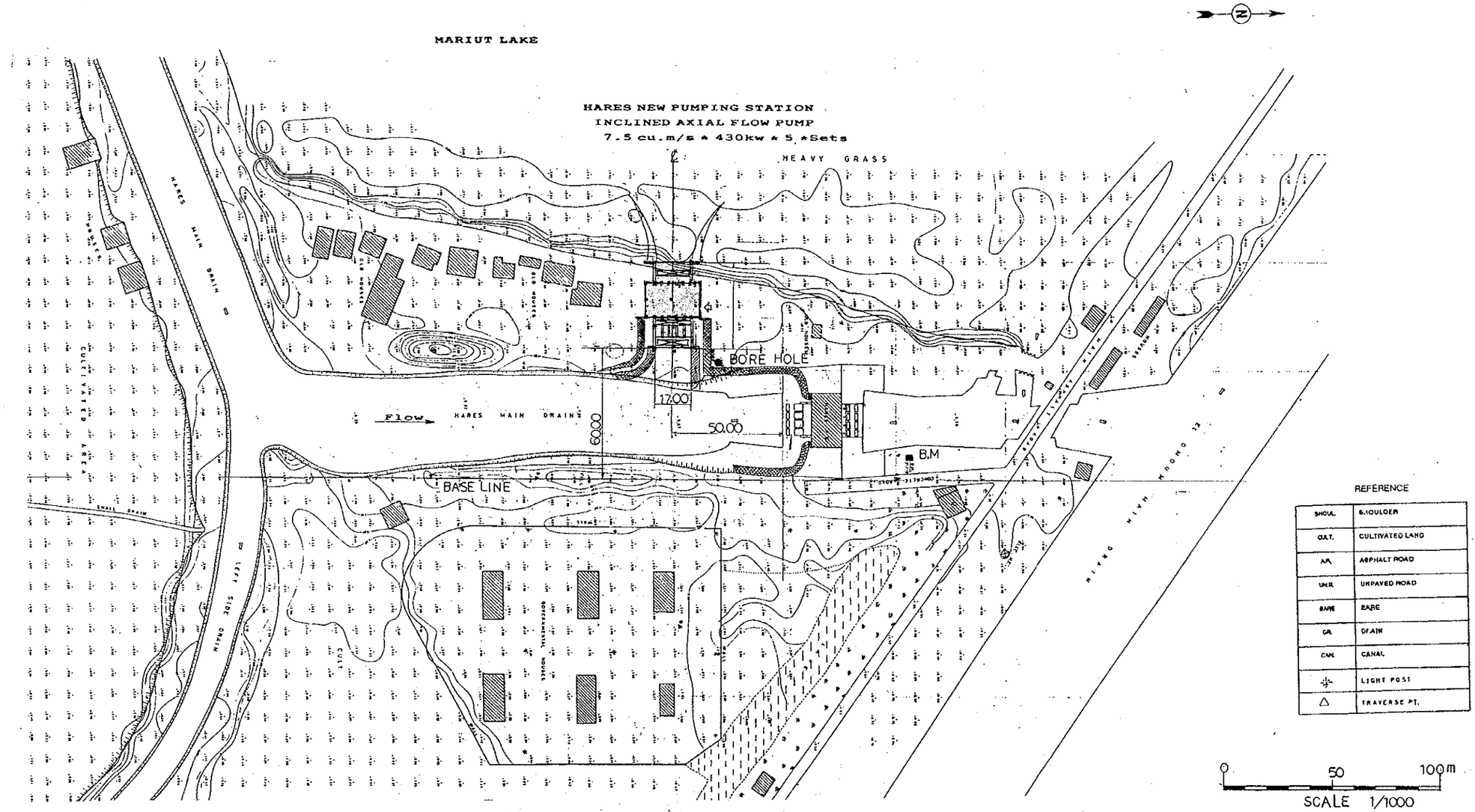
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA

ON-FARM DEVELOPMENT PLAN OF TILE DRAIN AND DRAINAGE DITCH IN SAMPLE AREA

DWG. NO. PDA-1004

JAPAN INTERNATIONAL COOPERATION AGENCY

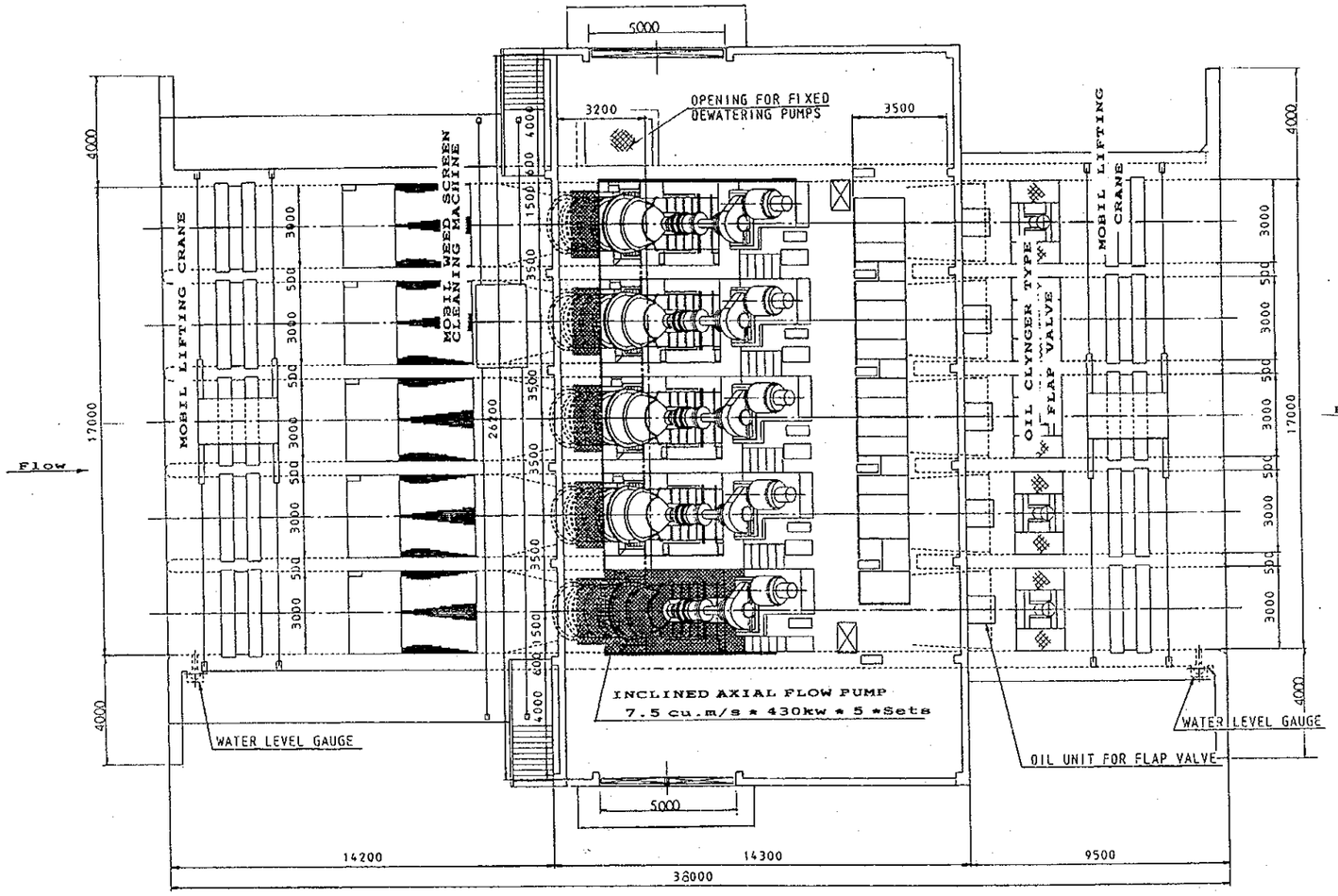
GENERAL PLAN



All dimensions are in meter.
All elevations are in meter.

