

**ANNEX J-1-C AN EXTRACT FROM ENVIRONMENTAL ACTION PLAN OF EGYPT PREPARED  
BY EGYPTIAN ENVIRONMENTAL AFFAIRS AGENCY 1992**

**An Extract from "Environmental Action Plan of Egypt" Egyptian Environmental Affairs Agency 1992.**

2.68 "Black Spot" Areas on Pollution and Degradation of Natural Resources (Water and Land). Based on available information, a number of "black spot" areas have been identified. The following areas are described in more detail in Annex V:

- Lake Maryut
- Lake Manzala
- Northeastern Region of Cairo, Shoubra El-Kheima
- East Cairo sewerage and treatment system and Bahr El-Baqar drain
- West Cairo sewerage and treatment system and El-Moheet drain
- Downstream section of Damietta Branch
- Downstream section of Rosetta Branch.

2.69 The following issues, also described in Annex V, are connected with the "black spot" areas:

- Bacterial pollution
- Pesticides
- Heavy metals
- Public health
- Lack of information on water quality status, causes and effects
- Further degradation as a result of inappropriate development.

## ANNEX V

### OVERVIEW OF "BLACK SPOT" AREAS AND RELATED ISSUES

- (a) **Lake Maryut.** This Lake suffers from serious pollution due to domestic and industrial effluent inputs from the Alexandria area. It is also a receptacle for agricultural drainage water. Despite its pollution, the lake is still used for fishing. There is a serious need for actions to prevent further deterioration and to evaluate what type of measures are needed to rehabilitate it together with the surrounding area. This calls for a regional environmental master plan, which will include actions to improve the environmental condition of the greater Alexandria area. Attention should be paid to municipal sewage treatment and disposal, industrial development and its attendant waste water treatment and disposal, relocation of drains and/or lagooning to separate polluted areas from less polluted areas that can still be used for fisheries, recreation, etc. As the clean up should be developed on an integrated basis, a regional master plan should also include the coastal waters of Alexandria.
- (b) **Lake Manzala.** Although the lake is exposed to high inputs of pollutants, the fish yield still amounts to more than 30 % of the total fisheries production in Egypt. there is a sever risk of heavy metal or pesticide pollution in the fish population. The most important source of pollution originates in East Cairo. Untreated and/or poorly treated waste water from this region is transported to Lake Manzala by the Bahr El-Baqar drain over a distance of more than 170 km. As well as organic matter, nutrients and bacteria, large amounts of heavy metals which might affect fish quality are also disposed in the lake via this drain.
- (c) **North-Eastern Region of Cairo, Shubra Al-Khima.** This region suffers from numerated waste water from the Qaliubia area and inputs from industrial activities.
- (d) **East Cairo sewage and treatment system and Bahr El-Baqar drain.** Untreated and/or poorly treated waste water from East Cairo is discharged into the Bilbeis drain. This drain is a part of the Bahr El-

Baqar drain system which discharges into Lake Manzala. The drain is heavily polluted and completely anoxic over its entire length of 170 km. Rural communities depend on this drain for irrigation.

- (e) **West Cairo sewage and treatment system and El-Moheet drain.** Waste water from West Cairo from the Zenein and Abu-Rawash plants, together with agricultural drainage, flow into the El-Moheet drain which at its tail-end discharges to the Rosetta Branch. The drain is heavily polluted with domestic and industrial waste water.
- (f) **Downstream section of the Damietta Branch.** The water quality in the Damietta Branch has deteriorated mainly as a result of domestic and industrial waste water, as well as agricultural drainage (Zifta area) and the reduced assimilative capacity due to low flows in the tail-end of this Branch.
- (g) **Downstream section of Rosetta Branch.** During summer, low flows in combination with high domestic and industrial waste water inputs from Kafr El-Zayat and agricultural drainage cause a gradual degradation of water quality down to the Edfina barrage. High contents of pesticides give rise to great concern since water from this branch is used for drinking water purposes. It is noted that plans to turn Lake Burullus into a fresh water reservoir may result in further deterioration of the part of the Rosetta branch downstream of the planned intake point.

#### Overview of "Black Spot" issues

- (a) **Bacterial pollution.** As a result of poor wastewater treatment, high concentrations of coliform bacteria are found in the Nile and its branches downstream of Cairo. Values of 1 to 10 million (Most Probable Number) MPN/100 ml have been measured in the Rosetta Branch. This is far above the standard of five thousand MPN/100 ml as given in Law 48 of 1982. Since exposure to pathogenic bacteria can cause serious health problems, adequate treatment of sewage should be given high priority.

- (b) **Pesticides.** High concentrations of pesticides are found in the Nile and Rosetta Branch. For example, the reported concentration for lindane ( $\gamma$ -HCH) and DDT are 5 to 10 times above European standards. As agricultural activities are the principal source, it is expected that concentrations in agricultural drain are even higher. The risk of pesticides relates to drinking water supply without proper treatment (by means of active carbon) and the accumulation in fish products. Apart from human health there is also a serious risk for natural values (e.g. birds).

The problem asks for a sound baseline study, including a review of pesticide use, import and production and measured concentrations in various water bodies, with special attention for drinking water resources and fishing areas. Short-term, or immediate, actions might be necessary in case unacceptable concentrations are found in drinking water.

- (c) **Heavy Metals.** High concentration of various metals are reported for the Rosetta Branch, the Alexandria region (coastal waters and Lake Maryiut) and Lake Manzala. Measurements in the Rosetta Branch show that cadmium, copper and zinc are above standards. It should be noted, however, that Egyptian standards for copper and zinc (of 1,000  $\mu\text{g/l}$ ) in receiving water bodies are too high (European stand are 50  $\mu\text{g/l}$  for copper and 150  $\mu\text{g/l}$  for zinc). High levels of mercury are also reported for the Alexandria region. Increased concentrations of metals are also found in the bottom sediment of Lake Manzala. The impact on the lake's fish resources remains unknown. As the heavy metals settle in sedimentation areas, they constitute a long-term threat for the environment. Actions are needed to determine the most important inputs and evaluate suitable reduction measures.

- (d) **Public Health.** Although high numbers of water-borne diseases are reported, it is believed that many more people suffer from diseases related to other forms of water pollution. Toxins such as pesticides and heavy metals in drinking water and food products can affect human health. Regular controls of drinking water quality and contamination of fish products must be achieved in the short-term, together with

adequate actions to prevent further exposure of the population to harmful contaminants.

- (e) **Lack of information on water quality status, causes and effects.** Although various studies and monitoring efforts have been carried out, information on water quality status, its causes and effects shows many gaps. To enable the formulation of effective measures to prevent further pollution of the vital water resources and to restore polluted areas, more detailed information is required for pollution sources, the transport and behavior of pollutants in the water system, the assimilative (self-purification) capacity of the water system, and the impacts of pollutants on various water uses. This calls for an adequate routine monitoring system, a data base and information system and an integrated modeling approach, to analyze the impact of individual pollution sources on ambient water quality, to predict future problems, and to evaluate the efficiency of proposed actions.
- (f) **Further degradation as a result of development.** Population growth, industrialization and the need for new agricultural areas and water use will increase the requirements for appropriate actions to prevent further pollution. Because water plays a central role in all these developments, there is a need for a planning unit to analyze future water requirements and distribution.

**K. RELATED PROJECTS AND STUDIES IN THE  
STUDY AREA**



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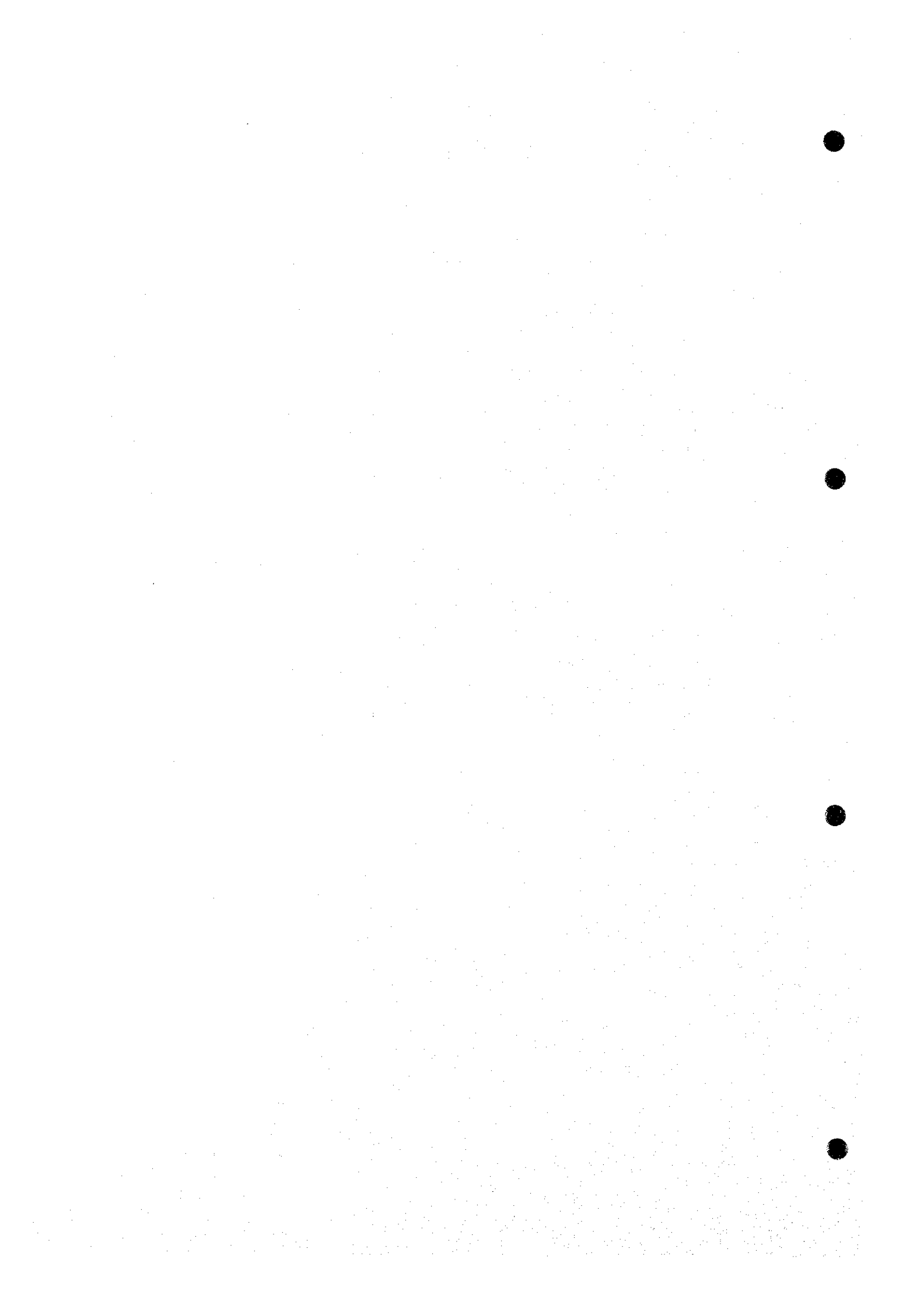
## ANNEX K. RELATED PROJECTS AND STUDIES IN THE STUDY AREA

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## ANNEX K. Related Projects and Studies in the Study Area

The following related projects and studies have been implemented in the Study Area;

- Subsurface Drainage Development Project
- Behera Rural Development Project (BRDP)
- Main System Management (MIS) Project
- Subsurface Drainage Design for Hares Pilot Area
- Reuse Monitoring Programme
- Omoum Drain Project
- Balaqtar Irrigation Project
- Mahmoudia Irrigation Improvement Project
- West Nubariya Agricultural Intensification Project

### 1) Subsurface Drainage Development Project

The subsurface drainage projects in Egypt by means of tile drains have been carried out at the beginning of 1960's through financial assistance of UNDP and World Bank.

In 1978, the drainage policy was revised to include long-term planning through the year of 2000 and guarantee sufficient flexibility in its implementation. The basis for the new policy is itemized as follows;

- To eventually provide most of cultivated lands with buried drainage networks,
- The cost of subsurface drains shall be repaid by the farmers on 20 year interest free annual installment, starting the third year after completion of the drainage system,
- Wide use of mechanical means and plastic pipes for installation of the pipe drainage networks.

According to the Government target for implementation of tile drainage, about 2.3 million hectare (5.5 million feddan) of land will be provided by tile drainage in the year of 2000.

In the Study Area, of which total area is about 177.6 thousand hectare (422.9 thousand feddan), cultivated land of about 156.6 thousand hectare

(372.7 thousand feddan), equivalent to 49.6 percent of the total cultivated area, is presently provided by tile drainage. Figure K-1 shows the provided tile drainage areas in the Study Area.

## 2) Behera Rural Development Project(BRDP)

### a) Objectives and Components of the Project

The project aims to formulate a comprehensive program to increase the production and to provide labor opportunities by establishing necessary institutional services, improving the income distribution, and raising the living standard according to scientific study for a group of vertical agricultural development programs.

The major components of the project are as follows;

- Soil improvement
- Agricultural intensification
- Subsurface drainage design for Hares Pilot Area
- Basic infrastructure improvement
- Improvement of agricultural services
- Project administration and coordination

The objective areas cover 135 villages, which is distributed in the biggest ten agricultural Districts in Behera Governorate, such as Kafr El-Dawal(17 villages), Abu Hommos(5), El-Mahmoudia(18), Damanhur(17), El-Delengate(15), Kom Hamada(13), Itay El-Baroud(20), ShoubraKhate(15), El-Rahmaniah(10), Hosh Essa(5).

### b) Project Implementation

The project agreement was signed in January 1982 among the Ministry of Agriculture, Land Reclamation and Fisheries, African Development Bank(ADB) and African Development Fund(AFD), and the execution of the agreement began in May 1986.

The project was/will be implemented as follows;

- First stage project(April 1984 - December 1989) --- 40 villages
  - . Kafr El-Dawar, El-Mahmoudia, and Abu Hommos Districts
- Extension stage of first stage (July 1989 - June 1992)--- 45villages
  - . Kom Hamada, El-Delengete, and Damanhur Districts
- Second stage project(July 1992 - ) --- 50 villages
  - . Itay El-Baroud, Shoubrakhat, El-Rahmania, Housh Essa Districts

The total project costs amount 30 million L.E. during the time of signing the agreement, of which 13.2 million L.E. represents the local components(43%), and 17,978 million US\$ from ADB and ADF represent the foreign component(57%).

### 3) Main System Management Project

#### a) Objectives of the Project

The Main System Management(MIS) project is one of ten components of the Irrigation Management System(IMS), which intend to strengthen the capability and capacity of the Ministry of Public Works and Water Resources (MPWWR) in the aspects of planning, design, operation, management, and maintenance of the Nile River irrigation system in Egypt.

Objectives of the project are as follows;

- Efficient management of the Nile River water resources
- Preparation of an accurate and real-time data to the water managers
- Communication facilities to operate the irrigation system facilities

As mentioned above, one of the primary objectives of the MSM project is to is implement a Remote Data Collection and Control System(RDC&C) throughout Egypt. The RDC&C will provide for real-time, remote data collection of information pertaining to the waters of Nile River, primary irrigation canals, main drains and pumping stations. The system will have the capability to perform remote control of water regulators and pump stations. The

project area encompasses over about 2.5 million hactare (six million feddan) of irrigated old land in Egypt.

Figure K-2 shows the MSM system data flow diagram indicating how the data will be transmitted from the remote collection site to the end users.

#### b) Project Implementation

The entire Irrigation Management Systems (IMS) Project is being funded by a grant from the United States Agency for International Development (USAID).

#### c) Existing MSM Systems in the Study Area

Automatic water level gauges are installed at the following sites in the vicinity of the Study Area;

- Trouga Pump Station
- El-Max Pump Station
- Kofr Boleen Regulator

#### 4) Subsurface Drainage Design for Hares Pilot Area

##### a) Objectives of the Pilot Area

The Hares Pilot area is located in the Western Delta, about 20 km south of Alexandria, and its area is 278 ha (690 feddan) with land elevation of 0.25 to 2.25 m below mean sea level (MSL) (see Figure K-3).

The main objectives of Hares Pilot Area is to test technology and economy of drainage systems in the sloping fringelands of the North Western Delta, with the following specified research objectives;

- Evaluation of an effect of drainage on the crop production,
- Determination of the most economic drainage intensity (spacing, depth, and length of laterals),
- Comparison of various locally produced synthetic envelope materials and evaluation of their effectiveness and costs, and

- Evaluation of the effect of using plastic collectors on implementation quality, hydraulic performance, cost and economy and maintenance requirements.

b) Project Implementation

The Hares Pilot Area and Technology Project is a joint activity of Drainage Research Institute, Ministry of Public Works and water Resources of Egypt and the Directorate General for International Cooperation, Ministry of Foreign Affairs, Government of the Netherlands.

The third phase project implementation was completed from July 1989 to June 1992.

5) Reuse Monitoring Programme

a) Objectives of the Programme

The Reuse Monitoring Programme(RMP) is an activity of the Open Drainage Division of the Drainage Research Institute affiliated to the Water research Center. The objectives of the programme are to provide the Ministry of Public Works and Water Resources with data concerning the quantity and quality of the generated drainage water in the Nile Delta and to provide the Reuse of Drainage Water Project with reliable data for calibration.

b) Project Implementation

The project is financed by the Ministry of Public Works and Water Resources in Egypt. To ensure a continuous flow of data, the Dutch Government has decided in the beginning of 1992 to provide the Reuse Monitoring Programme with technical support and equipment.

## 6) Omoum Drain Project

### a) Background of the Project

According to the report on the Omoum Drain Project, prepared by Irrigation Department, Ministry of Public Works and Water Resources in May 1984, an annual average quantity of water used in the West Delta is estimated at 10.3 billion cubic meter in the period of 1978 to 1982, which has been used for irrigation, drinking, industry and navigation purposes.

The irrigated area in the West Delta was estimated at about 0.50 million hectare (1.2 million feddan) in 1984. However, vast potential areas for agriculture exist especially in the area between El-Tahreer south and El-Tahreer north covering an area of about 42 thousand hectare (100 thousand feddan).

Under the situation, Egyptian Government made a plan to expand irrigation area as a government policy, in order to meet population growth in the country, by means of reuse of drainage water of the Omoum Main Drain.