ARAB REPUBLIC OF EGYPT	
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES	
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA	
HARES NEW PUMPING STATION GENERAL PLAN	
	DWG. NO. PDA-1005
JAPAN INTERNATIONAL COOPERATION AGENCY	

PLAN



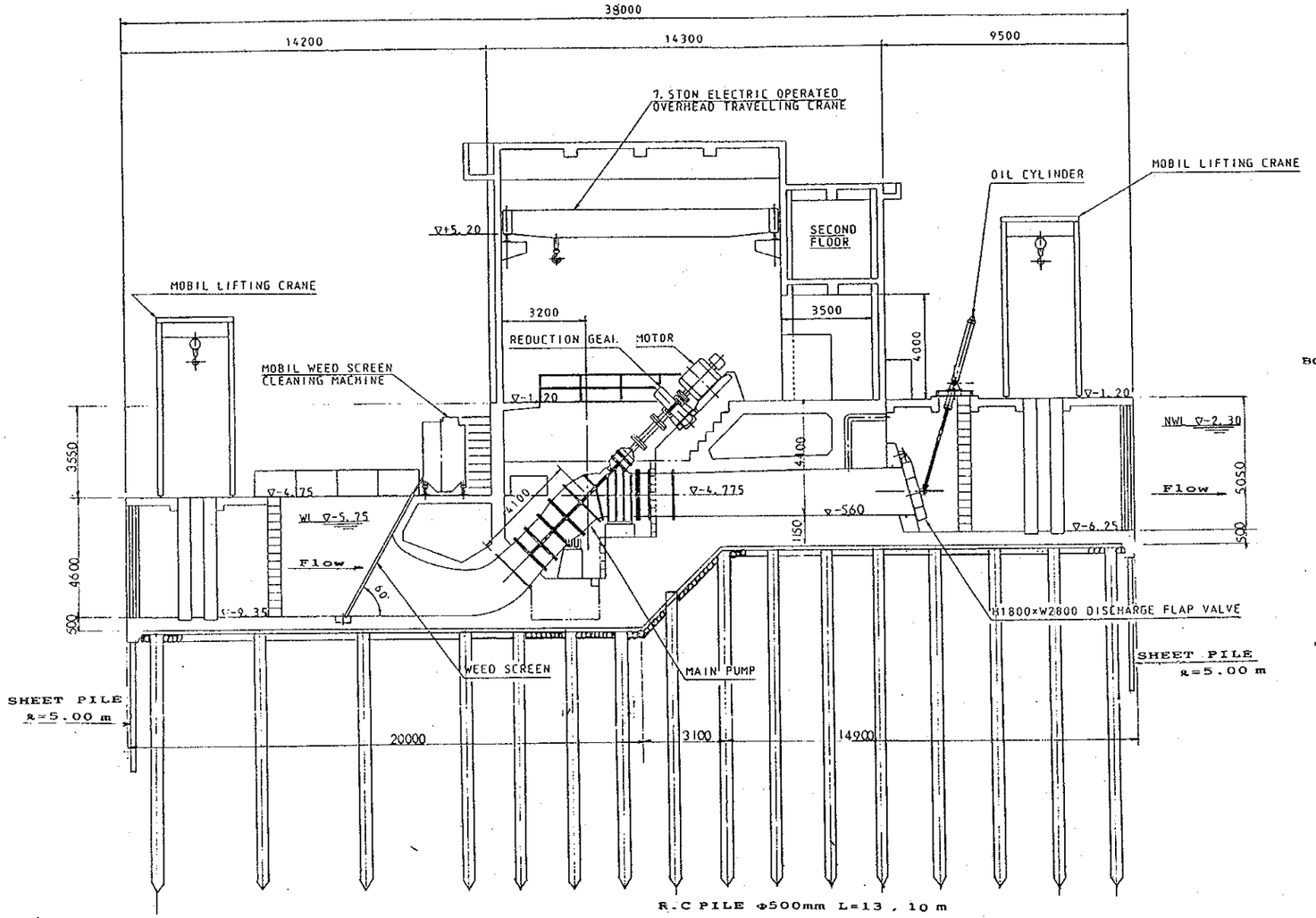
All dimensions are in millimeter.
All elevations are in meter.

0 5 10m

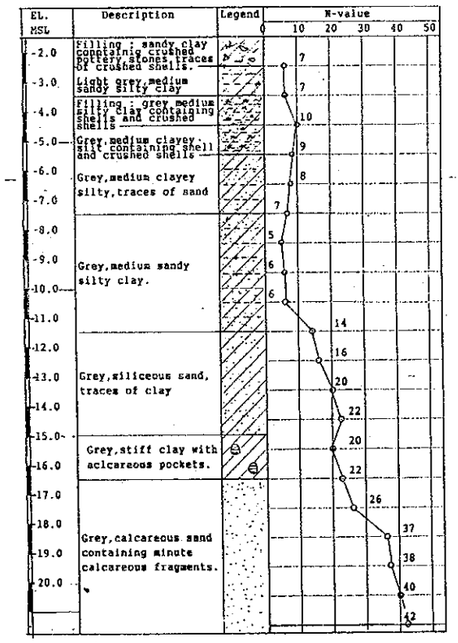
SCALE 1/100

ARAB REPUBLIC OF EGYPT			
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES			
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA			
HARES NEW PUMPING STATION PLAN			
		DWG. NO.	FDA-1006
JAPAN INTERNATIONAL COOPERATION AGENCY			

PROFILE



BORING NO.2 GL.-1.40

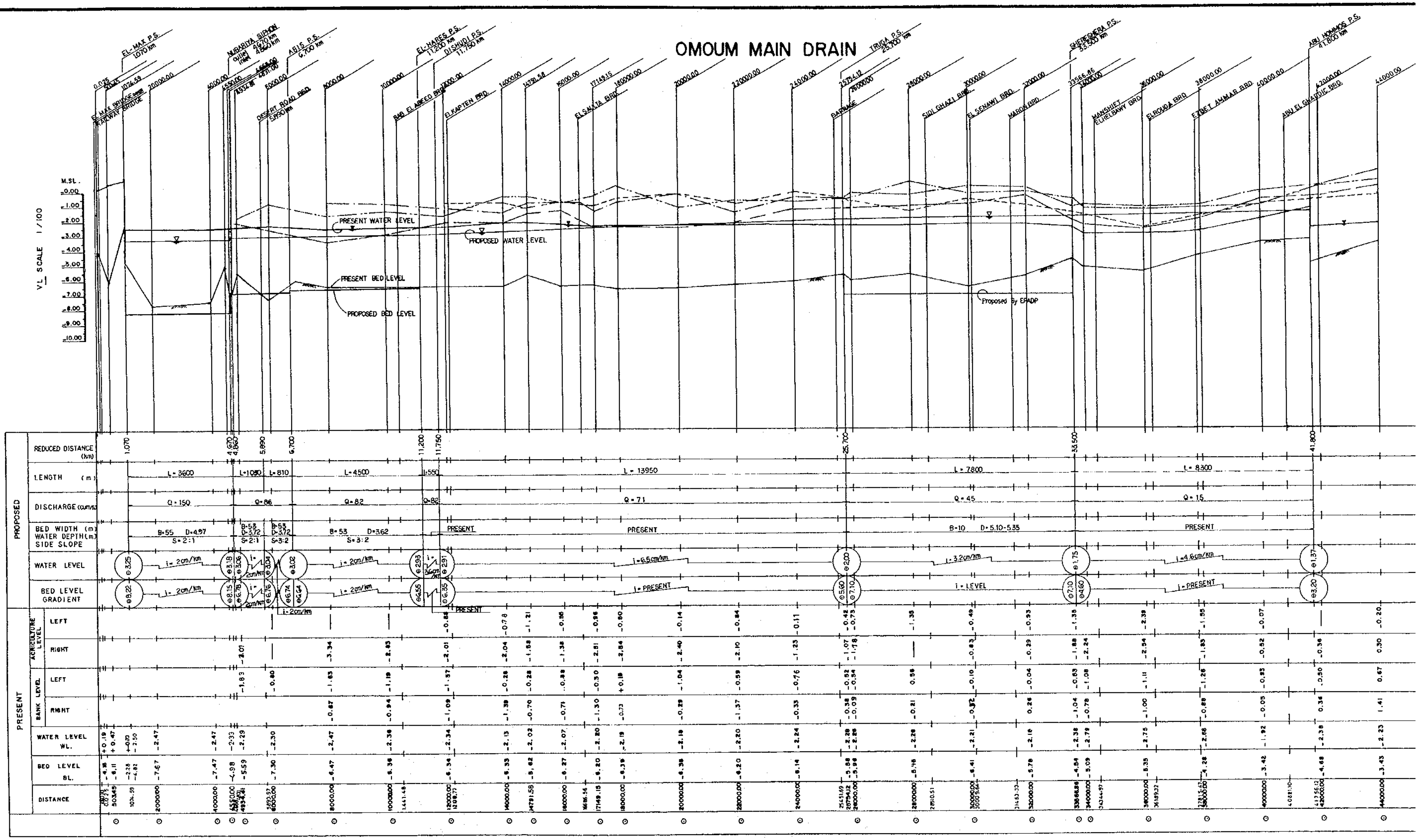


All dimensions are in millimeter.
All elevations are in meter.