### b) Project Features of Omoum Drain Project

The objectives of Omoum Drain Project is to collect the drainage water from the three catchments of Omoum Main Drain, Abu Hommos, Shereshera and Truga in a channel, which flows opposite to the direction of the Omoum Main Drain by the provision of regulator in Drain and three pump stations, as shown in Figure K-4. This collection of water will then be mixed with the fresh water of Nubariya canal at km 46.0. At this point, the canal serves an area of reclaimed lands of about 210 thousand hectare (500 thousand feddan), and will pass a discharge of five billion cubic meter per year.

The quantity of drainage water to be used in the project is about one billion cubic meter per year as shown below, and has an average salinity of 1,800 ppm. The expected salinity of water after mixing will be in the margin of 800 ppm.



The project is expected to be completed by the end of 1995.

Reuse Drainage Water to be Diverted

<u>Month</u>	<u>Discharge</u> (MCM)	<u>Salinity</u> (ppm)	<u>Month</u>	<u>Discharge</u> (MCM)	<u>Salinity</u> (ppm)
Jan.	44	2,155	Jul.	85	2,281
Feb.	33	2,545	Aug.	111	2,178
Mar.	92	2,117	Sep.	125	2,084
Apr.	91	2,303	Oct.	127	1,876
May	79	2,228	Nov.	57	2,084
Jun.	92	2,228	Dec.	61	2,174
			Total	996	2,188

7) Balaqtar Irrigation Project

a) Objectives and Components of the Project

Balaqtar Irrigation Project, of which project area is 4,830 ha (11,500 feddan) aims to demonstrate the modernize irrigation systems inclusive of on-farm level called as Meska, in order to expect to raise irrigation efficiency in the canal systems and to conduct well-water management at field level (see Figure k-5).

Major projects components of the project are as follows;

- Provision of head regulator on the Mohmoudia and improvement of Balaqtar canal of 16.8 km,
- Provision of pipe line systems branching off from the Balaqtar canal,
- Improvement of drainage conditions
- Improvement of on-farm facilities at Meska level
- Establishment of farmers' groups in each irrigation system

The irrigation water sources are diverted from the Mahmoudia canal through head regulator.

The Major crops in the project area are cotton, rice, maize, vegetable for summer crops and berseem, heat, vegetable, other crops in winter crops, respectively.

b) Project Implementation

The Project was implemented by the Irrigation Department for the period five years, from 1988 to 1992 with an assistance of International Bank as shown below;

- 1988 - 1989 : Construction of Balaqtar regulator and improvement of canal
- 1989 - 1990 : Provision of drainage systems
- 1990 - 1991 : Construction of aqueduct over Omoum drain
- 1991 - 1992 : Improvement works of the canal

8) Mahmoudia Irrigation Improvement Project

a) Objectives and Components of the Project

The overall objectives of the projects are summarized as follows;

- Increase of agricultural production by improving the irrigation facilities, through the introduction of continuous flow with downstream controls and the equitable distribution of water within tertiary blocks with improved water management at on-farm level.
- Improvement of farmers' income and involvement them in the management as well as operation and maintenance of tertiary canal equipped with single pump stations.
- Better communication with farming community, policy makers and technical staff of the Government staff.
- Improvement of institutional planning and implementation capacity of Ministry of Public Works and Water Resources in the irrigation subsector.

The project include the following components;

- Improvement of main and secondary canal delivery systems
- Development of tertiary canal systems
- Irrigation Advisory Services(IAS) to organize Water User's Groups (WUGs) at the tertiary level and Water User's Association(WUAs) at the secondary or branch levels
- Institutional support and strengthening
- Environmental assessment and management

- On-farm water management pilot program
- Communication components

b) Project Implementation

The project will be implemented for the period eight years from 1995 to 2002, with an assistance of World Bank finances, and its total project costs are amounted to be US\$ 204 million.

9) West Nubariya Agricultural Intensification Project

a) Background of the Project

West Nubariya Agricultural Project is located in the western desert, which is framed on the east by Nubariya Canal, in the north by the Mariut Lake, and in the south by the sand dunes. A Part of the priority development area, Nahda area, is lying in the eastern part of the Project Area. The Cairo-Alexandria Desert road penetrates the West Nubariya area from Km 175 to Ameria city.

Irrigation of West Nubariya Agricultural Project depends on the Nubariya canal. During 1952, the area served by Nubariya canal was 77,700 ha(185,000 feddan) increasing to 107,940 ha(257,000 feddan) by 1959. By the end of 1969, the total area served reached 172,200 ha(410,000 feddan). Plans call for Nubariya canal to eventually serve 319,200 ha(760,000 feddan). Therefore, widening Nubariya canal is a essential to meet the water requirements of the new area.

Furthermore, the project is presently faced to the following sever problems;

- The poor performance of large parastatal farms created on reclaimed lands in the 1970s. This constrain is being addressed by the Government of Egypt through the current policy of gradually divesting Public Sector Companies.
- The lack of maintenance of the irrigation infrastructure, which led to a rapid deterioration of the on-farm water conveyance and distri-

bution systems.

- The lack of production technology to be adopted to the desert environment.
- A week or complete absence of post reclamation assistance in extension, credit input supply, etc.

b) Objectives of the Project

Under the situations, the Food and Agricultural Organization (FAO) and World Bank programmed to undertake a project to intensify agricultural production in the West Nubariya Region through a six year project intending to:

- Rehabilitate on-farm irrigation infrastructure,
- Remodel the open drainage network and installation of tile drainage in some areas,
- Strengthen the adaptive research and agricultural extension services,
- Develop farming cooperatives,
- Develop agricultural credit institutions,
- Provide funds for incremental inputs and long-term investments in agricultural machinery, livestock, fruit tree, etc., and
- Establish a project management unit.

c) Recommended Works and Require Costs

Project works and their costs as of 1993 are summarized as follows;

<u>Project Works</u>	<u>Project Cost</u> ( '000 LE)
- Replacing Pump Station	11,342 ( - )1/
- Replacing, repairing or constructing structures on main or secondary canals	3,876 ( 560)
- Replacing, repairing or constructing structures on tertiary canals	20,408 (1,815)
- Lining, pitching and dredging canals	16,748 ( 157)
- Cleaning weeds from tertiary canal	2,762 ( 534)
Total	<u>55,136 (3,066)</u>

1/: Figures in parenthesis show the project costs for Nahda Area, of which net agricultural land is 10,941 ha (26,049 feddan), while total agricultural land for the project is 63,231 ha (150,551 feddan).

Source : Report on "West Nubariya Agricultural Intensification Project" Ministry of Public Works and Water Resources in August 1993.

As is observed in the above estimation, total project costs are 55.1 million Pound on the basis of 1993 unit price, which is equivalent to the amounts of 872 LE/ha or 366 LE/feddan on an average



FIGURE K-2 MSM SYSTEM DATA FLOW DIAGRAM

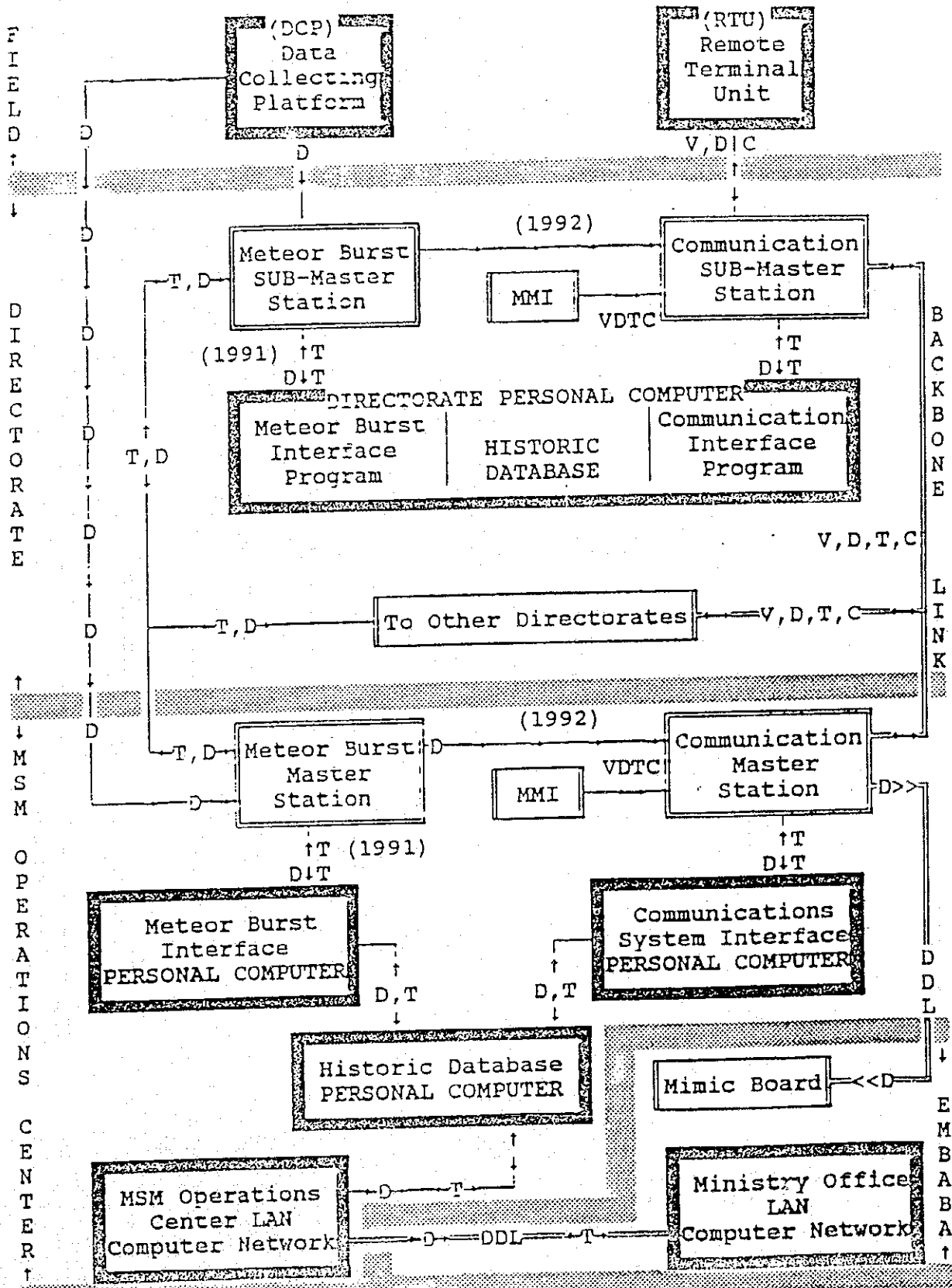
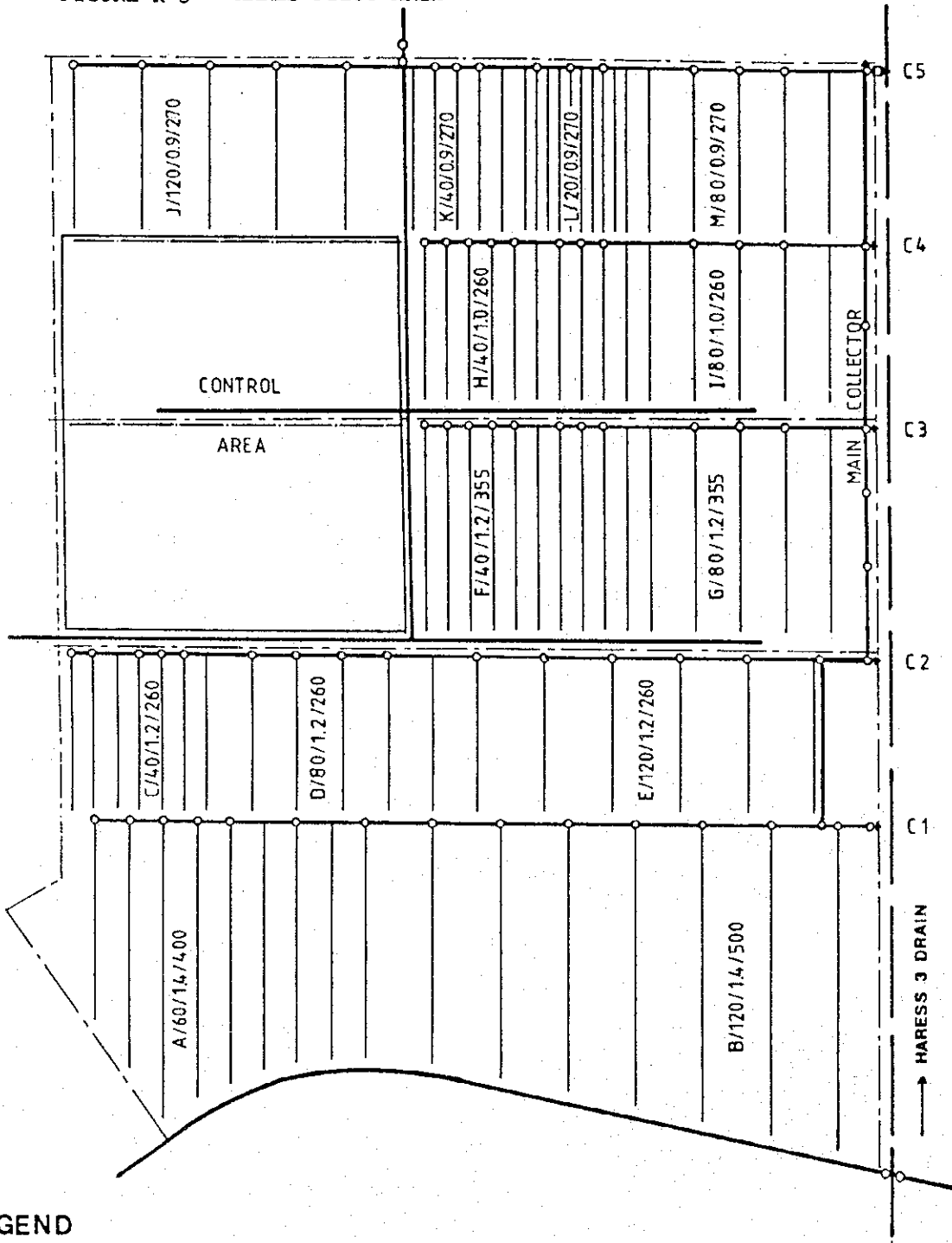


FIGURE K-3 HARES PILOT AREA



**LEGEND**

- IRRIGATION CANAL
- - - DRAIN
- - - FIELD BOUNDARY
- ⊕ CROSSING CANAL-DRAIN
- COLLECTOR (with manhole)
- LATERAL
- MANHOLE
- PUMPING STATION
- - - FUTURE COLL. EXTENSION

A/60/1.4/400 RESEARCH ALTERNATIVE  
(sector name/spacing/average depth/length of laterals)

MINISTRY OF PUBLIC WORKS  
AND WATER RESOURCES  
WATER RESEARCH CENTER  
DRAINAGE RESEARCH INSTITUTE

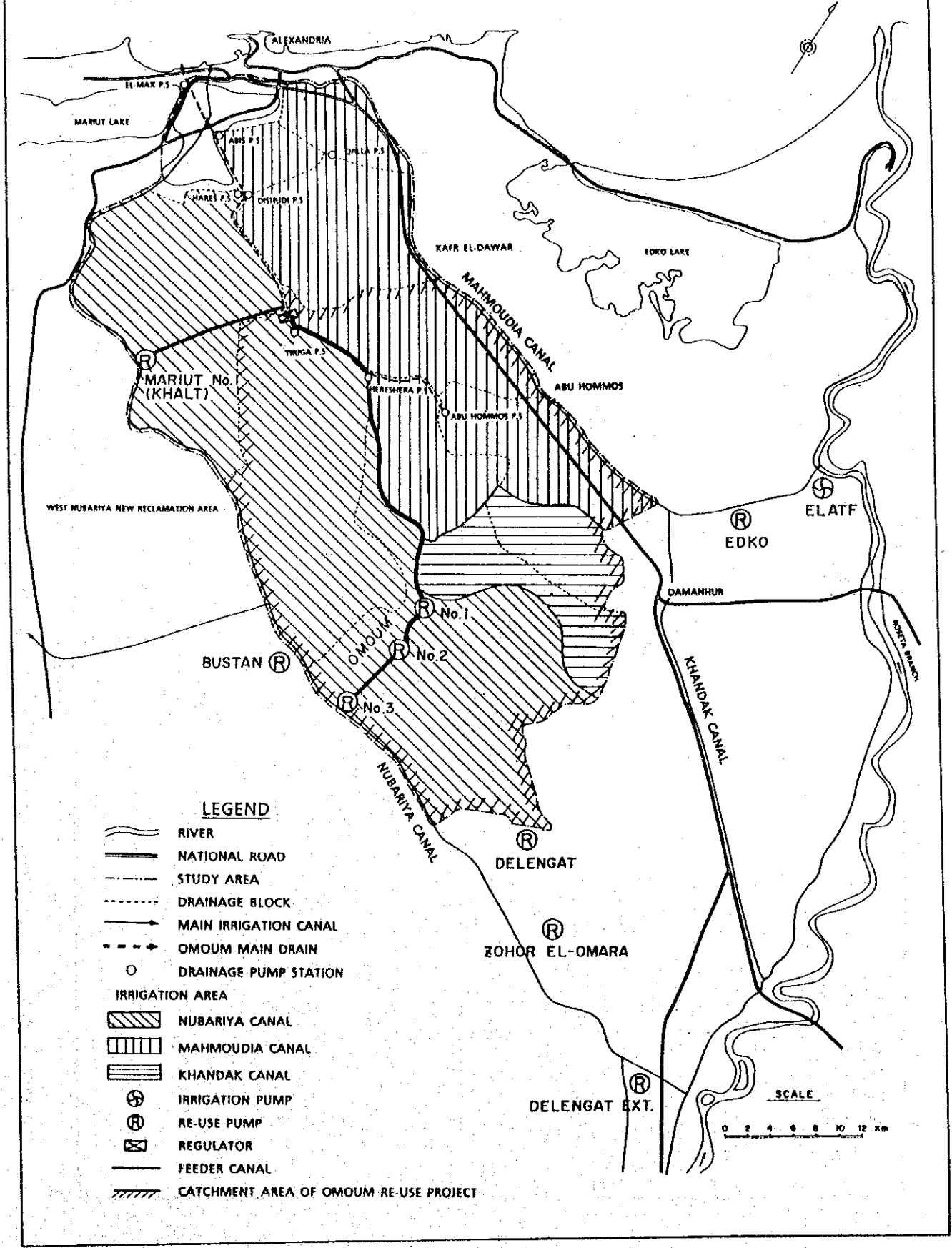
**HARES PILOT AREA**

Date: \_\_\_\_\_ Scale: 0 100 200 300  
(m)

FIG 1.2 : MODIFIED DRAINAGE DESIGN



FIGURE K-4 REUSE PROJECTS IN THE VICINITY OF STUDY AREA



**LEGEND**

- RIVER
- NATIONAL ROAD
- STUDY AREA
- DRAINAGE BLOCK
- MAIN IRRIGATION CANAL
- OMOUM MAIN DRAIN
- DRAINAGE PUMP STATION
- IRRIGATION AREA**
- NUBARIYA CANAL
- MAHMOUDIA CANAL
- KHANDAK CANAL
- IRRIGATION PUMP
- RE-USE PUMP
- REGULATOR
- FEEDER CANAL
- CATCHMENT AREA OF OMOUM RE-USE PROJECT

SCALE  
0 2 4 6 8 10 12 KM



**L. GOVERNMENT OFFICIALS INTERVIEWED BY  
THE STUDY TEAM**



**ANNEX L. Government Officials Interviewed by the Study Team**

In the courses of Phase-I and Phase-II field works, JICA Study Team contacted to the following officials concerned;

Ministry of Public Works and Water Resources

1) Planning Department

1. Eng. Ali Abu El Soud First Undersecretary,  
Chairman of MPWWR

2) Egyptian Public Authority for Drainage Projects (EPDAP) in Cairo

1. Eng. El Sayed Fouad Mousa Ramadan First Undersecretary,  
Chairman, EPADP
2. Eng. Yahia Abdel Aziz Vice-Chairman, EPADP
3. Eng. Fawzy M. Kamel Undersecretary, Design and Research,  
Former Chairman (Advisor), EPDAP
4. Eng. Salem Sayed Ahmed Mousa Former Chairman
5. Eng. Mahmoud Hassan Ahmed Former Vice-Chairman, EPDAP
6. Eng. Essa Mohamed Sayed Ahmed Director General, Planning &  
Following-Up and Evaluation  
Department
7. Eng. Rezk Hassan Menshawy Director General, Pump Station and  
Factories
8. Eng. Abdel Aal Ebrahim Director, Technical Office  
Investigation Department
9. Eng. Abdel Fattah Ahmed Saliman Assistant Director, Planning,  
Following-up and Evaluation Dept.
10. Eng. Mohammed Mahmoud Mustafa Assistant Director, Technical Office
11. Eng. Mohammed Hassan Civil Engineer, Field Design and  
Investigation Department
12. Eng. Wael Hussein Abbas

3) Department of Irrigation (DOI) in Cairo

1. Eng. Ahmed El Sawaf First Undersecretary,  
Chairman, Irrigation Department
2. Eng. Mohammed Talaat El Rakabawy Consultants for Water Distribution  
Affair
3. Eng. Ahmeed Salah General Director, Irrigation  
Improvement Project
4. Eng. Nabil Mahmed Hussein Director, irrigation Improvement  
Project

- 4) Mechanical and Electrical Department (MED) in Cairo
1. Eng. Abdel Ellatip M. Asker      Chairman, MED
  2. Eng. Victor Fares Ishak      Director General, Study and Specification Department
  3. Eng. Kamel Abo El Seoud      Director General, Technical Bureau
  4. Eng. Mohamed Ali El Dessouky      Head, Central Department for Project Sector
  5. Eng. Mohamed Sayed Aboul Fotouh      Staff, Study and Specification Dept.
- 5) Drainage Research Institute (DRI) in El Kanater El Khayria
1. Dr. Safwat Abdel-Dayem      Director, DRI
  2. Dr. Shaden T. Abbe-Gawad      Deputy Director, Environmental Specialist
  3. Dr. Gamal Abdul Nasser      Head, Laboratory
  4. Eng. Mohamed Saad      Re-use Department
  5. Eng. Ashraf El Sayed      Water Quality Davison
- 6) West Delta Drainage Directoate (WDDD) in Damanhur
1. Eng. Mina Iskander Mikhail      Undersecretary, WDDP
  2. Eng. Khalaf Nasef Khalaf      Director General, Drainage Project in West Delta Directorate
  3. Eng. Nabil Garugis Bashaay      Director General, Nubariya Drainage Projects
  4. Eng. Hatem Hosien      Director, Work Department
  5. Eng. Mohamed Fathy Saif      Director, Technical Office
  6. Eng. Ahmed El Madany
  7. Eng. Hassan El Sammad      Chief, Mariut District
- 7) West Delta Irrigation Directorate (WDID) in Damanhur
1. Eng. Magdi M. El. Kashet      Undersecretary, WDIP
  2. Eng. Ahemed Yaya Alahody      Director General, WDIP
  3. Eng. Fakry El Tety      Director,
  4. Eng. Khaled Hamauda      Irrigation Water Distribution Section
  5. Eng. Ahmed El Semami Mohamed      In charge of El Aft Pump Station
- 8) Nubariya Irrigation Directorate (NID)
1. Eng. Kamal Ghname      General Director, NID
  2. Eng. Wagdi Bokter      Inspector
  3. Eng. Sayeed Shalaby      Inspector
  4. Eng. Rafit Nesheed Grigis      Inspector for Nubariya Directorate
  5. Eng. Isayed Ali Shalaby      Head, Telemetry and Water Distribution of Nubariya Directorate

- 9) Nasr Canal Irrigation Directorate  
 1. Eng. Mohsen Ahmed Fahmy                      Irrigation Engineer
- 10) Horizontal Expansion and Project Affairs in Damanhur  
 1. Eng. Mahmoud Mostafa                      Chairman  
 2. Eng. Zakaria Abbas                      Deputy Chairman
- 11) North West Delta Mechanical and Electrical Directorate in Damanhur  
 1. Eng. Abdel El Hamid Ahmed Hassan      Chairman  
 2. Eng. Hosny El Sayed Morsy              Technical Office  
 3. Eng. Mohammed Abd Alla Shabana      Senior Eng. at El-Max Pump Station
- 12) Drainage Research Institute (DRI) in Damanhur  
 1. Eng. Karima Hanafi                      Assistant Director, DRI in Damanhur
- 13) Water Distribution Directorate for Lower Egypt  
 1. Eng. Samy Saad Salamah                  Assistant Director,

Ministry of Planning

1. Eng. Roda Mohamed Awadalla              Undersecretary, Land Reclamation,  
 Agricultural and Irrigation Sector

Ministry of Agriculture, Land Reclamation and Fishery (MALRF)

- 1) Ministry of Agriculture, Land Reclamation and Fishery  
 1. Dr. Saad Nasar                      First Undersecretary, Agricultural  
 Economics and Statistics  
 2. Mr. Mahmoud Nazif                  Undersecretary, Agricultural  
 Economics  
 3. Mr. Abdel Rask Hassan              General Director, Sampling Agro-  
 Statistics  
 4. Dr. Esmail M. Gamel El Din        General Director, Agro-Statistics  
 5. Dr. Nabil El Moelhi                  Manager, Water and Land Research  
 Institute
- 2) MALRF in Alexandria Governorate  
 1. Eng. Said Abd El Wahd              General Director  
 2. Eng. Hassan Mansour              Director, Public Relation  
 Department, Agricultural Sector  
 3. Eng. Saeed Oraby                  Director, Agricultural Extension

3) Ministry of Agriculture in Abu El Matameer

1. Eng. Talet Abdelazy El Kargotly      General Director
2. Eng. Salem Manoun                      Vice-General Director
3. Eng. Mikail Nassef                        Staff in Koum El Farag

4) Ministry of Agriculture, Land Reclamation and Fishery in Abu El Matameer

1. Eng. Mahammed Mabrouk Nawar      General Director
2. Eng. Fawzy Facid Yousef              Engineer

5) Ministry of Agriculture, Land Reclamation and Fishery, Abis Control Office for Cooperative and Development

1. Eng. Mhamoud Khalil                      General Director
2. Eng. Abd El Rahman Mohmed          General Director, Abis Control Office

6) District Office of Ministry of Agriculture, Land Reclamation and Fishery

1. Eng. Abdel Sattar El Sayed              Assistant Director, Hosh Esa Office
2. Eng. Mohamed Salah El Sherif          Director, Abu Hommos Office
3. Eng. Hussan Mohamad El Sayed          Director, Kafr El Dawar Office

Ministry of International Cooperation (MOIC)

1. Mr. Wahib El Miniawy                      Advisor, MOIC
2. Mr. Mohamed Farid M. Aly                  Director General, MOIC
3. Mr. Mohsin M. Sadek                        Director, Japan Department, MOIC
4. Ms. Samiha Barakat                         Economic Researcher

The Egyptian Meteorological Authority in Cairo

1. Mr. Ahmed A.M. Faris                      Director, Climatology Directorate

Cairo and Alexandria Universities

1) Cairo University

1. Pro. Dr. Deyaa Ahmed El-Kadi          Vice-Dean, Graduate Studies and Research Faculty of Agriculture
2. Pro. Dr. Mahmoud H. El-Shaer          Professor, Agronomy.
3. Pro. Dr. Mohamady Ibrahim              Professor, Soil Science, Soil Dept.



2) Alexandria University

- |                                    |                              |
|------------------------------------|------------------------------|
| 1. Prof. Dr. Mohamed Farid Youssef | Surveying Department         |
| 2. Prof. Dr. Fawzy H. Abdel-Kader  | Soil and Water Science Dept. |
| 3. Prof. Dr. Mikail Chaker         | Irrigation Department        |

Alexandria Governorate

- |                                 |  |
|---------------------------------|--|
| 1. Mr Al Sayed I. Al Gawsaky    | Governor, Alexandria Governorate                           |
| 2. Mr. Mohammed El Nakib        | General Manager  |
| 3. Mr. Aly Gouda                | Director General, Information and Decision Superior Center |
| 4. Mr. Fathy Mohammed Hassan    | Head, Environmental Protection Office                      |
| 5. Mr. Ahmed Hamed El Sayed     | Alexandria Governorate                                     |
| 6. Eng. Said Abdel Wahab        | General Manager, Agricultural Dept.                        |
| 7. Eng. Sobky Ahmed Abdel Sayed | Alexandria Governorate                                     |
| 8. Dr. Mohamed A. Essa          | Director, Alexandria Governorate Fish Farm.                |

Behera Governorate

- |                           |   |
|---------------------------|---|
| 1. Dr. Slah El-Din Atia   | Governor, Behera Governorate                              |
| 2. Mr. Lamey M. El-Shamey | Director General, Information and Decision Support Center |

Behera Water Supply Company

- |                        |                                       |
|------------------------|---------------------------------------|
| 1. Eng. Mahmud Mansor  | Chairman, Behera Water Supply Company |
| 2. Eng. Ebrahim Khalid | General Manager, Research Section     |

Alexandria General Organization for Sanitary Drainage (AGOSD)

- |                                |  |
|--------------------------------|--|
| 1. Mr. Hassan A. El Hakeh      | Chairman, AGOSD                        |
| 2. Eng. Mohamed Bahageto       | Undersecretary, Maintenance and Worker |
| 3. Eng. Faragalla Rezk Ebrahim | General Director, Civil Design Dept.   |
| 4. Mr. Magdy Makhtar           | Plant Manager, East Treatment Plant    |

Behera Road and Transportation Directorate

1. Eng. Rajaa Abu El Eo Touh Atia Director, Pavement Department

Institute of Agricultural, Economy Research in Damanhur

1. Dr. Mahmoud Yousef Moussa Head, Behera Research Unit

General Authority for Fish Resources Development

1. Mr. Ahamed El Fiki Undersecretary
2. Dr. Essam A. Sabry General Manager, Egyptian Fishery Company
3. Dr. Mohamed A. Essa Director, Alexandria Governorate Fish Farm, Mariut Lake

Egyptian Fishery Company

1. Dr. Essam A. Sabry General Director

Shore Police Station for Water Surface Area

1. Mr. Mogor Radwan Essam El Din Chairman, Shore Police Station

Embassy of Japan

1. Mr. Koichi Kimura Minister
2. Mr. Takeshi Minagawa First Secretary

Egypt JICA Office

1. Mr. Tadashi Shinoura Resident Representative
2. Mr. Hisatoshi Naitoh Vice-Resident Representative
3. Mr. Satoshi Umenaga Assistant Resident Representative
4. Mr. Kazuhide Nagasawa Assistant Resident Representative
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JICA Expert

1. Mr. Hiroshi Egami

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Public Works and Water Resources

2. Mr. Takeo Satoh

JICA Technical Advisor, Egyptian  
Fishery Company

3. Mr. Monma Yukihiro

JICA technical Advisor, Egyptian  
Fishery Company

## **M. COLLECTED DATA**

## ANNEX M. Collected Data

The following data and information for the Master Plan and Feasibility Study purposes are collected during the Phase-I and Phase-II study period.

### 1) Meteorology and Hydrology

#### 1) Meteorology and Hydrology

<u>Data</u>	<u>Station</u>	<u>Period</u>
- Monthly total rainfall	Alexandria	1973~94
- -do-	Damanhur	1973~92
- Daily rainfall highest three months	Alexandria	-do-
- -do-	Damanhur	-do-
- Hourly Rainfall of three highest daily rainfall	Alexandria	-do-
- -do-	Damanhur	-do-
- Maximum and minimum temperature	Alexandria	1942~90
- Evaporation	-do-	1942~85
- Sunshine hours	-do-	1951~90
- Maximum and minimum relative humidity	-do-	1946~90

Data source; Egyptian Meteorological Authority

- Daily rainfall(Oct.-Mar.), period of 14 years(1980-1994) at Alexandria station
- Daily pump discharge records including suction and delivery water levels at El-Max, Qalla, Abis, Hares, Dishudi, Truga, Shereshera and Abu Hommos, the period of four years (1991-1994)
- Daily record of reuse pump at Boustain and Mariut No.1 pump station, period of three years (1991-1993)
- Daily record of Nubariya drain, period of four years (1991-1994)

### 2) Irrigation and Drainage

#### a) Master Plan Study

##### Irrigation Aspect

- Monthly intake discharge of Mahmoudia canal at El Atf, Behera Irrigation Directorate, 1993
- Monthly inflow discharge to Mahmoudia from main sources, Behera

Irrigation Directorate, 1993

- Monthly intake discharge from Mahmoudia canal by the main intakes, Irrigation Directorate, 1993
- Monthly intake discharge to Nubariya canal, NID, 1993
- Monthly intake discharge to Nubariya canal from Naseri canal, NID, 1993
- Daily water requirement for the command area of Mahmoudia, Behera Irrigation Directorate, 1993
- Command area of main branches of Mahmoudia canal, Behera Irrigation Directorate, 1993
- Schematic diagram of Nubariya canal irrigation system, NID, 1993
- Monthly outflow from Nubariya canal (only seven points), NID, 1993
- Area covered by different crops in Nubariya area, NID, 1993
- Organization chart of Irrigation Directorate, August, 1994
- Schematic diagram of irrigation network
- Command area by each main/lateral canal, August, 1994
- Unit water requirement for each crop, August, 1994
- Irrigation rotational map (Nubariya canal and Mahmoudia canal), 1994
- Intake discharges by each main/lateral canals, August, 1994
- List of re-use pumping stations and their discharge data
- Proposed intake discharge from Nubariya Canal (1993 - 1994)
- List of on-going projects and proposed plans
- Study report using Omoum Main Drain Water for Irrigation Purposes, May, 1984
- Feeding canal profile for the project of mixing Omoum Main Drain water with Nubariya Canal at 46.0km
- Nubariya canal water distribution programme, Nubariya Irrigation Office, 1993

#### Drainage Aspect

- Various data/maps of drainage blocks in the Study Area, WDDD, 1993
- Monthly discharge data of all pumping stations in the study Area MED in Damanhur, 1988, 1992, 1993
- Daily water level (suction and delivery) data of all pumping stations, MED in Damanhur, January and April, 1994
- Basic information of all pumping stations, MED in Damanhur
- Monthly rate of escape from West Nubariya drain to Nubariya navigation canal, NID, 1993
- A Technical Report prepared by the Ministry after the 1991 Flood, WDDD
- Technical Report No. 70 about Hares Tile Drain Pilot Project, DRI in Damanhur
- Drainage Water El Umum Reuse Project, DRI, 1985
- The Utilization of Mariut Valley to Participate in the Development

- of the North-West Coastal Areas, Alexandria University, April 1994
- Hydrogeological Map of Egypt, Research Institute for Groundwater, Water Research Center, MPWWR
- Workshop on Re-Use of Drainage Water, DRI, March 1984
- Organization chart of Drainage Directorate, August 1994
- Jurisdiction map of Drainage Directorate, August 1994
- Schematic diagram of drainage network, August 1994
- Drainage area by each block with acreage, August 1994
- Area map of executed tile drain, August, 1994
- Location map of executed drain by each drainage block(Truga, Shereshera, Abu Hommos and Delengat areas), August 1994
- Drainage records by each pump
- Design criteria for open drains and tile drains, 1989
- Maintenance procedure of drainage facilities
- On-going drainage projects proposed plans (partial)
- Project Planning Report (Drainage Project 5)
- A Vision on the Future of Land Drainage in Egypt, April 1994
- Longitudinal profile of Hares Drain

## 2) Feasibility Study

### Irrigation Aspect

- Technical Report No. 17, Master Plan for Water Resources Development and Use, march 1981, Irrigation Department, MPWWR
- Calculation of Water Requirement, February 1995, Irrigation Department, MPWWR
- Design of Drain Systems, February 1995, EPADP, MPWWR
- Irrigation and Water Resources in 1991, Statistic Census Department
- Water Level Record of Nubariya Canal(MSM), February 1995, prepared by Irrigation Department, MPWWR
- Irrigation Improvement Project(IIP), March 1994, prepared by Irrigation Department, MPWWR

### Drainage Aspect

- Technical Report on Hares Pilot Project No. 46 and 69, prepared by DRI
- Tile Drain Plan in Hares Area, February 1995, Prepared by EPADP
- Storm Data in 1994, Alexandria Port
- Truga Tile Drain Map, February 1995, prepared by EPADP
- Irrigation Network Map of Hares Area, February 1995, prepared by Nubariya Irrigation Directorate
- Data of Hares Irrigation Area, March 1995, prepared by Nubariya Irrigation Directorate

### 3) Agriculture and Soils

#### a) Master Plan Study

- Agricultural land-use and crop production (National and District levels), DOS, Ministry of Agriculture, Land Reclamation and Fishery (MALRF, Cairo), 1984-1993
- Land-use, crop production and land holding (Local Unit level), Agricultural Statistical Zone Office MALRF (Damanhur), 1991-1993
- Animal husbandry and other agricultural production, Agricultural Statistical Zone Office, MALRF (Damanhur and Alexandria)
- Soil and land classification, Water and Land Research Institute and Land Improvement Authority (LIA, Damanhur), MALRF
- Groundwater table of cultivated land, EPADP (Cairo), 1992-1994
- Evaluation of Tile Drainage Project, EPADP (Cairo), 1994
- Profile of Behera Governorate, Behera Governorate