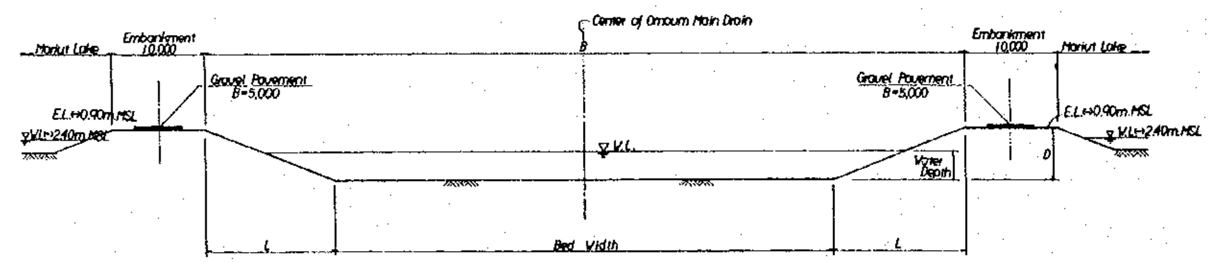
0 5 10m
SCALE 1/100

ARAB REPUBLIC OF EGYPT	
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES	
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA	
HARES NEW PUMPING STATION PROFILE	
	DWG. NO. PDA-1007
JAPAN INTERNATIONAL COOPERATION AGENCY	

OMOUM MAIN DRAIN



PRPOSED CROSS SECTION of OMOUM MAIN DRAIN



DIMENSION TABLE of OMOUM MAIN DRAIN

Type	Discharge (cum/sec)	Bed Width (m)	Side Slope	Bed Slope (cm/km)	Water Depth (m)	Velocity (m/sec)	B Ar. (m)	L Ar. (m)	D Ar. (m)
Type-1	150	55	1:2.0	2	4.97	0.464	84.2	14.6	7.3
Type-2	86	53	1:2.0	2	3.72	0.383	76.6	11.8	5.9
Type-3	86	53	1:1.5	2	3.72	0.395	70.8	8.9	5.9
	82	53	1:1.5	2	3.62	0.388	70.2	8.6	5.7

Remarks

Type-1 ; El-Max P.S. ~ Nubariya Siphon Outlet

Type-2 ; Nubariya Siphon Inlet ~ Desert Road Bridge(5.88km Point from Mediterranean Sea)

Type-3 ; Desert Road Bridge ~ Abis P.S. & Abis P.S. ~ Nawas P.S.

VL 1/100

METERS 7 6 5 4 3 2 1 0 0.5 1

ML 1/50000

METERS 5000 4000 3000 2000 1000 0 500 1000

REFERENCE

BL	BED LEVEL
WL	WATER LEVEL
	RIGHT BANK LEVEL
	LEFT BANK LEVEL
	RIGHT AGRICULTURE LEVEL
	LEFT AGRICULTURE LEVEL

MINISTRY OF

FARMLAND E

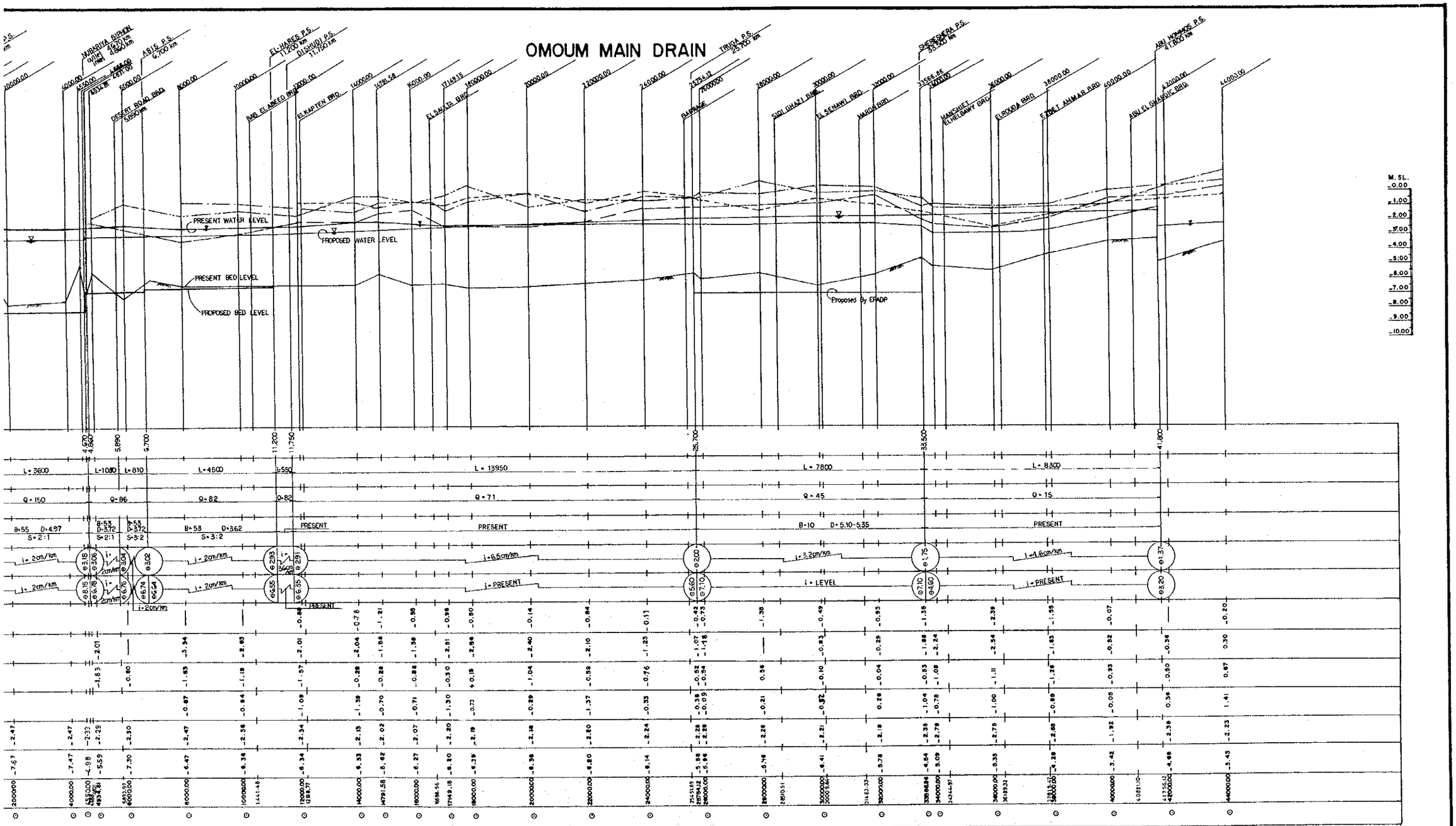
OMOUM MAIN DR

PROPOSE

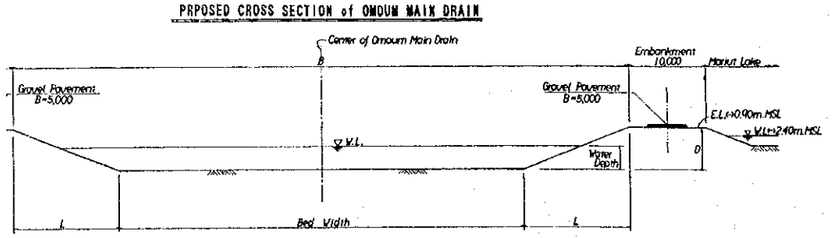
DATE

JAPAN I

OMOUM MAIN DRAIN



PRPOSED CROSS SECTION of OMOUM MAIN DRAIN



DIMENSION TABLE of OMOUM MAIN DRAIN

Type	Discharge (cum/sec)	Bed Width (m)	Side Slope	Bed Slope (cm/km)	Water Depth (m)	Velocity (m/sec)	B Av. (m)	L Av. (m)	D Av. (m)
Type-1	150	55	1:2.0	2	4.97	0.464	84.2	14.6	7.3
Type-2	86	53	1:2.0	2	3.72	0.383	76.6	11.8	5.9
Type-3	86	53	1:1.5	2	3.72	0.395	70.8	8.9	5.9
	82	53	1:1.5	2	3.62	0.388	70.2	8.6	5.7

※※mm/sec

Type-1 ; El-Mex P.S. ~ Mobariya Siphon Outlet
Type-2 ; Mobariya Siphon Inlet ~ Desert Road Bridge(5.88km Point from Mediterranean Sea)
Type-3 ; Desert Road Bridge ~ Abis P.S. & Abis P.S. ~ Marea P.S.