#### b) Feasibility Study

- Pre-Drainage Investigation on El Hares Pilot Center, June 1994, prepared by DRI
- 1989/1990 Agricultural Census Report, Behera Governorate, 1995, prepared by MALRF
- 1989/1990 Agricultural Census Report, Alexandria Governorate, 1995, prepared by MALRF
- Annual Leaflet of the Cultivated Area, 1992, April 1993, prepared by MALRF
- The Annual Leaflet of the Cropped Area, 1992, April 1993, prepared by MALRF
- Map of Cropping Rotation at Village Level in 1984, prepared by Office of MALRF, Abu El Matameel
- Irrigation Improvement Project in Mahmoudia, Agricultural Aspects, March 1994, prepared by PPD, MPWWR
- Annual Report on Agricultural Statistics, Alexandria, 1993, February 1995

### 4) Agro-Economic Conditions

#### a) Master plan Study

- Summary of the Third Five-Year Plan (1992/93-1996/97), Ministry of Planning, July 1992,
- Evaluation of Delta Tile Drainage Project, Cairo University, March, 1994
- Economic Reform, United State Agency for International Development (USAID), 1992
- Population Census in 1987, Central Agency for Public Mobilization and



Statistic (CAPMAS)

- The Household Income, Expenditure and Consumption Survey in Egypt, CAPMAS
- Operation and Maintenance Costs in West Delta Project Directorate

b) Feasibility Study

- Statistic Year Book, June 1994, prepare by Central Agency for Public Mobilization & Statistic, Cairo, Egypt
- World Bank Report on Irrigation Project in West Delta region, 1994, prepared by PPD, EPADP
- Farm Economic Survey in Hares Area, February 1995, conducted by Study Team
- Irrigation Improvement Project, Mohmoudia, Wasat and Manaifa Preparation Report, Main and Annex (5 Volumes), 1994, prepared by IPP & PPD, MPWWR
- Staff Appraisal Report Arab Republic of Egypt, Irrigation Improvement Project, December 1994
- Drainage Executive Management Report, June 1995, prepared by Ministry Transport, Public Works and Water management, Netherlands
- National Drainage Project, Crop Yield Data Collection and Reporting, January 1995, prepared by Darwish Consulting Engineer
- West Nubariya Agricultural Intensification Project, February, prepared by MPWWR

5) Project Facilities

a) Master Plan Study

- Profile of Omoum Main Drain and branches, WDDD
- Dimensions of Omoum Main Drain and laterals, DWWD
- Profile and plan of Nubariya Canal, MED
- List of drainage pumping stations, WDDD
- Technical data of drainage pumping stations, MED
- Running condition of existing pumping stations, MED
- Daily discharge records at El Max pumping station (1990-1994), MED
- Operation records of El-Max Pumping Station, 1990-1994, MED

b) Feasibility Study

- Design Longitudinal and Cross Section of Drain in Hares Area
- Actual Longitudinal and Cross Section of Drain in Hares Area
- Design Cross Section of Discharge-Channel
- Data on Transmigration for Improvement of Discharge-Channel, prepared by West Delta Drainage Directorate
- Design Textbooks in Civil Engineering (Regulator), February 1986 written by Pro. Nazeih Assad Younan

- Design Textbooks in Civil Engineering (Irrigation Structure), January 1991 written by Prof. Nazeih Assad Younan
- A technical Report for Examining El-Max Pumping Station (Building of Japanese Pump), February 1994, Mechanical and Electrical Department (MED) MPWWR
- Staff Appraisal Report on Pumping Stations Rehabilitation Project II in Arab Republic of Egypt, April 1990, prepared by World Bank
- Hourly Pump Running Data in Hares from September 26, 1994 to October 5, 1994, prepared by MED
- Daily Pump Running Data in Hares from April 1991 to December 1994. prepared by MRD
- Unit Price for Cost Estimation such as Labor Rate, Construction Materials, Civil Works, Fuel Consumption, Capital Cost of Equipment, and adopted Proportion of Foreign and Local Components as of 1995 at Central and Regional EPADP Offices

#### 6) Rural Development

- Village water supply network map in Behera Governorate, Behera Water Supply Company (BWSC)
- General information of Abu Hommos Treatment Plant, BWSC
- Village road map and road intensity in Behera Governorate, Behera Road and Transportation Directorate
- Report on Behera Rural Development Project, Ministry of Agriculture and Land Reclamation
- General information of rural community
- Data on related projects in the Study Area

#### 7) Environments

##### a) Master Plan Study

- Total fish production of Mariut Lake (1985-1993), General Authority for Fish Resources Development (GAFRD)
- Fish production estimates, Statistical Year Book, 1952-1992
- Nozha fish farm total production, Egyptian Fisheries Co. Nozha Hydro Drome, 1975 - 1993
- Annual fish production of Alexandria Governorate Fish Farm, Alexandria Governorate Fish Farm, 1991 - 1994
- Fisherman and fishing boat in Mariut Lake, General Authority Fish Resources Development, 1994
- Water quality of Mariut Lake, GAFRD
- Chemical analysis of Nozha Hydro Drome, 1992-1994, Egyptian Fisheries Co., 1991 - 1994
- Water quality criteria of Alexandria Governorate Fish Farm,

Alexandria Governorate Fish Farm, 1994

- Operation Monthly Report, July 1994, East Treatment Plant
- Laboratory report for West Treatment Plant, February, 1994, West Treatment Plant
- Discharge and quality of treatment plant, Alexandria General Organization for Sanitary Drainage, 1994
- Paper for workshop on Mariut Lake, April 1994, Alexandria University
- Law and Degrees on Pollution and Environment, Middle East Library
- Census of Fish Production in ARE, 1992

b) Feasibility Study

- Nubariya Navigation Canal By-Pass Data (station 100 km), November 1994-February 1995, Nubariya Irrigation Directorate,
- Nubariya Area Irrigation Water Distribution Record, January 1994-January 1995, Nubariya Irrigation Directorate,
- Bahig Command Area Supplemental Feasibility Report, May 1993, prepared by MPWWR
- East Treatment Plant Average Daily Flow, December 1993-December 1994, prepared by East Treatment Plant, Alexandria General Organization for Sanitary Drainage (AGOSD)
- West Treatment Plant Average Daily Flow, January 1993-December 1994, prepared by West Treatment Plant, Alexandria General Organization for Sanitary Drainage (AGOSD)

8) Survey

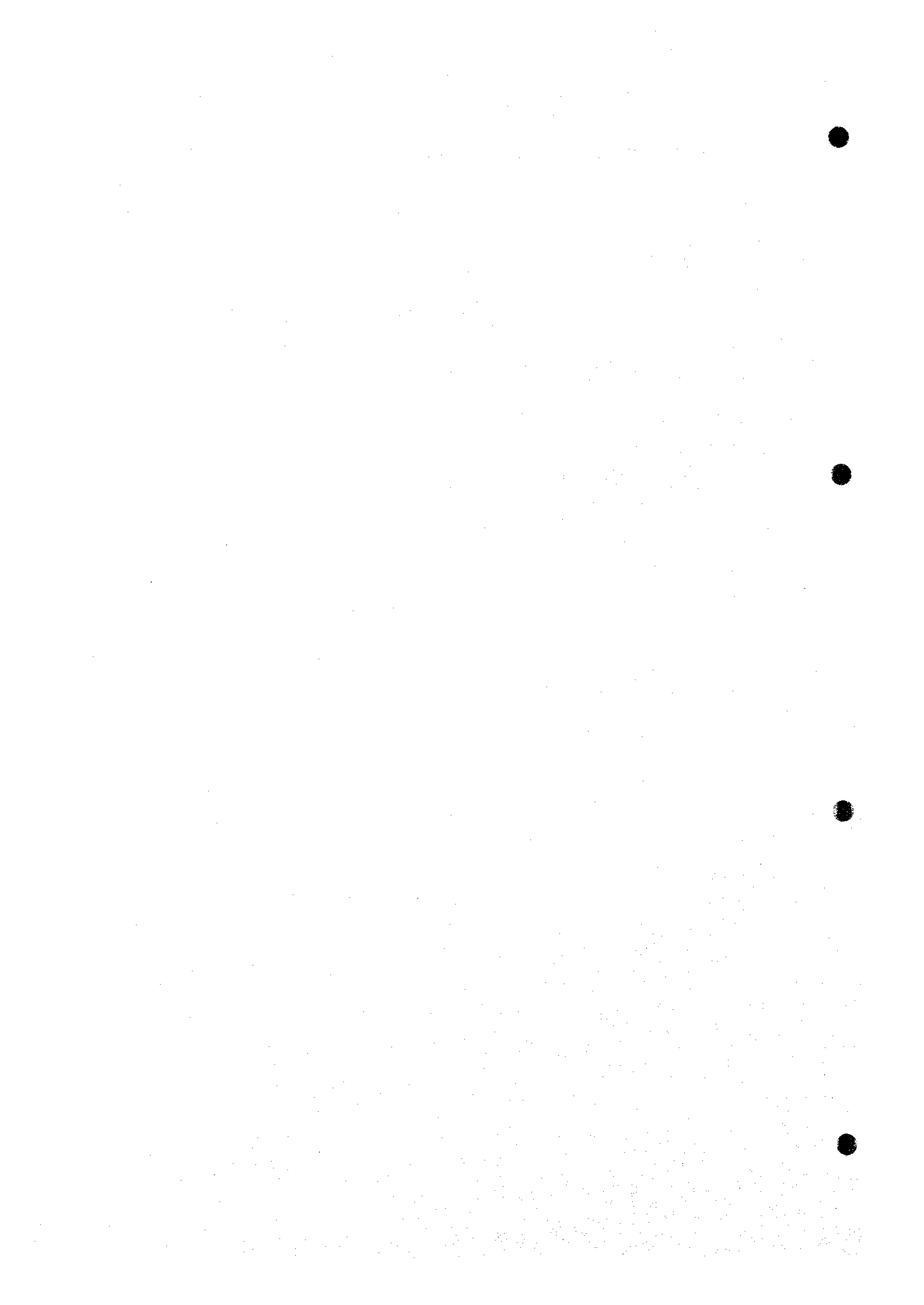
- Description of Levels Survey Book Western Delta, Egyptian Survey Authority
- Level Survey Data, Egyptian Survey Authority
- Longitudinal profile and Cross section survey of Omoum Main Drain

**N. SPECIFICATION OF CONTRACT-BASED FIELD WORKS**

## ANNEX N. SPECIFICATION OF CONTRACT-BASED FIELD WORKS

### Contents

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A-4. Water Level Gauge Installation .....	N-31
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## ANNEX N. SPECIFICATION OF CONTRACT-BASED FIELD WORKS

### A. Phase-I Field Works

#### A-1 Farm Economic Survey

##### 1. Collection of Village Information

The eight number of sample villages are chosen, as a whole, by the Employer at the up-stream, middle-stream, and down-stream areas of the Study Area, and the village list will be provide to the surveyor.

##### 1) Village Farmer List

In the sample village, farmer list shall be collected with the information of farm size and land tenure such as full owner, part owner and tenant farmer.

##### 2) Collection of General Information

- a) Population and number of households(as of 1994)
- b) Area coverage of sub-surface drainage systems (percent of total cultivation land)
- c) Kind of major crops and animals
  - Winter crops
  - Summer crops
  - Nile crops
  - Permanent crops
  - Animal husbandry

##### 3) Number of landless farm labor households

##### 4) Number of patient for water related diseases

##### 2. Sampling Farmers

200 sample farmers shall be selected from eight sampling villages mentioned above, applying stratified way of sampling for three categories of

farmers, that is, large, medium, and small farmers in each village. Selection of the farmers shall be made considering that the farm size and land tenure type of the sample farmers are representative for the each categories of farmers.

Out of the selected 200 farmers, respective 48 and 152 farmers shall be interviewed for "Farm Economic Survey" and "Crop Production Survey", as shown below;

<u>Surveying</u>	<u>Number of Sampling Farmers</u>
- Farm Economic Survey	48 farmers
- Crop Production Survey	152 farmers

When the eight sample villages are selected, the six sampled farmers, two Large, (two Medium and two small-scaled farmers), totaling 48 farmers, will be interviewed in accordance with the questionnaire of "Farm Economic Survey" and 19 sampled farmers(seven Large, six Medium and six small-scaled farmers), totaling 152 farmers for "Crop Production Survey" respectively in each sample village, as shown below;

<u>No.of Villages</u>	<u>Location</u>	<u>Farm Economic Survey</u>	<u>Farm Production Survey</u>
1	Up-stream	6 farmers	19 farmers
2	-do-	6	19
3	Middle-stream	6	19
4	-do-	6	19
5	Down-stream	6	19
6	-do-	6	19
7	-do-	6	19
8	-do-	6	19
<u>Total</u>		<u>48</u>	<u>152</u>

The survey of the extra pages of "Ex.1" and "Ex.2" in the "Farm Economic Survey" will be made for only one sample farmer who are knowledgeable to reply the related question in each sample village.



### 3. Tabulation of Survey Results

The survey result will be tabulated in each village as well as each area by the Surveyor in the attached form, which will be prepared by the Employer, and if necessary those tabulation form will be revisable by the Surveyor.

### 4. Bill of Quantities

Bill of quantities for farm economic survey are shown below;

#### BILL OF QUANTITIES

<u>Items</u>	<u>Descriptions</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u> (LE)	<u>Amount</u> (LE)
1001.	Farm economic survey	farmers	48		
1002.	Farm production survey	farmers	152		
1003.	Reporting	LS			
	Total		200		

# FARM ECONOMIC SURVEY

Farm No. <span style="float: right;">---</span>
---

Name of Farmer \_\_\_\_\_  
 Address Village : \_\_\_\_\_  
 District : \_\_\_\_\_  
 Governorate : \_\_\_\_\_

Date interviewed: \_\_\_\_\_, 1994  
 Enumerator: \_\_\_\_\_

1. Farming Experience No. Years \_\_\_\_\_

## 2. Family Composition and Working Conditions

No.	Family Composition at Present				Working Conditions (Nov., 1992 to Oct., 1993)						
	Age	Sex		Family Status	Days Worked		Worked in Other Farm		Non-farm Occupation		
		Male	Female		on your Farm	Working Status	Days Worked	Gross Annual Income	Job Sites	Working Days	Gross Annual Income
					days/year			Cash LE			Cash LE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(11)	(12)	(13)	(14)
1					R T				R T		
2					R T				R T		
3					R T				R T		
4					R T				R T		
5					R T				R T		
6					R T				R T		
7					R T				R T		
8					R T				R T		
9					R T				R T		
10					R T				R T		
11					R T				R T		
12					R T				R T		

Note: Col. (4)	Items Family Status  (6), (12) Working Status  (9), (14) In Kind  (11) Job Site	Code / Description 1: head of family 2: spouses 3: respondent's children 4: step son/daughter 5: parent 6: relatives 7: servant/employee 8: others  R: regular employee T: temporary employee  W: wheat O: others  1: in and around the village 2: other place in Egypt 3: other countries
----------------	--	--

3. Area of Land Holding (At Present)

(Unit: feddan)

Land Items	Own (1)	Rent (2)	Subtotal (3)	Lease (4)	Total (5)=(3)+(4)
1. Field for Temporary Crops					
2. Field for Permanent Crops*1					
3. House Lot					
4. Others (Specify: )					
Total					

Note: \*1... included orchard

4. Rent and Leased Land Fee (Nov., 1992-Oct., 1993)

Items	1. Temporary Field Crops	2. Field for Orchard or Permanent Crops	3. Others	Total
1. Rent fee per year				
a. Paid in cash (LE) (1)				
b. Paid in kind (Kg) (2)				
• (Kg) (3)				
• Others ( ) (4)				
2. Lease fee per year				
a. Received in cash (LE) (5)				
b. Received in kind (Kg) (6)				
• (Kg) (7)				
• Others ( ) (8)				

Note: Others ... included the area of house lot and others.