VL 1/100
METERS 7 6 5 4 3 2 1 0 0.5 1

HL 1/50000
METERS 6000 4000 3000 2000 1000 0 500 1000

REFERENCE

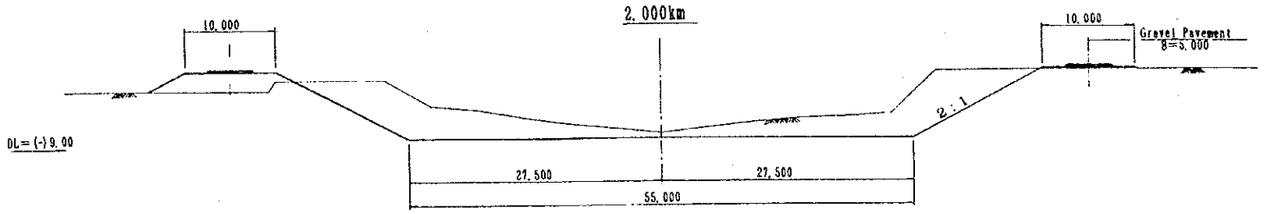
B.L.	BED LEVEL
W.L.	WATER LEVEL
	RIGHT BANK LEVEL
	LEFT BANK LEVEL
	RIGHT AGRICULTURE LEVEL
	LEFT AGRICULTURE LEVEL

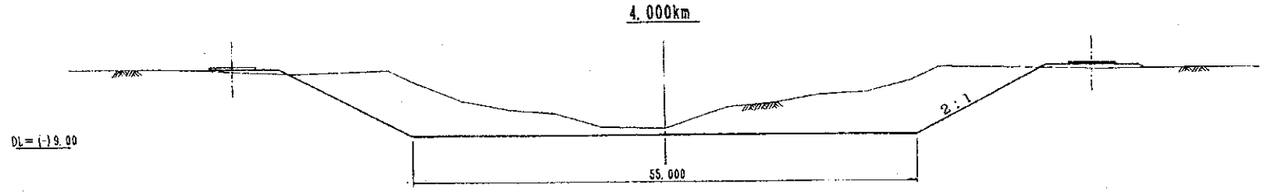
ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT
IN OMOUM AREA

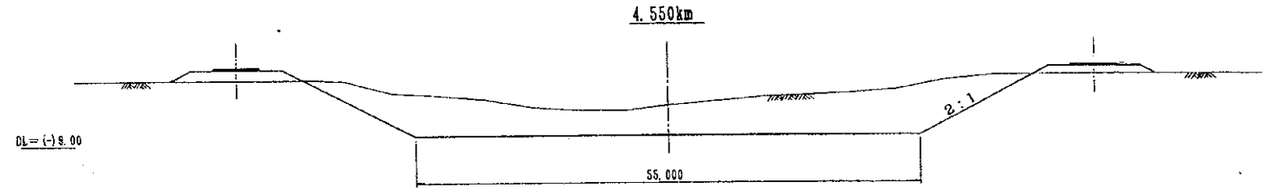
OMOUM MAIN DRAIN
PROPOSED LONGITUDINAL SECTION

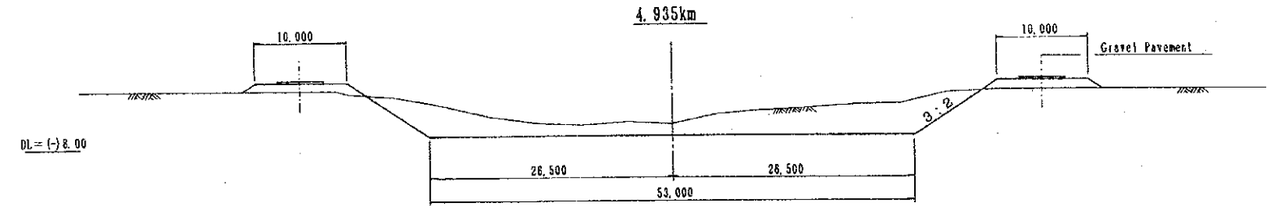
DATE | DWG. NO. PDP-1001

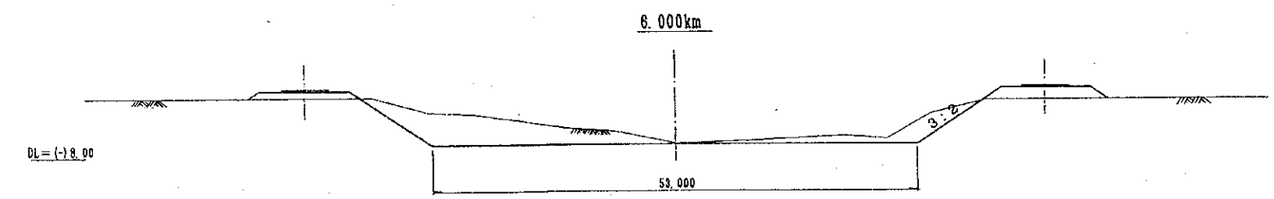
JAPAN INTERNATIONAL COOPERATION AGENCY

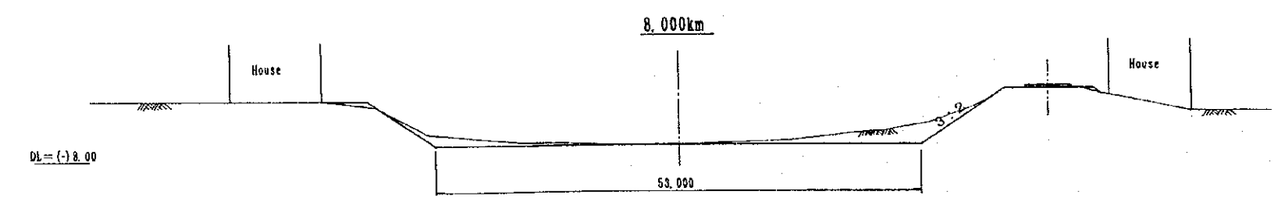


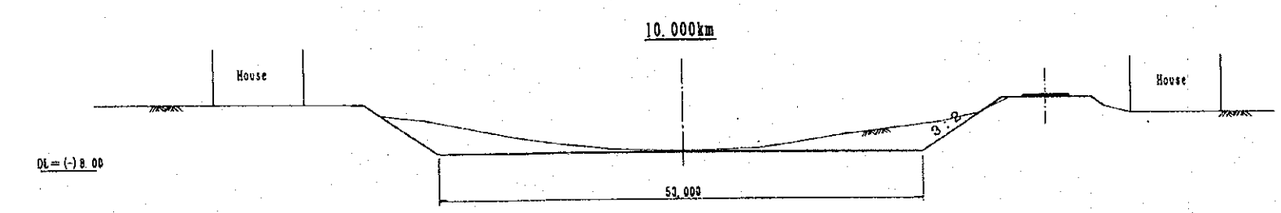












Distance means from River Mouth of Discharge Channel.

All dimensions are in milli meter.
All elevations are in meter. MSL.