5. Crop Production (Nov. 1992-Oct. 1993)

Name of Crop (month-month)	Major Varieties	Cropping Pattern	Crop Production		Crop Damage	
			Planted Area (feddan)	Production (kg)	By Saline Soils	By Poor Drainage
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. ( - )				M B		
2. ( - )				M B		
3. ( - )				M B		
4. ( - )				M B		
5. ( - )				M B		
6. ( - )				M B		
7. ( - )				M B		
8. ( - )				M B		
9. ( - )				M B		
10. ( - )				M B		
11. ( - )				M B		
12. ( - )				M B		

Note:

Col.	Item	Code / Description
(1)	Growing period From planting to harvesting	Ex. Jul.-Nov.
(2)	Major Variety	1: high yielding/improved variety 2: local/traditional varieties
(3)	Cropping Pattern	1: continuous single cropping 2: rotated cropping (two crops per year) 3: rotated cropping (more than three crops per year) 4: others (specify)
(6), (7)	Crop Damage by Saline Soils /Poor Drainage	1: severely damaged 2: moderately damaged 3: no damage

M.....main products  
B.....by products(straw/stalks)

6. Use of Family Input by Crop( Additional No.1 for limited sample farmers)

1. Crop \_\_\_\_\_  
 2. Variety \_\_\_\_\_  
 3. Planted Area \_\_\_\_\_ feddan

Item	Unit	Total	Per feddan	Remark (Specification)
a. Seed / seedling	Kg			
b. Chemical Fertilizer	Kg			
-	Kg			
-	Kg			
-	Kg			
-	Kg			
-	Kg			
c. Compost / Manure	Kg			
d. Pesticides				
- Pesticides	Kg/l			
- Insecticides	Kg/l			
d. Herbicides				
-	Kg/l			
-	Kg/l			
f. Man power				
- Family Labor	man-hr			
- Hired Labor	man-hr			
g. Animal power				
- Land preparation	anim.-hr			
- Other works	anim.-hr			
h. Machinery				
- Land preparation	hr			
- Seeding	hr			
- Transplanting	hr			
- Threshing	hr			
- Other works	hr			

Note: Major crops..... winter=4crops  
 summer=4crops  
 perennial=2crops

7. Labor Input by Month ( Additional No.2 for limited sample farmers)

1. Crop \_\_\_\_\_

2. Panted Area \_\_\_\_\_ feddan

(Unit:hr)

3. Harvested Area \_\_\_\_\_

Month	Nursery	Plowing	Compacting/ Ridging	Seeding	Fertiizing
	Family/Hired	Family/Hired	Family/Hired	Family/Hired	Family/Hired
Nov.	/	/	/	/	/
Dec.	/	/	/	/	/
Jan.	/	/	/	/	/
Feb.	/	/	/	/	/
Mar.	/	/	/	/	/
Apr.	/	/	/	/	/
May	/	/	/	/	/
Jun	/	/	/	/	/
Jul.	/	/	/	/	/
Aug.	/	/	/	/	/
Sep.	/	/	/	/	/
Oct.	/	/	/	/	/
Total	/	/	/	/	/
Month	Weeding, Mechanical	Weeding, Chemical	Spraying, Psticides	Irrigation/ Drainage	Harvesting
	Family/Hired	Family/Hired	Family/Hired	Family/Hired	Family/Hired
Nov.	/	/	/	/	/
Dec.	/	/	/	/	/
Jan.	/	/	/	/	/
Feb.	/	/	/	/	/
Mar.	/	/	/	/	/
Apr.	/	/	/	/	/
May	/	/	/	/	/
Jun	/	/	/	/	/
Jul.	/	/	/	/	/
Aug.	/	/	/	/	/
Sep.	/	/	/	/	/
Oct.	/	/	/	/	/
Total	/	/	/	/	/
Total	Farm Transporting				
Month	Family/Hired	Family/Hired	Family/Hired	Family/Hired	Family/Hired
Nov.	/	/	/	/	/
Dec.	/	/	/	/	/
Jan.	/	/	/	/	/
Feb.	/	/	/	/	/
Mar.	/	/	/	/	/
Apr.	/	/	/	/	/
May	/	/	/	/	/
Jun	/	/	/	/	/
Jul.	/	/	/	/	/
Aug.	/	/	/	/	/
Sep.	/	/	/	/	/
Oct.	/	/	/	/	/
Total	/	/	/	/	/

8. Destination of Crop Products(Nov, 1992-Oct., 1993)

Items	1.		2.		3.		4.		5.	
	M	Kg	M	Kg	M	Kg	M	Kg	M	Kg
1. Sold	B		B		B		B		B	
2. Family consumption	M		M		M		M		M	
	B		B		B		B		B	
3. Seeds	M		M		M		M		M	
	B		B		B		B		B	
4. Feeds	M		M		M		M		M	
	B		B		B		B		B	
5. Payment for farm works	M		M		M		M		M	
	B		B		B		B		B	
6. Stock	M		M		M		M		M	
	B		B		B		B		B	
7. Others(Specify)	M		M		M		M		M	
	B		B		B		B		B	

Items	6.		7.		8.		9.		10.	
	M	Kg	M	Kg	M	Kg	M	Kg	M	Kg
1. Sold	B		B		B		B		B	
2. Family consumption	M		M		M		M		M	
	B		B		B		B		B	
3. Seeds	M		M		M		M		M	
	B		B		B		B		B	
4. Feeds	M		M		M		M		M	
	B		B		B		B		B	
5. Payment for farm works	M		M		M		M		M	
	B		B		B		B		B	
6. Stock	M		M		M		M		M	
	B		B		B		B		B	
7. Others(Specify)	M		M		M		M		M	
	B		B		B		B		B	

9. Quantity and Farm-gate Price of Sold Crop Products(Nov, 1992-Oct., 1993)

to Whom sold Main Products	Merchant (Private)			Others( )		
	Quantity (1) Kg	Unit Price (2) LE	Form of Products (3)	Quantity (4) Kg	Unit Price (5) LE	Form of Products (6)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						

Note: (3) ...Form of products: paddy, white rice, fresh, dried, with shell. etc.

10. Inventory of Livestock and Poultry

Items	Unit	1. Cattle	2. Buffaloes	3. Sheep	4. Goats	5. Camels	6. Horses
Oct., 1993	No. (1)						
Bought	No. (2)						
	Value*1 (3)						
Born	No. (4)						
Sold	No. (5)						
	Value*1 (6)						
Dead	No. (7)						
Consumed at Home	No. (8)						
Others	No. (9)						
Aug., 1994	No. (10)						

Items	Unit	7. Mules	8. Donkeys	9. Chickens	10. Ducks	11. Chicken Eggs	12. Others ( )
Oct., 1993	No. (1)						
Bought	No. (2)						
	Value*1 (3)						
Born	No. (4)						
Sold	No. (5)						
	Value*1 (6)						
Dead	No. (7)						
Consumed at Home	No. (8)						
Others	No. (9)						
Aug., 1994	No. (10)						

Note: Value\*1... Value of livestock and poultry (Ex. .LE. 1, 500, wheat... 50Kg)





13. Non-farm Income Source(Nov, 1992-Oct, 1993)

Source	Annual Income	
	In cash	In kind
1. Renting Fee of Working Animals to Others		
2. Renting Fee of Farm Machineries and or Accessories to others		
3. Interest Earned on Money Loaned to Others		
4. Allowance from Relative and Others		
5. Receipt of Gift from Relative and Others		
6. Others( )		
Total		

14. Debt (Nov, 1992-Oct, 1993)

Purpose	Source of Loan	Cash LE	In kind		Remaining Debt (Oct, 1993)	Repayment of Debt by Oct. 1993		Remarks
			Item	Kg		Principal	Interest	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
1. Crop Production							%/year	
a.								
b.								
c.								
2. Livestok								
3. Machinery								
4. Land								
5. Household Facilities								
6. Education								
7. Others(Specify)								
Total								

Note: Col. (1) Item Code / Description

(1) Crop Production 1: Fertilizers  
2: seeds/seedlings  
3: hired labor  
4: others(specify)

(2) Source of Loan 1: merchant  
2: land owner  
3: relatives  
4: neighbors  
5: bank  
6: others(specify)

15. Household Expenditure

Items		Amount		Amount per year
		Payed In Cash	Payed In Kind	
		LE	Kg	LE
1. Food per month	a. Wheat, rice and other grains			
	b. Beans			
	c. Eggs			
	d. Meat	i. Sheep & Goats		
		ii. Beef		
		iii. Poultry		
		iv. Milk		
		v. Others( )		
		total		
	e. Fish	i. Freshwater fish		
		ii. Marine fish		
		Total		
f. Vegetables				
g. Other viands				
Sub-total				
2. Soft drinks, beverages and etc. per month				
3. Tobacco/Cigarettes per month				
4. Housing per year	a. House rent			
	b. House improvement			
	c. House maintenance/operation			
	d. House furnishing and equipment			
	Sub-total			
5. Fuel for light and water per year				
6. Clothing per year				
7. Personal and medical care expense per year				
8. Transportation and communication per year				
9. Recreation per year				
10. Education per year				
11. Tax per year				
12. Others per year( )				
Total				

16. Major Problems and Its Suggestion for Solution at Village Level  
 (Please reply on following problems and the suggestion to solve the problems)

Items	Code	Description
(1) Major problems in your Village		a. farm drainage
		b. soil salinity
		c. shortage of irrigation water
		d. lack of farm credit
		e. lack of roads
		f. lack of public communication services
		g. lack of hospital facilities / services
		h. lack of electricity facilities / power
		i. lack of educational facilities
		j. Others ( specify: )
(2) Suggestion to Solve the Perceived Problems		a. farm drainage improvement
		b. irrigation improvement
		c. strengthening of farm credit supply
		d. improvement of roads facilities
		e. streng the ning public communication services
		f. upgrading of rural hospital facilities / services
		g. upgrading of rural electrification
		h. upgrading educational facilities
		i. Others ( specify: )
	(3) Major Item of farm Management for Development within Following Five years in your Farm (select: )	
		b. sugar crop
		c. fiber crops
		d. fruit crops (specify: )
		e. vegetables (specify: )
		f. Others ( specify: )

Note: Col. Item Code / Discription

(1)	Major Problems in your Village	1:	severely affecting
		2:	moderately affecting
		3:	not affecting
(2)	Suggestion for Solution	1:	very necessary
		2:	necessary
		3:	not necessary
(3)	Major Farm Management Item	1:	plan to develop the item of farm management
		2:	no plan

17. Participation on Farming and Other Activities of your women  
Family Members

Items	Code	Description
(1) Present Participation in Farming and Other Activities		a. crop husbandry
		b. animal husbandry
		c. taking / transporting of drinking water
		d. taking / transporting of domestic water
		e. home industry (specify: )
		f. others (specify: )
(2) Plan to Participate in Farming and Other Activities		a. crop husbandry
		b. animal husbandry
		c. taking / transporting of drinking water
		d. taking / transporting of domestic water
		e. home industry (specify: )
		f. others (specify: )

Note: Col. Item Code / Discription  
 (1)(2) Farming / 1: participate  
 Other Activities 2: often participate  
 3: do not participae

**CROP PRODUCTION SURVEY**

Farm No. \_\_\_\_\_

Name of Farmer \_\_\_\_\_

Date interviewed: \_\_\_\_\_, 1994

Address Village \_\_\_\_\_

Enumerator: \_\_\_\_\_

District \_\_\_\_\_

Governnorate \_\_\_\_\_

1. Farming Experience

Since(year) \_\_\_\_\_

2. Family Composition and Working Conditions

(Unit: persons)

		Male	Female	Total
		(1)	(2)	(3)
Total Family Member				
Working Conditions	2-1. Your Farm			
	-Temporary worker			
	-Regular worker			
	2-2. Other Farm			
	-Temporary employee			
	-Regular employee			
2-3. Non-Agriculture	-Temporary employee			
	-Regular employee			

3. Area of Land Holding(at Present)

(Unit: persons)

Land Items	Own	Rent	Subtotal	Lease	Total
	(1)	(2)	(3)	(4)	(5)=(3)+(4)
1. Upland Field					
2. Field for Permanent Crops #1					
3. Pasture Land					
4. Wood Land					
5. House Lot					
6. Others(Specify: _____ )					
7. Total					

Note: #1...included orchard

4. Rent and Leased Land Fee(Nov., 1992-Oct., 1993)

Items	1. Temporary Field Crops	2. Field for Orchard or Permanent Crops	3. Others	Total
<u>1. Rent fee per year</u>				
a. Paid in cash(LE) (1)				
b. Paid in kind				
• (Kg) (2)				
• (Kg) (3)				
• Others( ) (4)				
<u>2. Lease fee per year</u>				
a. Received in cash(LE) (5)				
b. Received in kind				
• (Kg) (6)				
• (Kg) (7)				
• Others( ) (8)				

Note: Others ...included the area of house lot and others.

5. Crop Production (Nov. 1992-Oct. 1993)

Name of Crop (month-month)	Major Varieties	Cropping Pattern	Crop Production		Crop Damage	
			Planted Area (feddan)	Production (kg)	By Saline Soils	By Poor Drainage
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. ( - )				M B		
2. ( - )				M B		
3. ( - )				M B		
4. ( - )				M B		
5. ( - )				M B		
6. ( - )				M B		
7. ( - )				M B		
8. ( - )				M B		
9. ( - )				M B		
10. ( - )				M B		
11. ( - )				M B		
12. ( - )				M B		

Note:

Col.	Item	Code / Description
(1)	Growing period From planting to harvesting	Ex. Jul. -Nov.
(2)	Major Variety	1: high yielding/improved variet 2: local/traditional varieties
(3)	Cropping Pattern	1: continuous single cropping 2: rotated cropping(two crops per year) 3: rotated cropping(more than three crops per year) 4: others(specify)
(6), (7)	Crop Damage by Saline Soils /Poor Drainage	1: severely damaged 2: moderately damaged 3: no damage

M.....main products

B.....by products(straw/stalks)



6. Major Problems and Its Suggestion for Solution at Village Level  
 (Please reply on following problems and the suggestion to solve the problems)

Items	Code	Description
(1) Major problems in your Village		a. farm drainage
		b. soil salinity
		c. shortage of irrigation water
		d. lack of farm credit
		e. lack of roads
		f. lack of public communication services
		g. lack of hospital facilities / services
		h. lack of electricity facilities / power
		i. lack of educational facilities
		j. Others ( specify: )
(2) Suggestion to Solve the Percieved Problems		a. farm drainage improvement
		b. irrigation improvement
		c. strengthening of farm credit supply
		d. improvement of roads facilities
		e. streng the ning public communication services
		f. upgrading of rural hospital facilities / services
		g. upgrading of rural electrification
		h. upgrading educational facilities
		i. Others ( specify: )
(3) Major Item of farm Management for Development within Following Five years in your Farm (select: )		a. grain crop production (specify: )
		b. sugar crop
		c. fiber crops
		d. fruit crops (specify: )
		e. vegetables (specify: )
		f. Others ( specify: )

Note:	Col.	Item	Code	/	Discription
	(1)	Major Problems in your Village	1:		severely affecting
			2:		moderately affecting
			3:		not affecting
	(2)	Suggestion for Solution	1:		very necessary
			2:		necessary
			3:		not necessary
	(3)	Major Farm Management Item	1:		plan to develop the item of farm management
			2:		no plan

7. Participation on Farming and Other Activities of your women  
Family Members

Items	Code	Description
(1) Present Participation in Farming and Other Activities		a. crop husbandry
		b. animal husbandry
		c. taking / transporting of drinking water
		d. taking / transporting of domestic water
		e. home industry (specify: )
		f. others (specify: )
(2) Plan to Participate in Farming and Other Activities		a. crop husbandry
		b. animal husbandry
		c. taking / transporting of drinking water
		d. taking / transporting of domestic water
		e. home industry (specify: )
		f. others (specify: )

Note: Col. Item Code / Discription  
 (1)(2) Farming / 1: participate  
 Other Activities 2: often participate  
 3: do not participae

## A-2. Route Survey of Omoum Main Drain

### 1. Outline of Works

#### 1.1 Bench Mark Survey of Omoum Main Drain

Location of monument of bench mark(BM) shall be indicated by the Employer. Establishment of BM shall be carried out on the specification mentioned below; Specification of the bench mark is shown in Figure-1.

#### Items to be submitted

- Control data list and photograph

#### 1.2. Route Survey of Omoum Main Drain

##### 1) Route Surveying

Route survey of Omoum Main Drain(total length of about 40 km) will be started from the EL Max Pump station. Intersection point(IP) at interval of 2,000 m and changing points(CP) of topographic feature shall be established by wooden steaks. Specification of wooden stakes is shown in Figure-2.

#### Items to be submitted

- Route map : Scale 1:25,000

##### 2) Profiling of The Drain

Elevation of IP and CP, which are established by route surveying, shall be measured by minor order leveling of the specification mentioned below.

#### Item to be submitted

- Drawing profile : Scale Sh = 1:5,000, Sv = 1:100

### 1.3 Cross Section Survey of Omoum Main Drain

Cross section of the drain shall be surveyed at a interval of every 2.0 km as a rule and at a changing point of cross section of the drain. Survey width is about 200 m on an average.

#### Items to be submitted

- Drawing of cross section : Scale S = 1:200

## 2. Classification of Surveying

### 2.1 Minor Order Leveling

Route survey by minor order leveling shall be connected from the existing bench mark to the established bench mark.

#### 1) Monument

The top of monument shall be painted in red mark.

- Method and size of wooden bench mark are shown in Figure-2.
- Location of bench mark shall be determined according to topographic condition and changing of cross section of the canal.

#### 2) Instrument shall be as follows;

- Level : 40"/2mm
- Staff : Minimum graduation 10 mm

#### 3) Method of Observation

- Distance between staffs : Maximum 100 m
- Elevation : cm
- Measurement : One way observation distance

#### 4) Tolerance

- $6 \text{ cm} + 6 \text{ cm} \sqrt{S}$  S : One way distance in km

5) Quality Control Sheet

Chief surveyor shall prepare quality control sheet and submitted to the Employer. The form of quality control sheet will be indicated by the Employer.

6) Final Results

The following survey results shall be prepared by the surveyor;

- Profile drawing : 1 set
- Final results : 1 set
- Field notes : 1 set
- computation sheet : 1 set

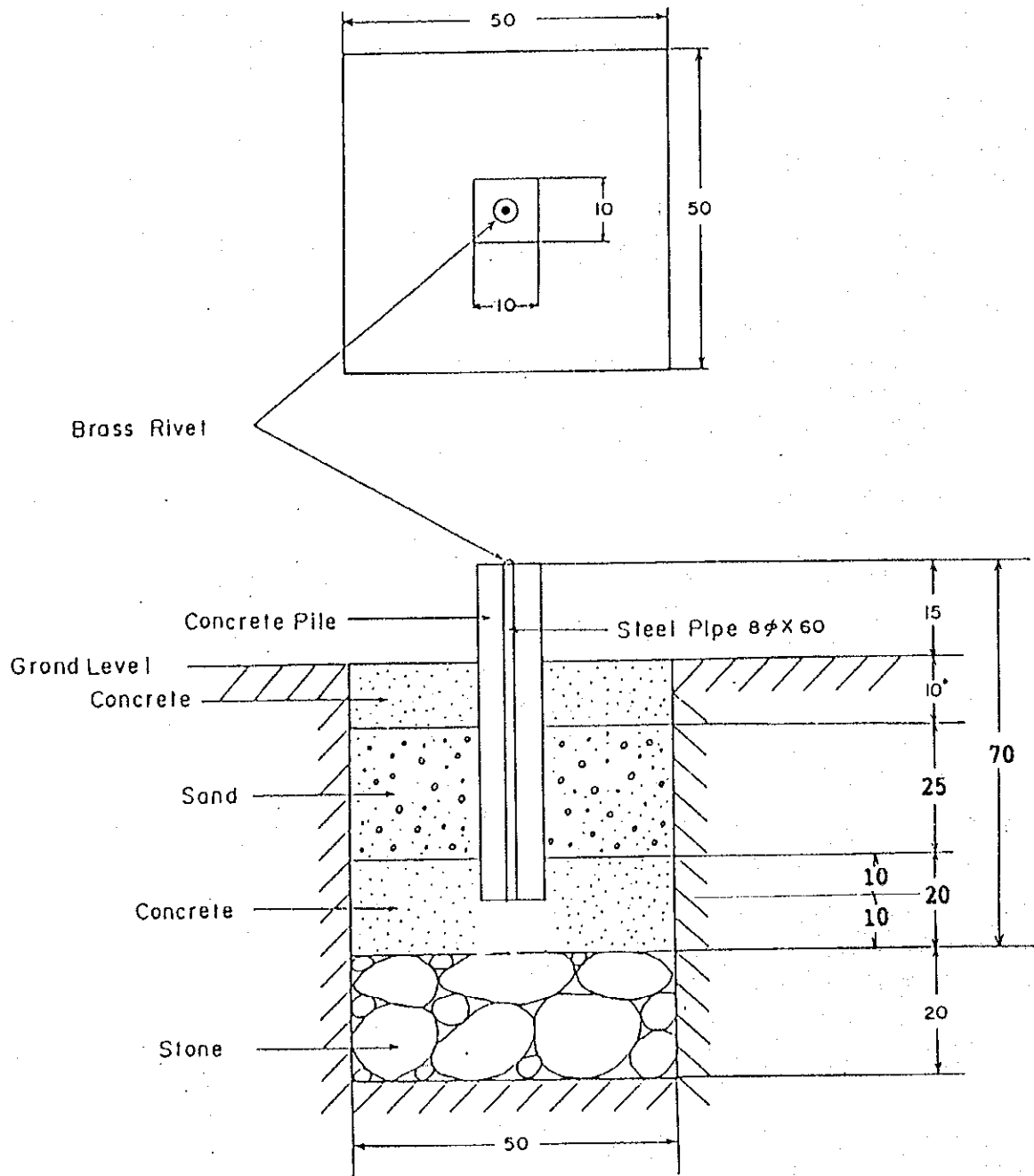
3. Bill of Quantities

Bill of quantities for route survey of Omoum main drain are shown below;

BILL OF QUANTITIES

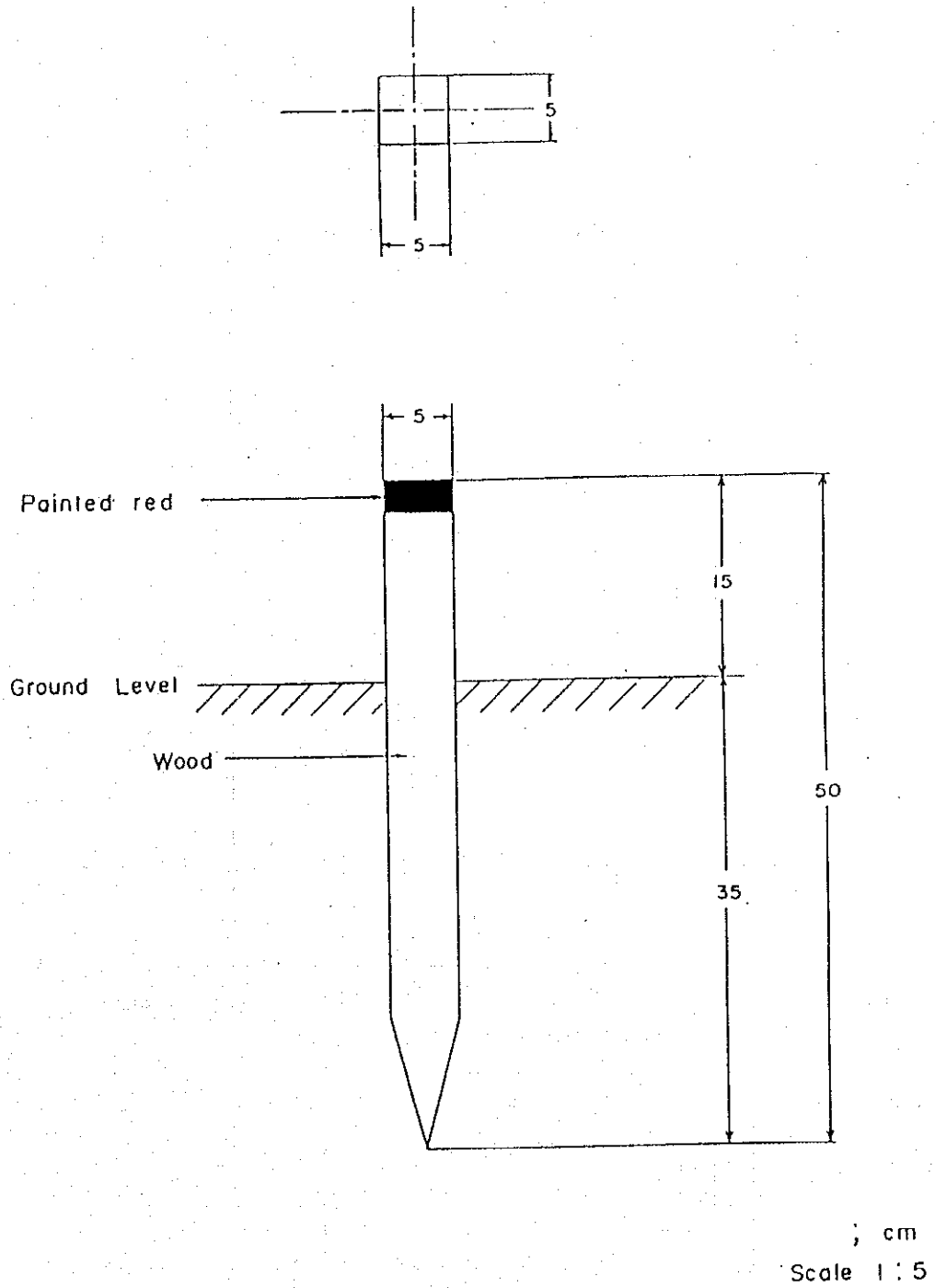
<u>Items</u>	<u>Descriptions</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u> (LE)	<u>Amount</u> (LE)
1001.	Bench mark survey	pla.	1		
1002.	Route Surveying	km	45		
1003.	Cross section Survey	section	30		
	Total				

Fig 1 Bench Mark and Base Point



cm  
Scale 1 : 10

Fig 2 Survey Point (timber pile)



**QUALITY CONTROL SHEET**

**MINOR ORDER LEVELING**

Project	Farmland Environmental Improvement	Employer	Sanyu consultants Inc.
Works Area	Oumou Main Drainage Canal	Employee	
Term		Chief Surveyor	
Total Distance		Inspector	

Route	Distance	Error of Closure	Tolerance	Summary

Tolerance	$6 \text{ cm} + 6 \text{ cm}\sqrt{s}$ s:One way distance in km	Summary
Surveyor		
Instrument Name	Level: Staff:	



## A-3. Water Quality Survey

### 1. Purpose of Analysis

In order to carry out the Initial Environmental Examination in the proposed project, water quality analysis in the Omoum drainage area is proposed. Water quality analysis is one of essential items to clarify the environmental condition in the Omoum drainage area.

### 2. Sites and Number of times for Water Sampling

#### 2.1. Sampling Sites (see attached Location Map) (Total 20 sites)

- |   |           |
|---|-----------|
| 1) Lake Mariout                                       | 3 sites   |
| . Near by El Max pump station                         |           |
| . Release point of drain water                        |           |
| . Center of Lake                                      |           |
| 2) Omoum Main Drain                                   | 5 sites   |
| . End of Drain (El Max pump station suction side)     |           |
| . Near by other drainage pump station( delivery side) |           |
| 3) Branch Drain and Pump Station                      | 10 sites  |
| . Drainage pump station                               | (6 sites) |
| . Branch drain (including re-use site)                | (4 sites) |
| 4) Supply Water (Irrigation Canal)                    | 2 sites   |
| . Upper reach of Nubaria canal                        |           |
| . Behera Rayah canal at Damanhur                      |           |

#### 2.2 Number of Times Water Sampling

- 1) First sampling : Second week of August 1994
- 2) second sampling : First week of September 1994

### 3. Analyzed Items

#### 1) Organic Mater and Others

- a. Organic mater
  - Biochemical Oxygen Demand (BOD)
  - Chemical Oxygen Demand (COD)

- b. Dissolved Oxygen (DO)
- c. Suspended Solid (SS)
- d. Bacterium, Colon Bacillus
- e. Hydrogen Iron Activity (PH)
- f. Electric Conductivity (EC)

1/: All of the samples from twenty sites should be examined with this item(1).

2) Nutritive Chloride and Others

- a. Total Nitrogen (T-N)
- b. Total Phosphorus (T-P)
- c. Other Chemical Property
  - Calcium (Ca)
  - Magnesium (Mg)
  - Sodium (Na)
  - Potassium (K)
  - Carbonates (CO3)
  - Bicarbonates (HCO3)
  - Sulphates (SO4)
  - Chlorides (Cl)
  - Sodium Adsorption Ratio (SAR)

2/ : Water sampled from the selected five sites should be examined with Item(1) and (2). The selected sites are listed below and shown in location map attached.

- . Lake Mariout sample site : 3 sites
- . Omoum Main Drain at Haris pumping site (delivery side) : 1 site
- . Upper reach of Nubarria canal : 1 site

4. Expected Date to be delivered of analyzed Results

- 1) First Sampling Results : End of August, 1994
- 2) Second Sampling Results : 23th of September, 1994

5. Following items should be observed at the stage of water sampling.

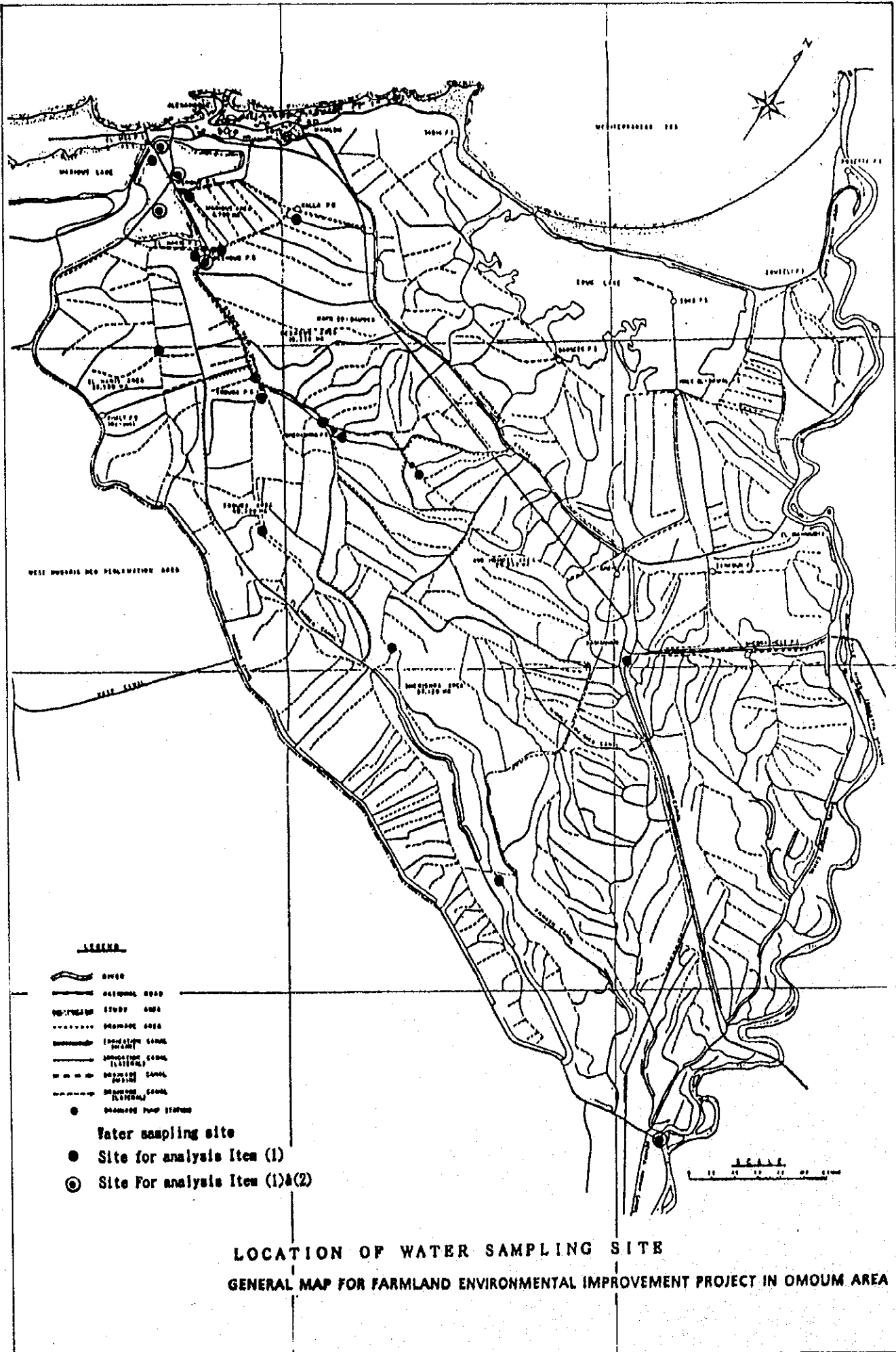
- 1) Discharge
- 2) Water depth and sampling depth from surface
- 3) Smelling
- 4) Turbid or muddiness
- 5) Water color
- 6) Air and water temperature
- 7) Electric conductivity (EC)
- 8) Dissolved oxygen (DO)
- 9) Hydrogen ion activity (Ph)

6. Bill of Quantities

Bill of quantities for water quality survey are shown below;

BILL OF QUANTITIES

<u>Items</u>	<u>Descriptions</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u> (LE)	<u>Amount</u> (LE)
First time analysis					
1001.	Water sampling	sample	20		
1002.	Water quality analysis and discharge measurement, etc.	sample	20		
Second time analysis					
1003.	Water sampling	sample	20		
1004.	Water quality analysis and discharge measurement, etc.	sample	20		
Reporting					
1005.	Reporting of the analysis	LS			
	Total				



#### A-4. Water Level Gauge Installation

##### 1. Scope of Works

The scope of works contained in the Agreement is as follows:

- Selection of suitable sites
- Construction of recorder shelter
- Construction of surrounding fence
- Installation of staff-gauges and recorders
- Accessory works (construction of access wooden path to the gauge)

##### 2. Purpose of Works

The purpose of the Works is to record the water level and stage of the drain in the Study Area.

##### 3. Location of Works

The works shall be carried out at the different selected sites (10 sites for staff-gauges and 2 sites for water level gauges) within the catchment area of Omoum main drainage system of Behera Province. The sites are shown on the attached location map. The installation works shall be carried out at the exact places pointed by the Employer.

##### 4. Field Works

Field works shall be performed according to the dimensions of the installation works, Recorder shelter and fence as shown in the Figure-1 and Figure-2. The procedure of the work shall be as follows:

###### 4.1 Staff-Gauges

###### 1) Installation

The installation shall be performed according to the dimensions shown in the Figure-1. The dimensions which are not mentioned shall be decided after the field investigation and consultation with the Employer.

## 2) Adjustment with the Mean Sea Level(M.S.L.)

Figures of the gauges have to be adjusted with the M.S.L.(for example M.S.L.= Gauge reading 2.0 m)

## 3) Access to the Gauges (optional)

An access wooden path to the gauge from the canal bank has to be made for smooth data collection and maintenance works, where it is necessary. The decision will be made by the Employer after the site selection.

## 4.2 Water Level Recorders

### 1) Installation

#### Sensor Part

Installation of the sensor in the canal has to be made firmly at the selected sites, according to the Figure-2 (case 1 or case 2). The Employer will decide about the case prior to the work order. The dimensions which are necessary but not mentioned in the figure shall be decided with proper consultation with the Employer. The connecting wire between sensor and shelter has to be protected by appropriate material.

#### Recorder Part

Installation has to be made at a distance considering the length of the cable (about 30m). Specifications are given in Figure-2(recorder part), case 1 or case 2. The case will be decided by the Employer prior to the work order. The shelter has to be provided with a good lock and key. A surrounding fence with an entrance has to be built in order to protect the shelter from animals. The entrance has to be provided with a quality lock and key. Any dimension missing in the figures shall be decided with proper consultation with the Employer.

5. Supply of Machine, Equipment, Materials and Measuring Devices

All machines, equipment, materials needed for the works shall be provided by the Contractor.

6. Bill of Quantities

Bill of quantities for water level gauges are shown as follow;

BILL OF QUANTITIES

<u>Items</u>	<u>Descriptions</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
				(LE)	(LE)
1001.	Staff gauge installation	pla.	10		
1002.	Automatic gauge installation	pla.	2		
1003.	Preparation of report (including leveling survey)	LS			
	Total				

Fig. 1 Lay-out of Staff-gauge Installation

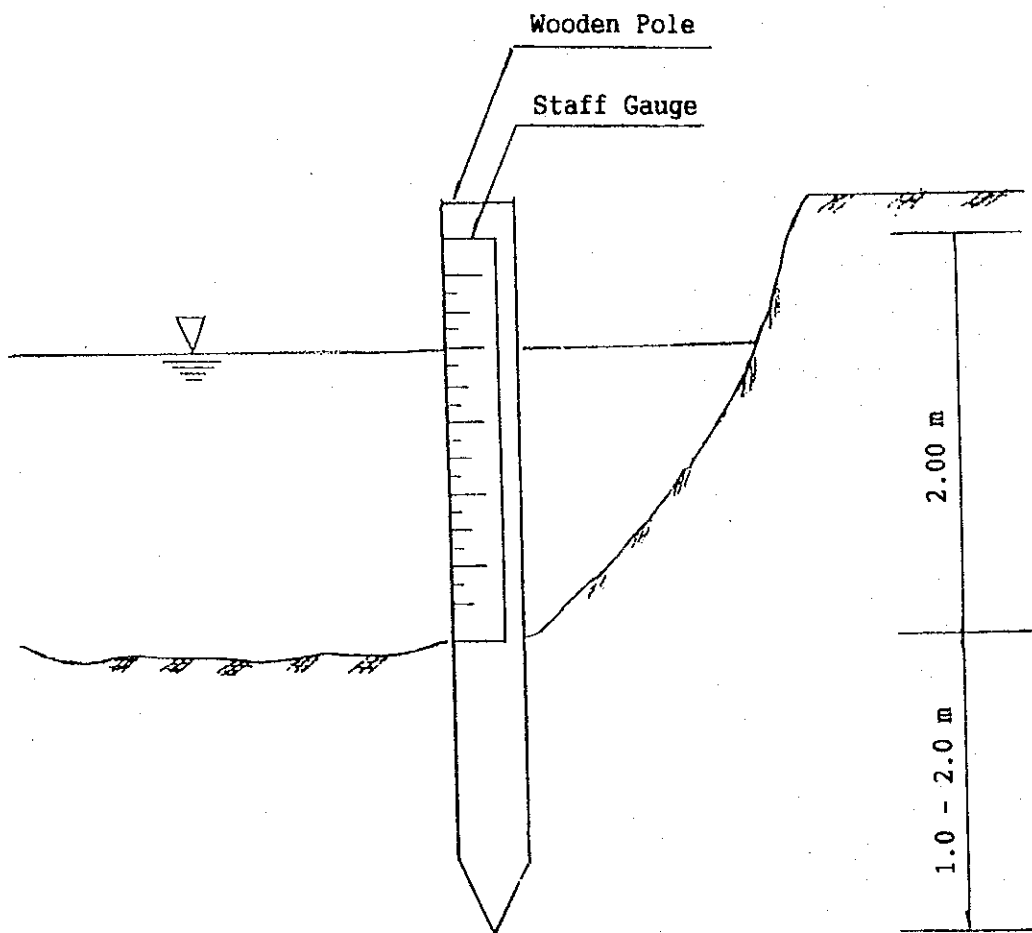




Fig. 2 Lay-out of Water Level Recorder Installation  
(Sensor part)