0 5 10 15 20m
SCALE 1/300

ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES

FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA

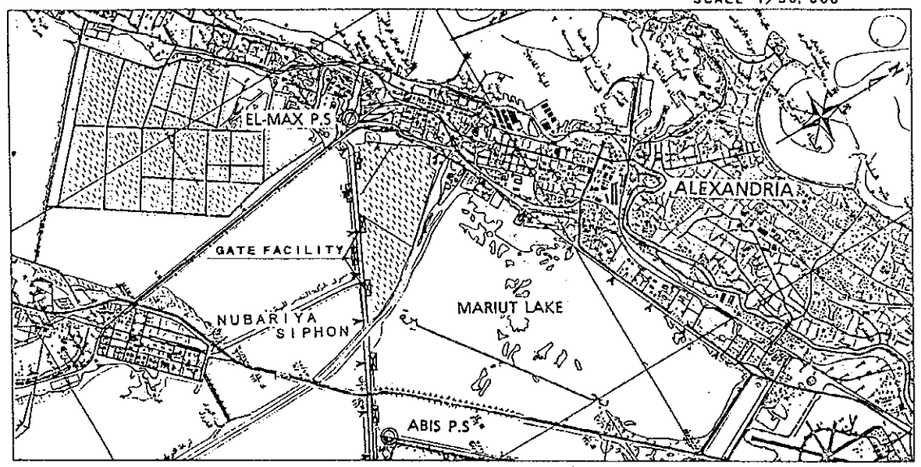
OMOUM MAIN DRAIN
PROPOSED CROSS SECTION

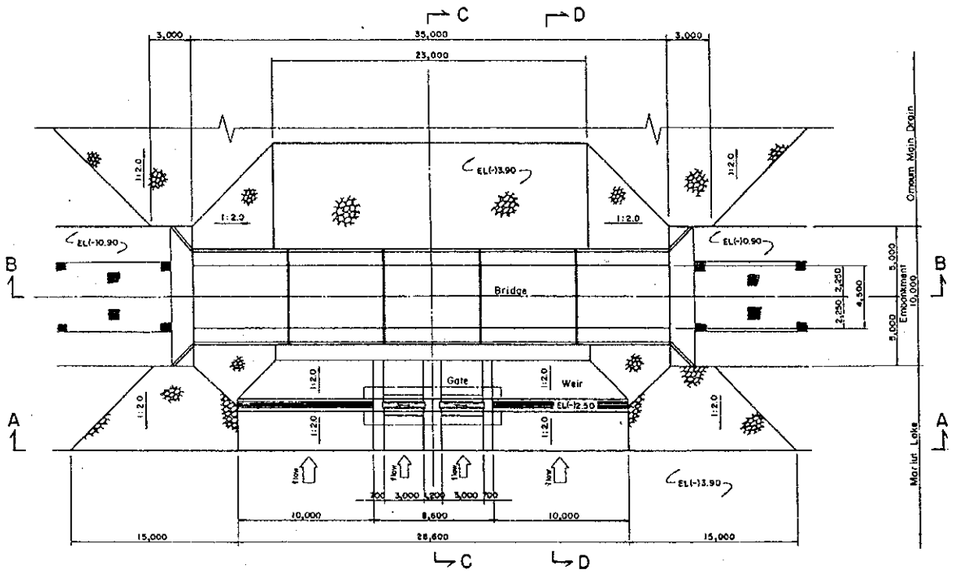
		DWG. NO.	PDP-1002

JAPAN INTERNATIONAL COOPERATION AGENCY

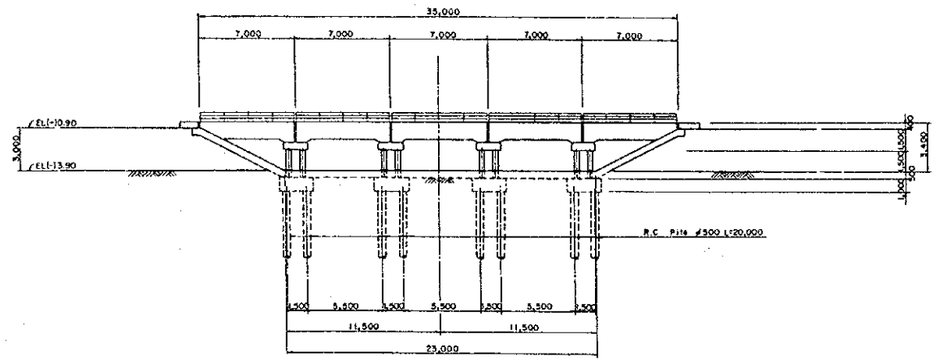
LOCATION MAP OF GATE FACILITIES

SCALE 1/50,000

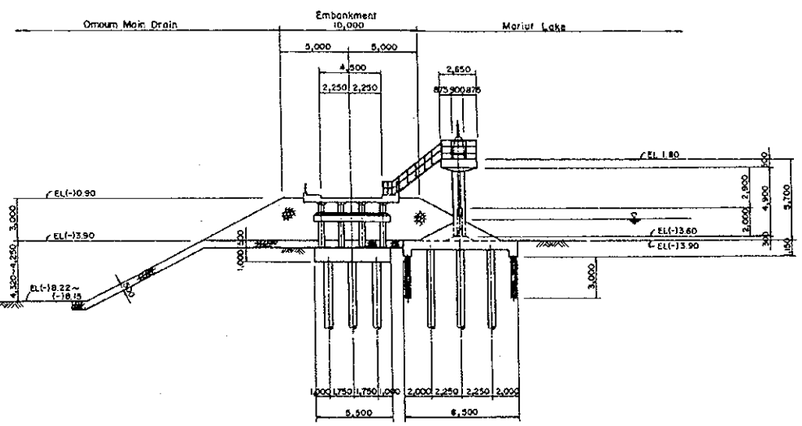




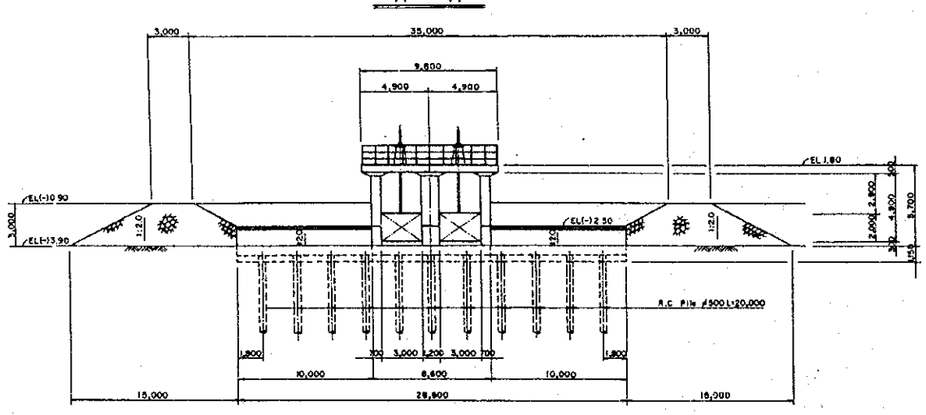
B — B



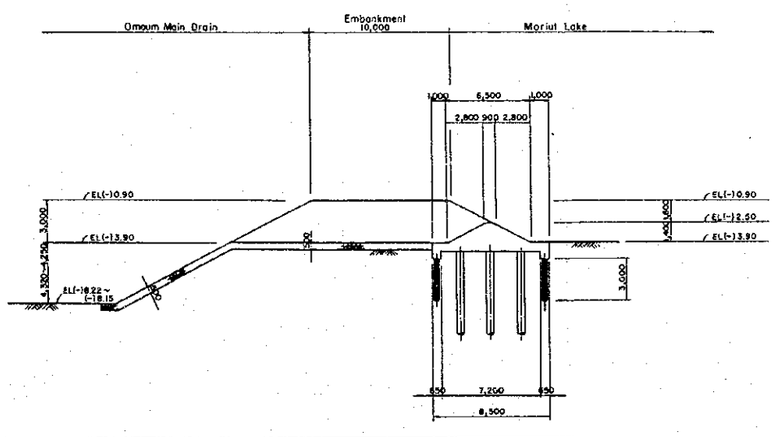
C — C



A — A



D — D



All dimensions are in milli meter.
All elevations are meter. MSL.

0 5 10 m

SCALE 1/200

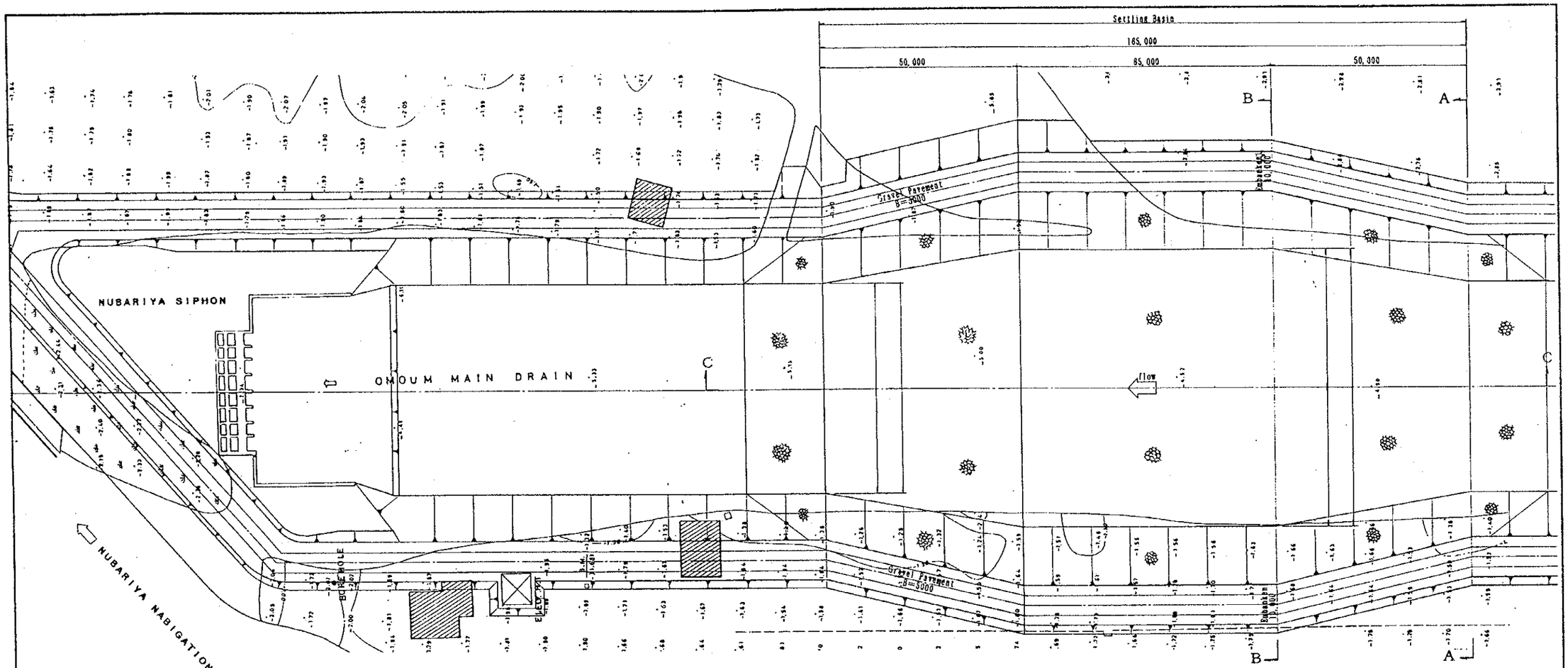
ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES

FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA

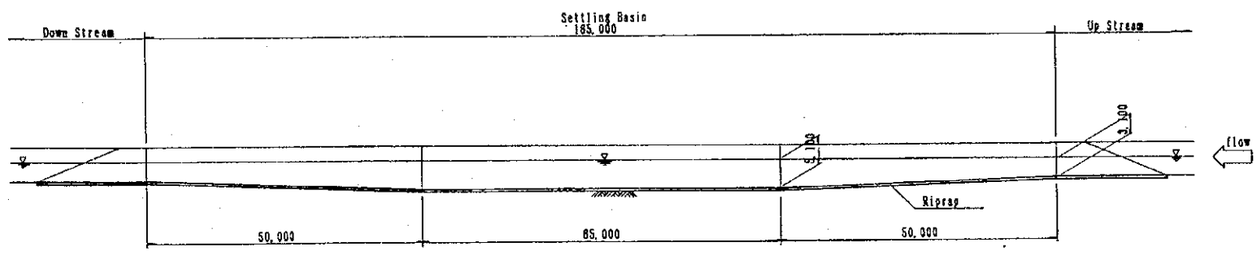
OMOUM MAIN DRAIN
TYPICAL DRAWING OF GATE FACILITIES

DWG. NO. PDP-1003

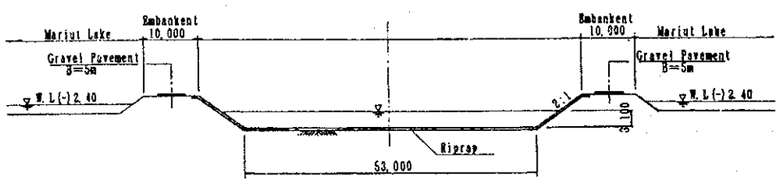
JAPAN INTERNATIONAL COOPERATION AGENCY



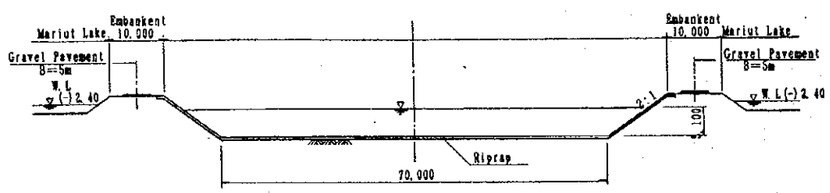
C—C



A—A



B—B



All dimensions are in millimeter.
All elevations are in meter. MSL.

SCALE 1/500

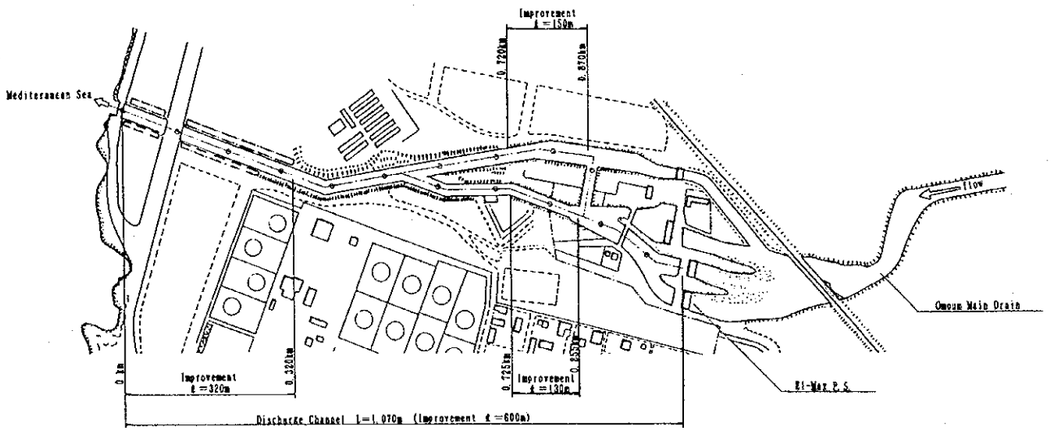
ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES

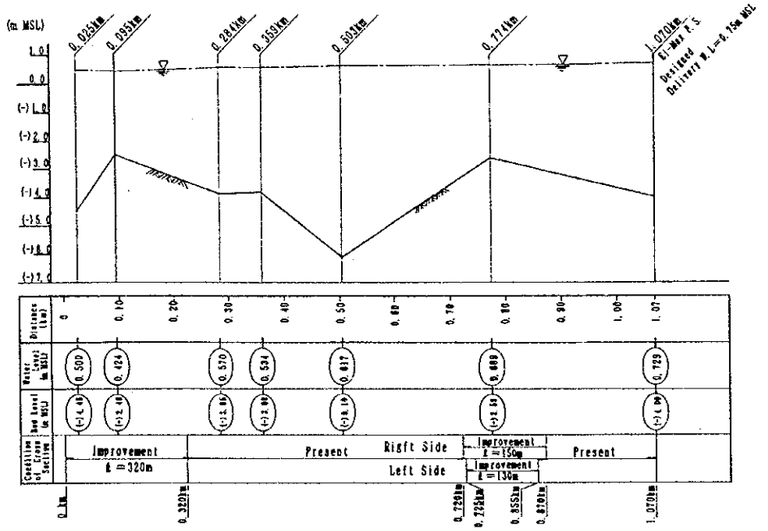
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT
IN OMOUM AREA