Case- 1

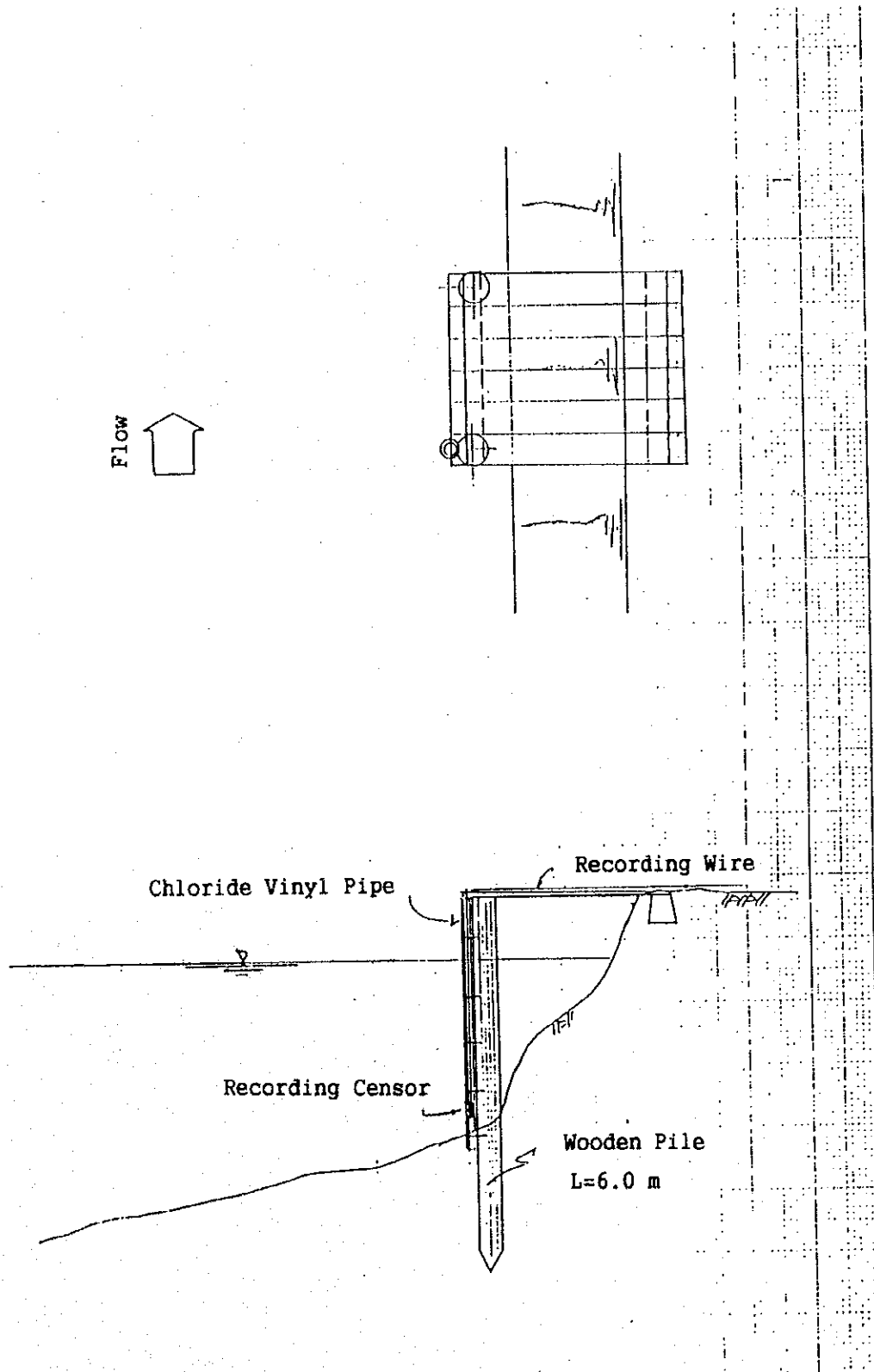


Fig. 2 Lay-out of Water Level Recorder Installation  
(Sensor part)

Case-2

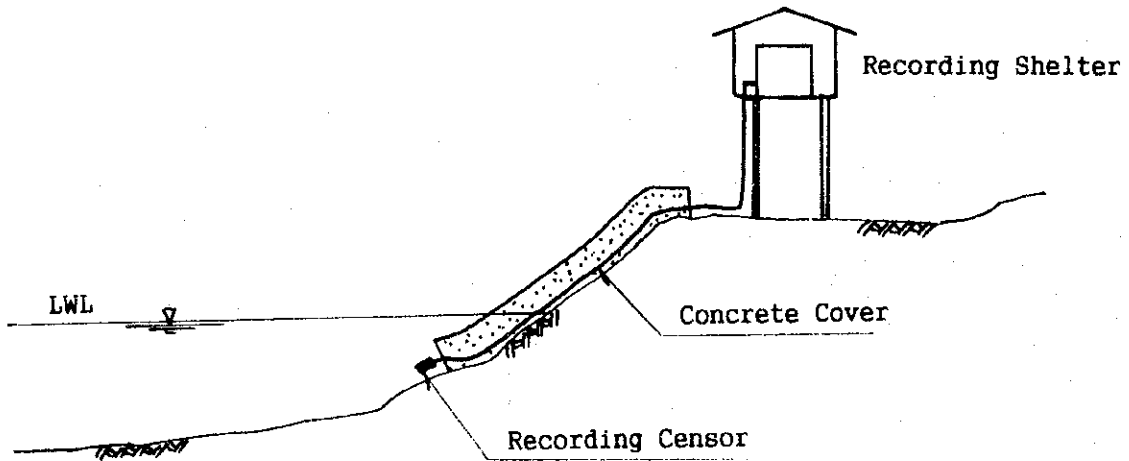


Fig. 2 Lay-out of Water Level Recorder Installation  
(Recorder part)

Case- 1

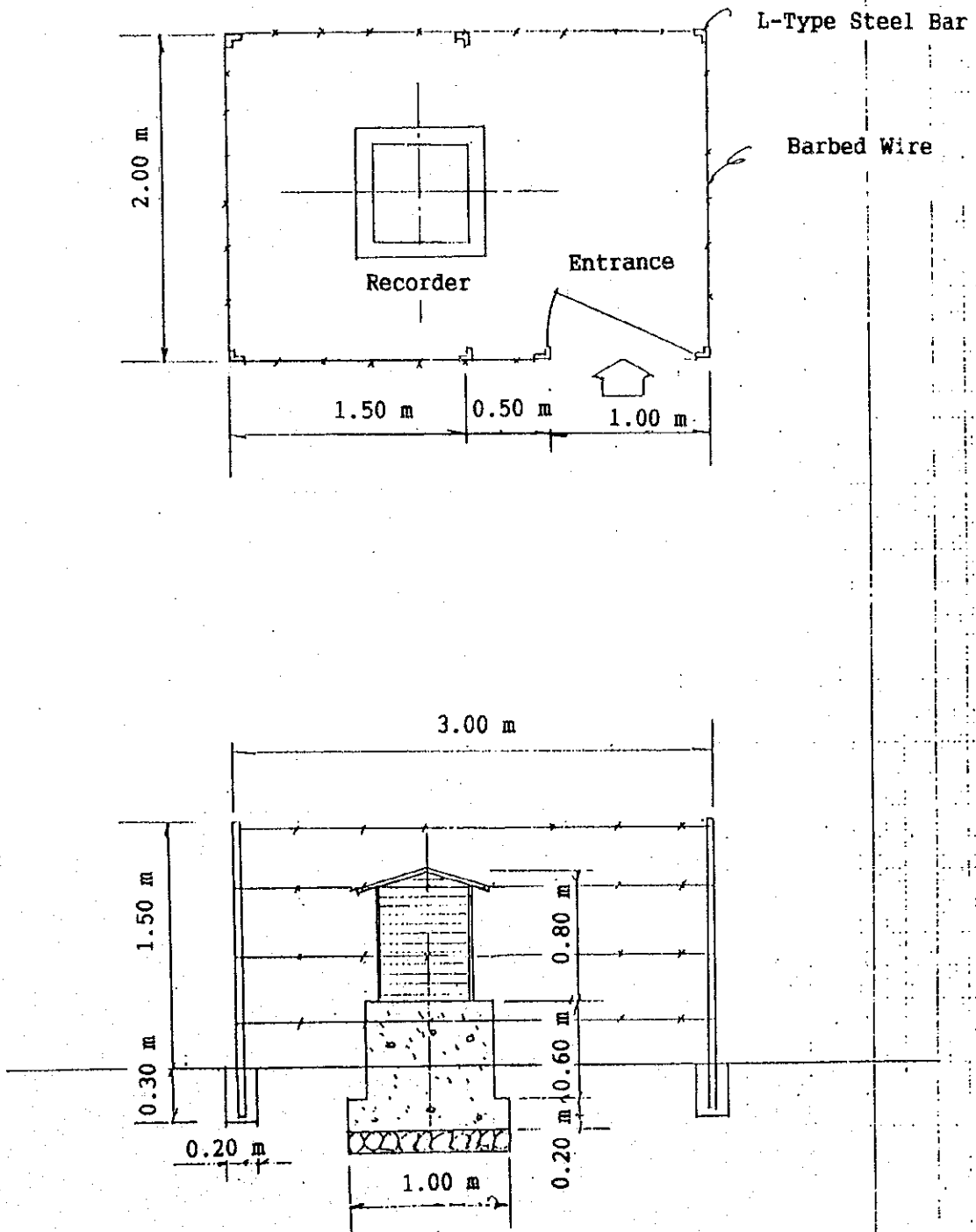
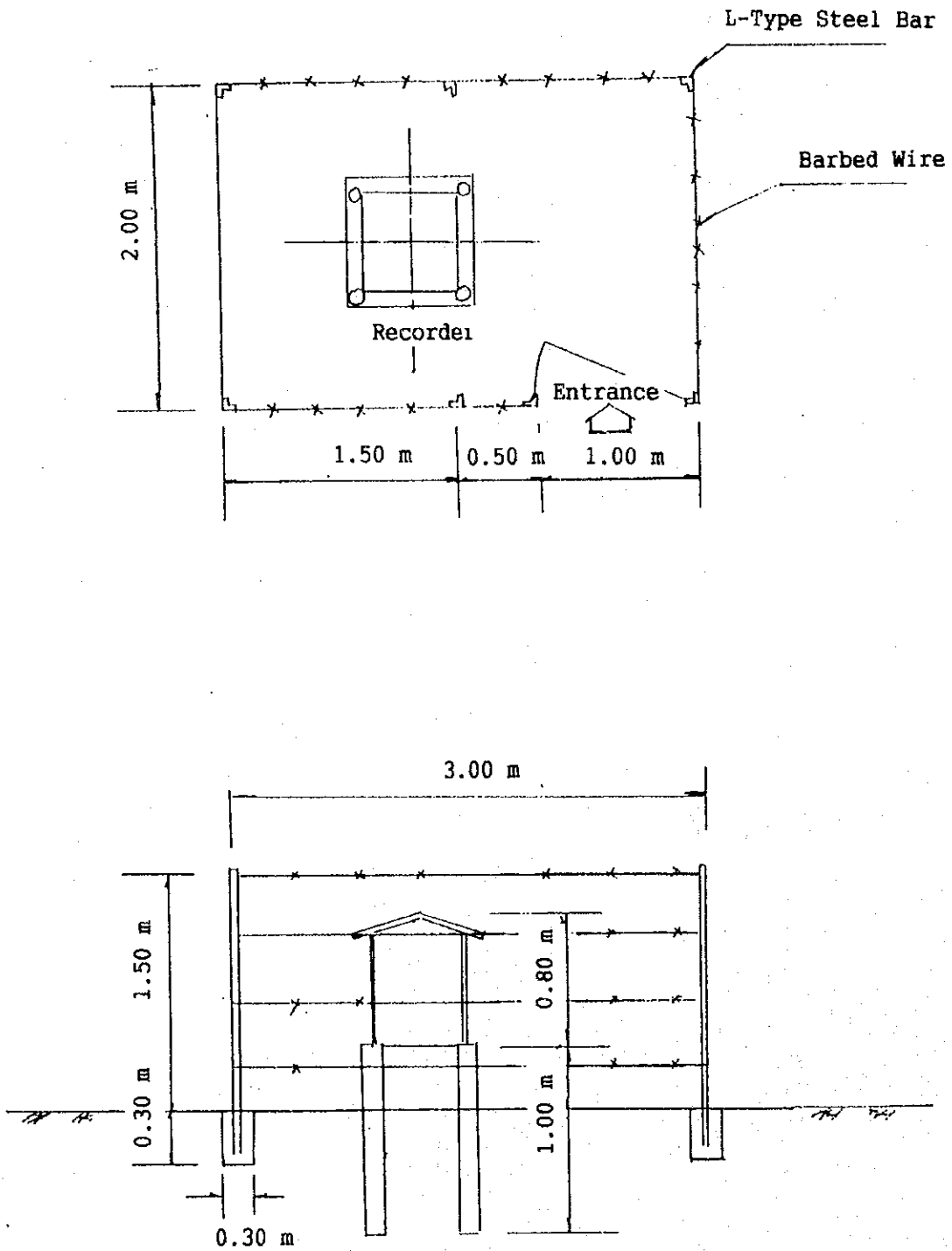
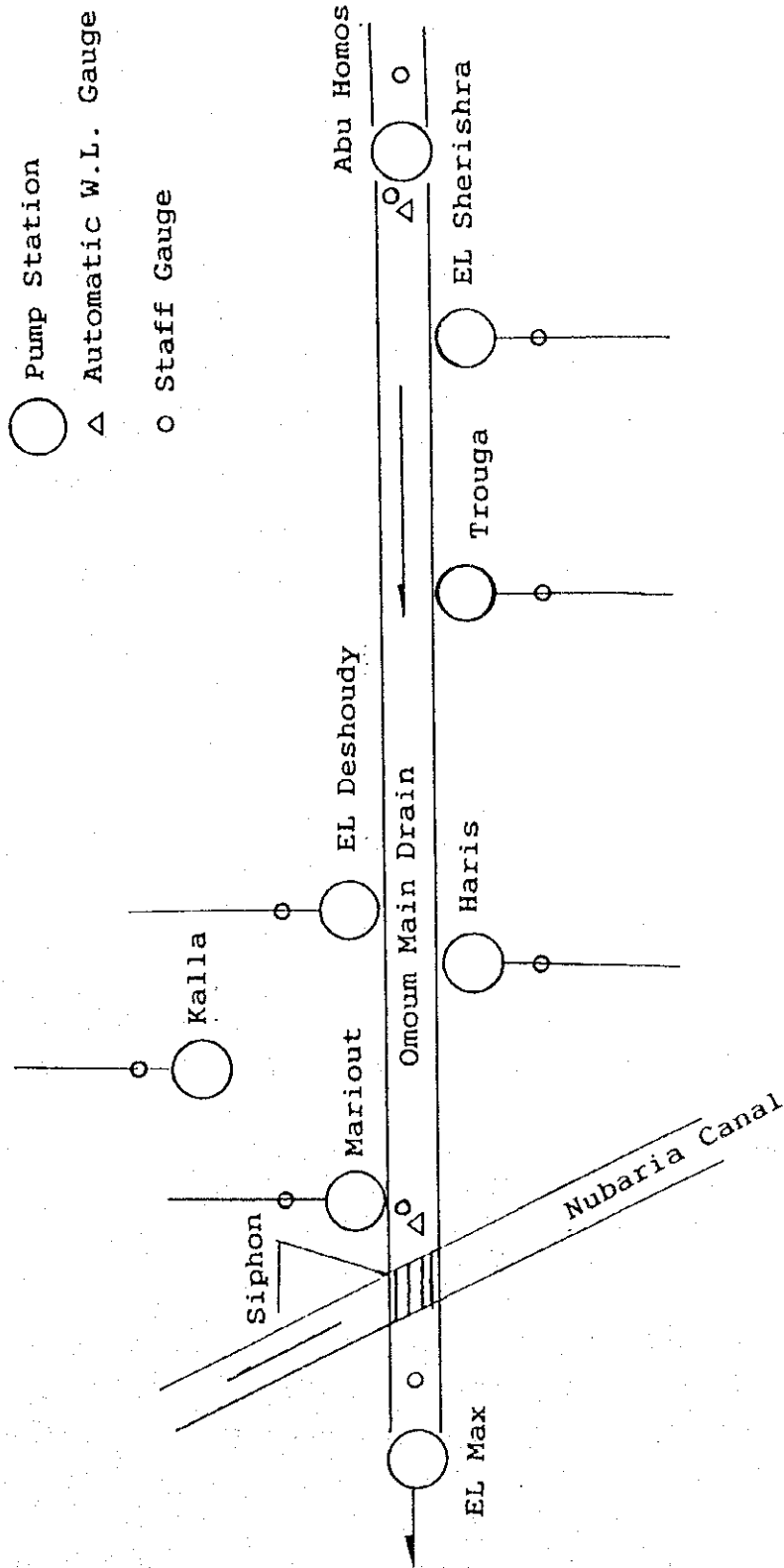


Fig. 2 Lay-out of Water Level Recorder Installation  
(Recorder part)

Case-2



LAY OUT OF THE AUTOMATIC W.L. GAUGES AND STAFF GAUGES



## B. Phase-II Field Works

### B-1 Topographic Survey

#### 1. Outline of Works

##### 1.1 Bench Mark Survey of for Topographic Survey

The number of sites to be surveyed in this work is three, that is El-Max pump station, Hares pump station and Nubariya siphon. Establishment of Bench Mark, BM (Control Point) in each site shall be carried out on the specification of Chapter II. The newly established control point shall be connected with the existing Bench Mark established by JICA Study Team in August 1994 at the El-Max pump station site. Specification of Bench Mark is shown in Figure-1.