NUBARIYA SIPHON
PLAN OF SETTLING BASIN

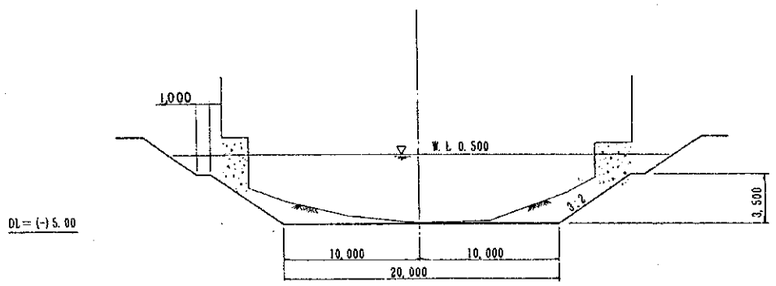
DWG. NO. PDP-1004

JAPAN INTERNATIONAL COOPERATION AGENCY

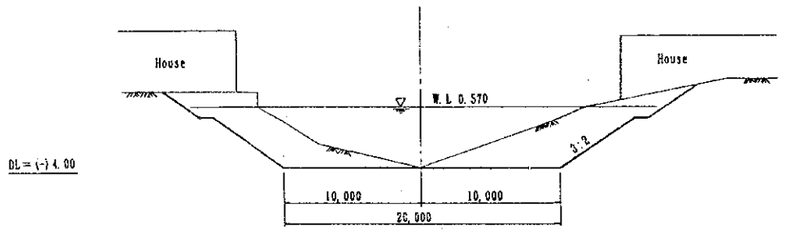




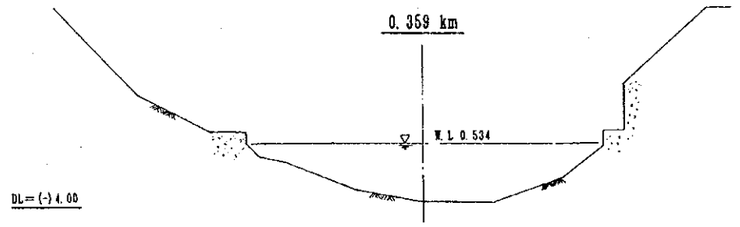
0.025 km



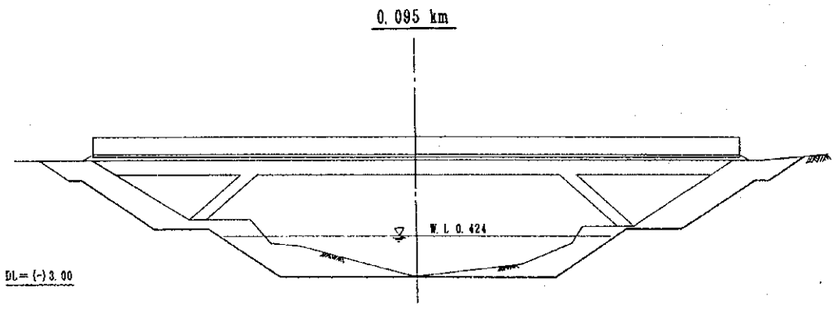
0.284 km



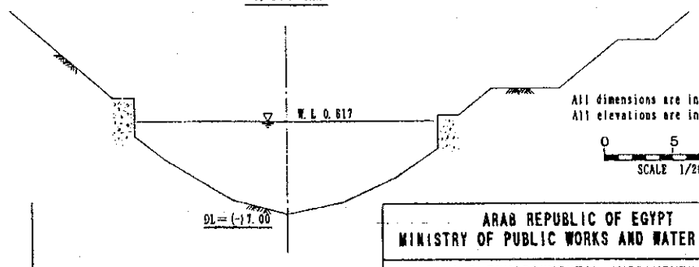
0.359 km



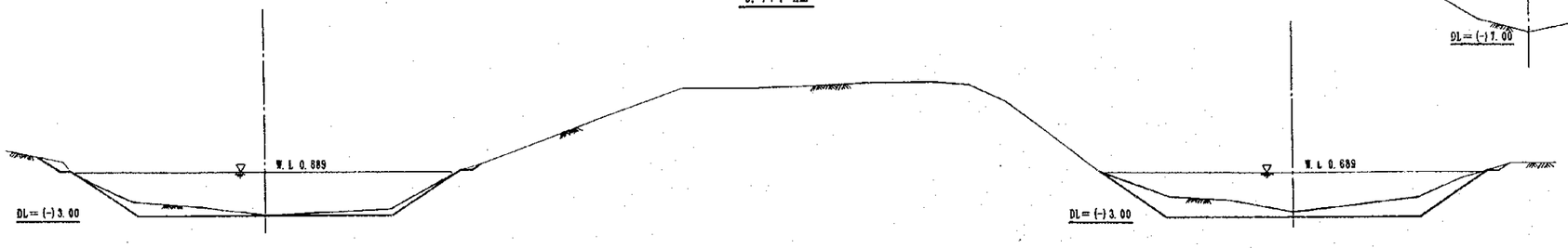
0.095 km



0.503 km



0.774 km



All dimensions are in milli meter.
All elevations are in meter, MSL.

0 5 10m
SCALE 1/200

ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES

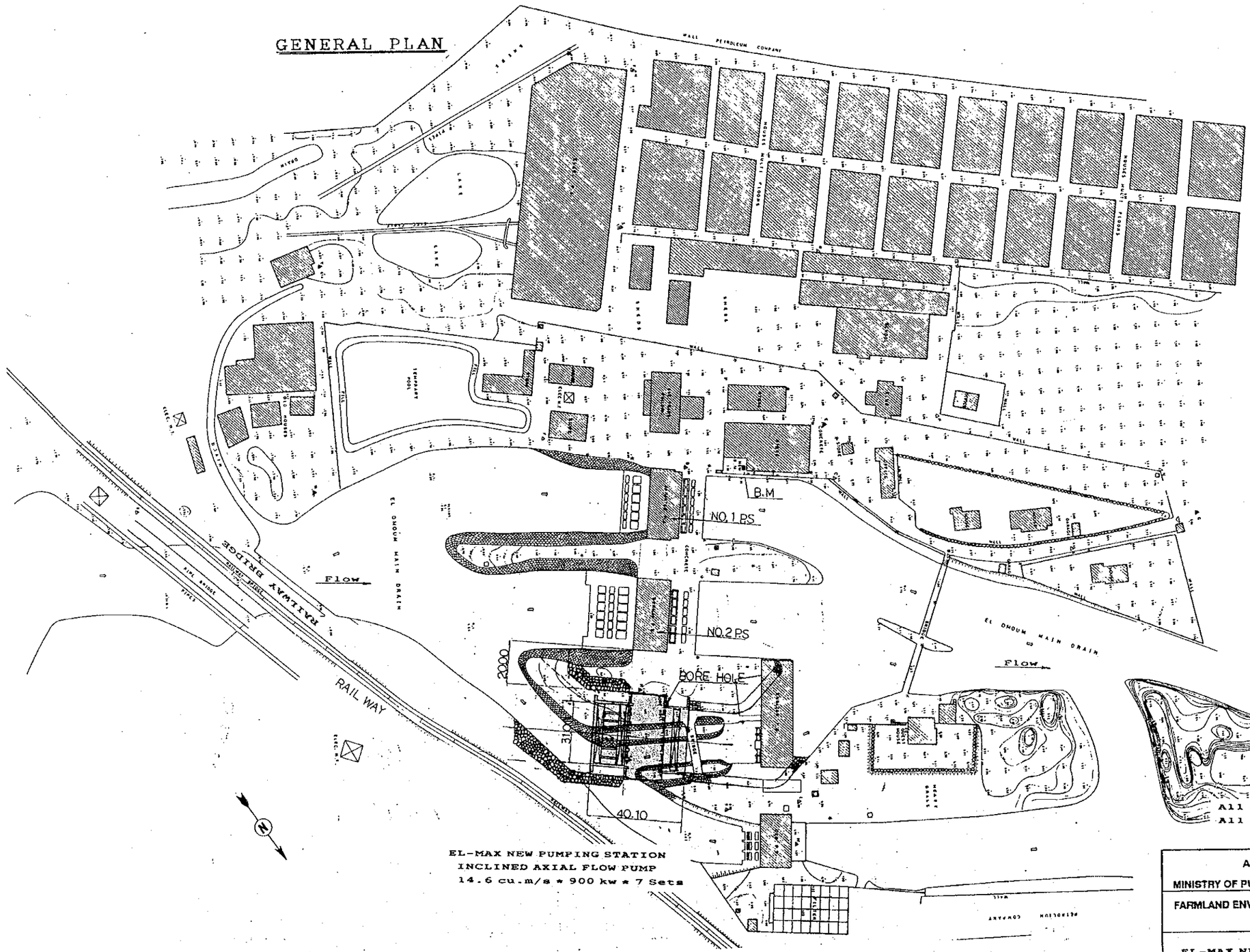
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA

DISCHARGE CHANNEL
PROPOSED LONGITUDINAL AND CROSS SECTION

DWG. NO. PDP-1005

JAPAN INTERNATIONAL COOPERATION AGENCY

GENERAL PLAN



REFERENCE

SHOUL.	SHOULDER
CULT.	CULTIVATED LAND
AR.	ARPHALT ROAD
UNR.	UNPAVED ROAD
BARE	BARE
DR.	DRAIN
CAN.	CANAL
	LIGHT POST
△	TRAVERSE PT.

EL-MAX NEW PUMPING STATION
INCLINED AXIAL FLOW PUMP
14.6 cu.m/s * 900 kw * 7 Sets

All dimensions are in meter.
All elevations are in meter.

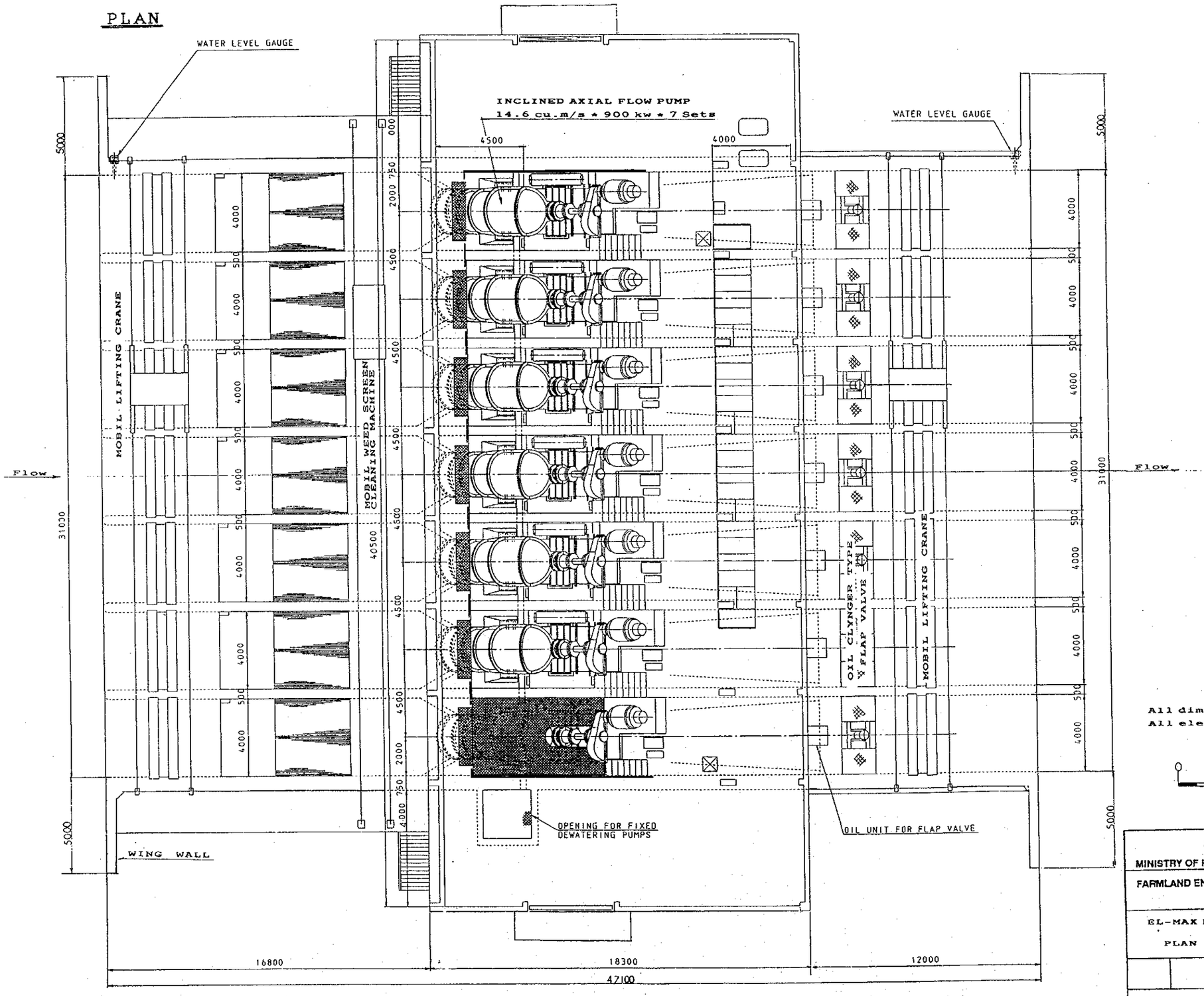
ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT
IN OMOUM AREA

EL-MAX NEW PUMPING STATION
GENERAL PLAN

DWG. NO. PDP-1006

JAPAN INTERNATIONAL COOPERATION AGENCY

PLAN

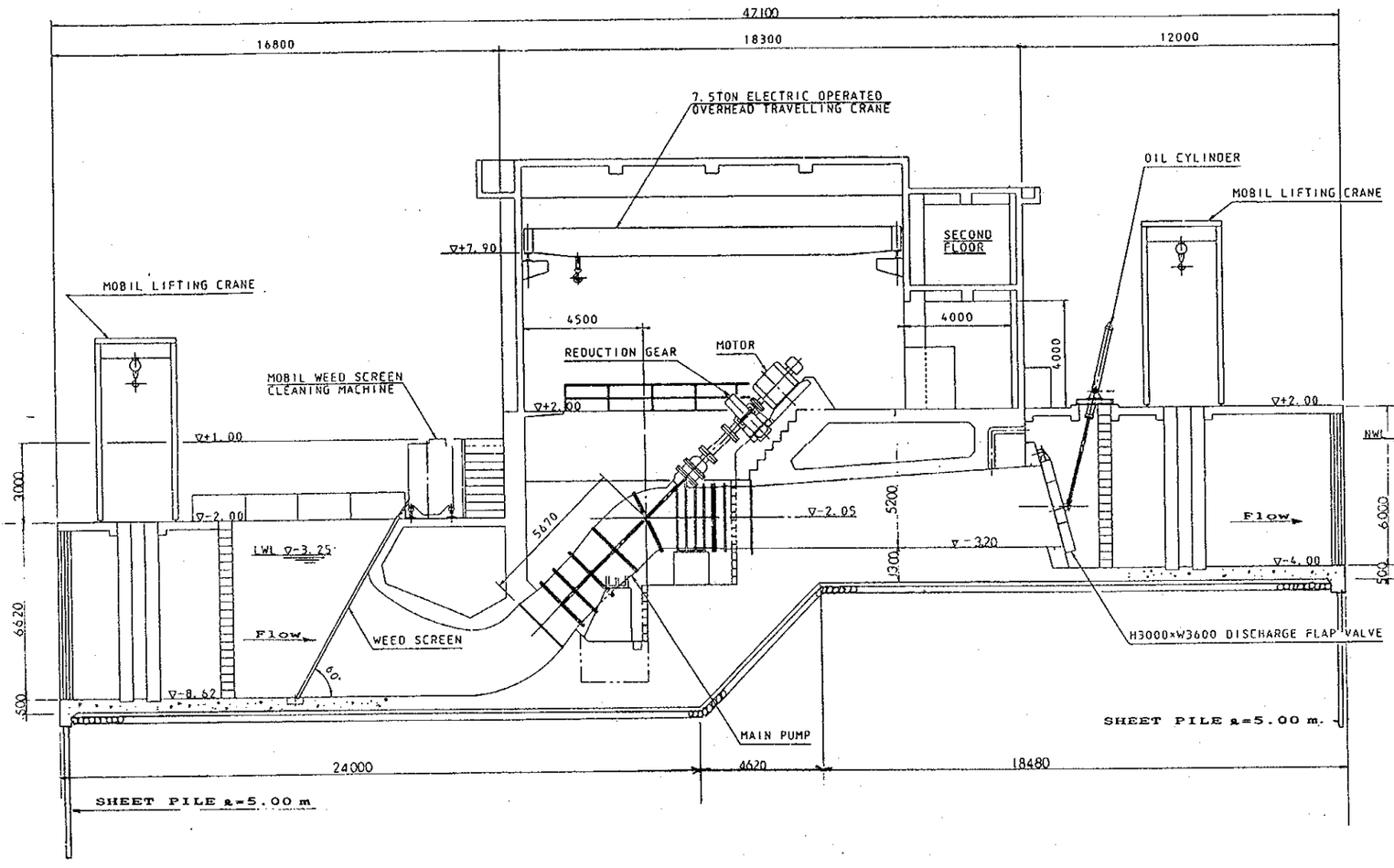


All dimensions are in millimeter.
All elevations are in metex.

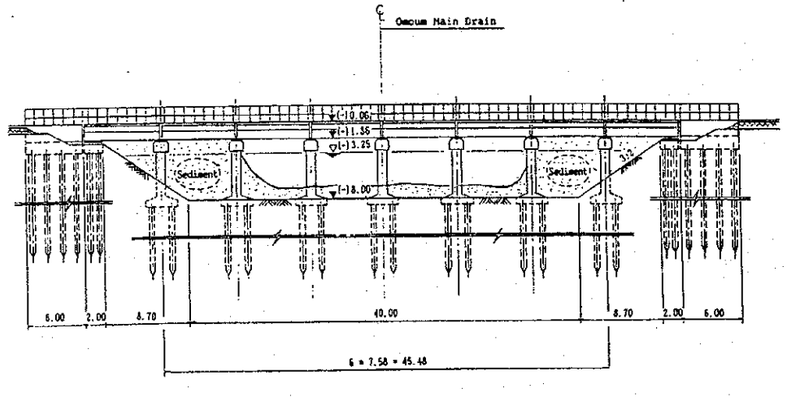
0 5 10m
SCALE 1/100

ARAB REPUBLIC OF EGYPT	
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES	
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT IN OMOUM AREA	
EL-MAX NEW PUMPING STATION	
PLAN	
	DWG. NO. PDP-1007
JAPAN INTERNATIONAL COOPERATION AGENCY	

PROFILE



RAILWAY BRIDGE



BORING NO.1 GL.+1.16

EL. MSL	Description	Legend	N-value 0 10 20 30 40 50
0.00	Filling: Calcareous sand containing grey silt, pebbles, crushed limestone, crushed potsherds, minute calcareous fragment		30, 50
-1.0	Cemented calcareous sand.		6
-2.0	Shells and crushed shells containing calcareous sand.		4
-3.0			5
-4.0	Grey, soft clay containing shells, crushed shells and limestone.		30
-5.0			32
-6.0	Grey, calcareous sand containing crushed limestone and minute calcareousfragments.		23
-7.0			14
-8.0			36
-9.0			36
-10.0	Grey, calcareous sand containing minute calcareous fragments.		37
-11.0			38
-12.0			38
-13.0			38
-14.0			40
-15.0	Grey, calcareous and silliceous sands containing minute calcareous fragment.		42
-16.0			43
-17.0			40
-18.0			40
-19.0			

All dimensions are in millimeter.
All elevations are in meter.

0 5 10m
SCALE 1/100

ARAB REPUBLIC OF EGYPT
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
FARMLAND ENVIRONMENTAL IMPROVEMENT PROJECT
IN OMOUM AREA

EL-MAX NEW PUMPING STATION
PROFILE

DWG. NO. PDP-1008

JAPAN INTERNATIONAL COOPERATION AGENCY