#### Items to be Submitted

- Control data list and photograph

##### 1.2 Topographic Survey of the Facility Sites

Topographic survey shall be carried out by the Surveyor at the following sites, and areas to be surveyed will be indicated by the Employer.

El-Max pump station	: 30 ha (500 m x 600 m)
Hares pump station	: 18 ha (300 m x 600 m)
Nubariya siphon	: 40 ha (400 m x 1,000 m)
Total	88 ha

Principal control point to be used for topographic surveying shall be located at intersecting points of every 50 m mesh line in accordance with the specification of second order traversing in Chapter II. Specification of the control point is shown in Figure-2.

Based on the principal control point, topographic features shall be measured at intersecting point of every 10 m mesh line in principal. Topo-

graphic character and existing structures including of lectric post, cable, culvert, etc. laying between intersecting points shall be measured, and the topographic features shall be drawn in accordance with map symbol of Figure-3.

#### Items to be Submitted

- Topographic map : Scale 1 : 500 with 50 cm contour interval, spot elevation, flow direction, building, land boundary, etc.

### 1.3 Profile and Cross section Survey of Nubariya Siphon

The profile and cross section survey of the Omoum main drain at up and downstream of the Nubariya siphon with a length of about 190 m and width of 30 m, which is crossing the Nubariya navigation canal shall be surveyed.

Extent of profile survey of the Omoum main drain is 1,000 m. Intersection point(IP) at interval of 50 m and changing point(CP) of topographic features shall be established by wooden stakes. Specification of wooden stakes is shown in Figure-2. Elevation of IP and CP established shall be measured by minor order leveling of the specification of Chapter II.

Cross section survey shall be made at a interval of every 50 m as a rule and at a changing point of cross section of the Omoum main drain inclusive of the siphon. The survey width is 400 m on an average.

#### Items to be Submitted

- Drawing of profile : Scale Sh = 1 : 500, Sv = 1 : 100
- Drawing of cross section : Scale Sh = 1 : 400, Sv = 1 : 100

## 2. Classification of Surveying

### 2.1 Second Order Traversing

Second order traversing shall be carried out for establishment of supplemental control point to be used for detail surveying. The traversing

route shall be connected to the principal control point.

1) Monument

The top of monument shall be painted in red mark.

- Method and size of bench mark (wooden stake) are shown in Figure-2.
- Location of bench mark (wooden stake) shall be determined according to topographic map scale and contour interval.

2) Instrument

The following instruments shall be used.

- Theodolite : 10"
- EDM : 10 mm + D/300,000  
EDM : Electro-Optical Distance Measurement  
D : Distance in m
- Steel tape : Calibration record shall be required.

3) Method of Observation

Instrument shall be installed constant height.

- Horizontal angle
  - Measurement unit : 10"
  - Number of measurement : 2 times
  - Graduation : 0 , 90
  - Double angle difference : 60"
  - Difference of observation : 40"
- Vertical angle
  - Measurement unit : 10"
  - Number of measurement : 1 times
  - Allowance of constant of elevation : 60"
- Distance
  - Measurement unit : mm
  - Number of measurement : 3 times
  - Distance discrepancy : 4 cm



#### 4) Tolerance

- Crossing error of direction angle :  $30'' n$  (n : number of angle)
- Crossing error of coordination : 1/2,000
- Crossing error of relative height :  $20 \text{ cm} \sum D \cdot \sqrt{L}$   
(D : distance in km,  
L : number of measurement)

#### 5) Quality Control Sheet

Chief surveyor shall prepare quality control sheet and submit to the Employer.

#### 6) Final Results

- Control point network : 1 set (1 : 1,000)
- Coordination sheet : 1 set
- Field note : 1 set
- Computation sheet : 1 set

#### 2.2 Minor Order Leveling

Profile and cross section survey of Omoum main drain shall be made by minor order leveling.

##### 1) Monument

The top of monument shall be painted in red mark.

- Method and size of bench mark (wooden stake) are shown in Figure-2.
- Location of bench mark (wooden stake) shall be determined according to topographic condition and changing of cross section of the canal.

##### 2) Instrument

The following instrument shall be used;

- Level : 40"/2mm
- Staff : Minimum graduation 10 mm

3) Method of Observation

- Distance between staffs : Maximum 80 m
- Elevation : cm
- Measurement : One way observation distance

4) Tolerance

- $6 \text{ cm} + 6\text{cm} \cdot \sqrt{S}$  S : One way distance in km

5) Quality Control Sheet

Chief Surveyor shall prepare quality control sheet and submitte to the Employer. The form of quality control sheet will be indicated by the Employer.

6) Final Results

The following survey results shall be prepared by the surveyor;

- Profile drawing : 1 set
- Final results : 1 set
- Field notes : 1 set
- Computation sheet : 1 set

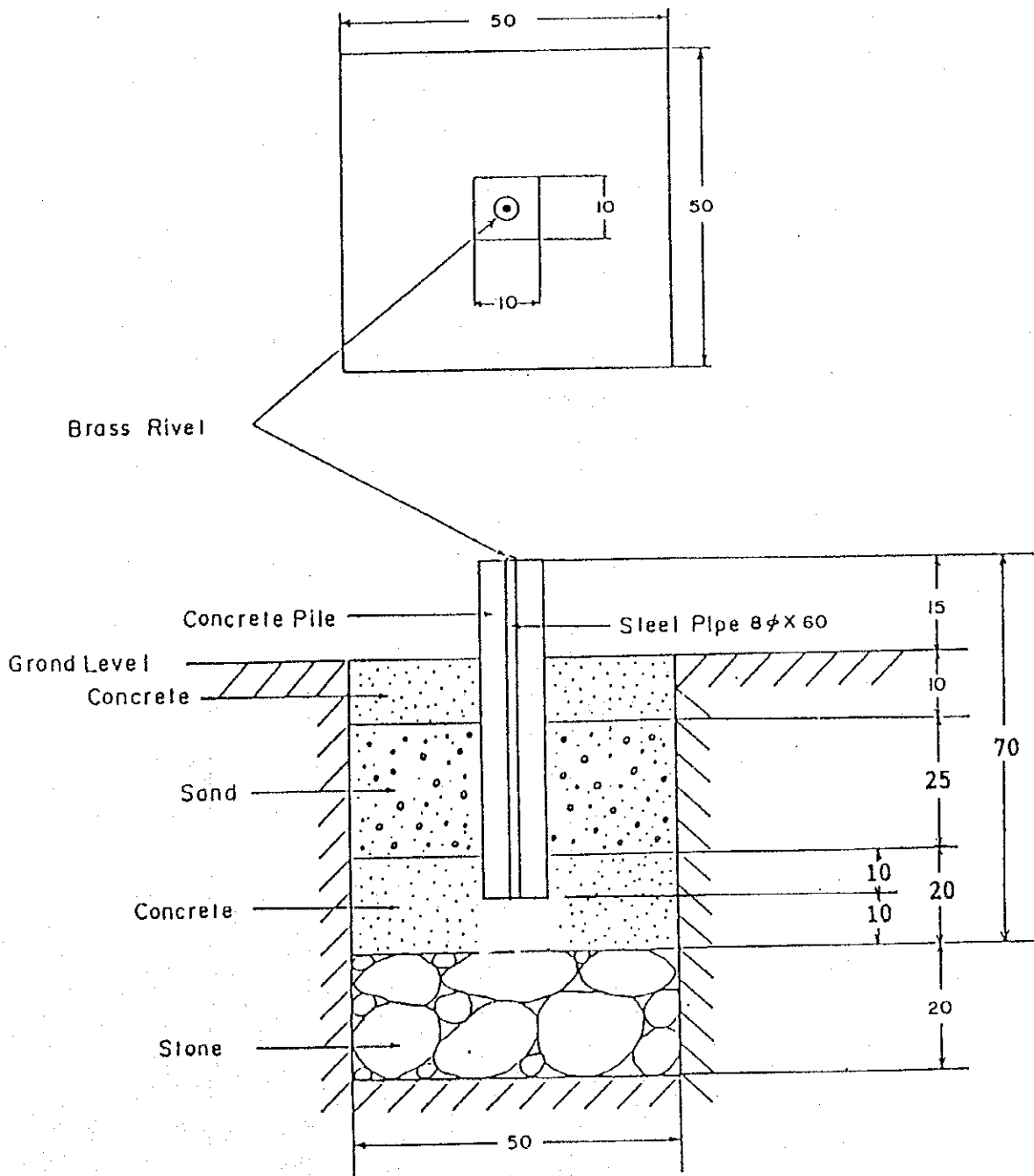
3. Bill of Quantities

Bill of quntites of topographic survey are shown below;

BILL OF QUANTITIES

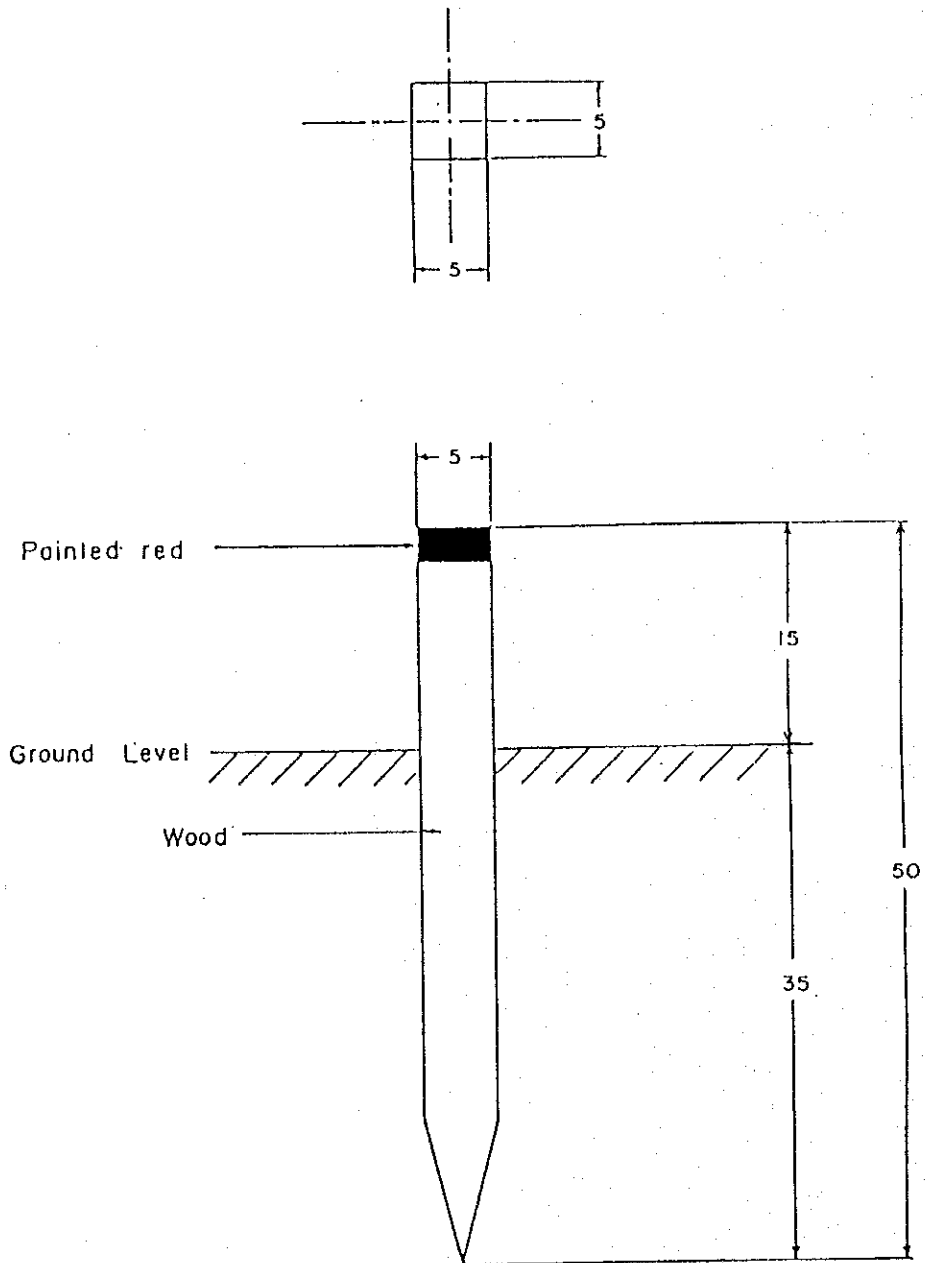
<u>Items</u>	<u>Descriptions</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u> (LE)	<u>Amount</u> (LE)
1001.	Bench Mark Survey	pla.	2		
1002.	Topographic Survey	ha	88		
1003.	Profile and Cross Section Survey	m	1,000		
	Total				

Fig 1 Bench Mark and Base Point



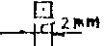
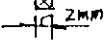
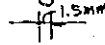

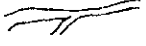



; cm  
Scale 1 : 10

Fig 2 Survey Point (timber pile)



cm  
Scale 1 : 5

Figure-3 Drawing Symbols

Description	Line Weight	Symbols
Bench Mark	0.2	 (-) 2.503 m
Principal Control Point	0.2	 (-) 2.105 m
Supplemental Control Point		
Inter Mediate Contour	0.1	0.10 mm, every 0.5 m
Index Contour	0.25	0.25 mm, every 1.0 m
Slopes	0.2	
Roads	0.2	
Drains or Canals	0.2	
Boundary of Vegetation	0.1	
Buildings	0.2	
Farmland	0.1	
Marsh (Swamp)	0.1	

1. Map

2. Data

Elevation -----

Address -----

Day of set down -----

Fundamental bench mark -----

3. Photograph

QUALITY CONTROL SHEET

MINOR ORDER LEVELING

Project	Farmland Environmental Improvement	Employer	Sanyu consultants inc.
Works Area	Omoum Main Drainage Canal	Employee	
Term		Chief Surveyor	
Total Distance		Inspector	

Route	Distance	Error of Closure	Tolerance	Summary

Tolerance	$6 \text{ cm} + 6 \text{ cm} \sqrt{s}$ s: One way distance in km	Summary
Surveyor		
Instrument Name	Level: Staff:	

## B-2 Geological Investigation

### 1. Purpose of Investigation

Core drilling works together with standard penetration test should be performed for the purposes of obtaining geo-technical data about subsurface conditions of the proposed sites of El-Max pump station, Hares pump station and Nubriya siphon.

### 2. Quality of Investigation

Scheduled quantity of the investigation is shown in Table-1, and the location will be indicated by the Employer.

### 3. Work Schedule

The Investigation should be conducted on work schedule as shown in Table-2.

### 4. Technical Specification

#### 4.1. Core Boring

Core drilling works should be performed as all core type by the use of hydraulically driven rotary machines in the vertical direction and up to the depth as specified and /or as indicated by the Employer. Diameter of the holes be larger than 66 mm.

- percentage of core-recovery should be obtained as high as possible during the drilling. Re-drilling with contractors' own expenditure should be ordered, if poor core-recovery is obtained.
- After completion of core-drilling, frilled holes should be filled up with the cement mortal grouting of which mixture contains 750 kilo-gram Portland cement per one cubic meter of mortal.
- Water level in the boreholes should be measured and recorded every time before commencement of the day's drilling works. This measure-



ment should be continued for each borehole during the period when the hole is being drilled.

- In case pressured groundwater is encountered, its depth should be recorded accurately and informed to the Employer as soon as possible.
- The recovered core sample should be placed in order in core boxes. Each core box should have five grooves, each of which have a size to accommodate a core samples for one meter section. Accordingly, each core box should contain core samples for five meter section. The core boxes should be marked with borehole numbers and the figures to indicate the depth where the core samples are taken. The core samples should be placed in order in the same length of the grooves of core box as the length drilled to take those core samples. The parts of no core recovery should be left vacant in the grooves. The color photograph of core samples should be taken for each box.
- Investigation report including the following contents should be submitted.
  - . Location map, responsible engineer name, date of working, model name of machine, quantity of boring or tests
  - . Geological outline of the area
  - . Drill logs
  - . Description of soils
  - . Available data of soil factors such as unit weight, internal friction angle, cohesion, bearing force of foundation, permeability, etc.
  - . Color photograph of drilling works and core samples
  - . Daily working reports

Number of report to be submitted : one original and three copies  
Size of report : A-4 size

- The borehole drill logs are presented on drawings with at least 1/100 scale in vertical length, and three drawings shall contain the following information;
  - . Borehole number, location, size of casing and date of drilling
  - . Surface elevation
  - . Depth of hole and thickness of layer
  - . Model name of drilling machine
  - . Total core recovery
  - . Geological description of the borehole or the recovered core, including classification, extent of weathering color of solidity (soft, moderately hard or hard, massive or flaky or fracture), etc
  - . Core recovery length, core recovery ratio for every one meter

- section or for every core hole
- . Results of the standard penetration tests
- . water level in the hole, weather and remarks

#### 4.2 Standard Penetration Test

Standard penetration test should be performed at every one meter depth in the sections of deposit and strongly weathered layer. The standard penetration test should be conducted in accordance with the ASTM and JIS or equivalent standard.

The results of the test should be recorded in the daily report of drilling in number of blows for each 10 cm of penetration of the 30 cm long test drive.

#### 5. Bill of Quantities

The bill of quantities for geological investigation are shown below;

##### BILL OF QUANTITIES

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u> (LE)	<u>Amount</u> (LE)
1001	Mobilization and Demobilization Cost	L.S			
1002	Core Boring	m	60		
1003	Standard Penetration Test	time	60		
1004	Report	L.S			
<hr/>					
	Total				

Table-1. Quantity of Investigation

Core Boring

El-Max pump station	20 m depth * 1 boring
Hares pump station	20 m depth * 1 boring
Nubariya siphon	20 m depth * 1 boring

Standard Penetration test ; 60 times

Table-2. Work Schedule

Description	February				Remarks
	1	10	20	28	
1. Field Work					
El-Max pump station	=====				
Hares pump station		=====			
Nubariya siphon			=====		
2. Office Work and Submission of Report				=====	

## B-3 Soil Survey

### 1. Physical Soil Investigation

#### 1.1 Physical Soil Test for Planning Upland Irrigation

##### 1) Objective of the Survey

In order to make plan of the upland irrigation in the selected priority area in terms of adequate irrigation water supply and methods, irrigation intervals, and so forth, soil investigation and physical soil tests shall be undertaken in the Study.

##### 2) Investigation Items

The thickness of plow layers and effective soil layers, soil texture, soil color, the place of gley horizon, the hard pan and its hardness, groundwater level and the distribution of crop roots shall be clarified.

##### 3) Selection of Investigation Point

For investigation, ten sites, which is equivalent to 40 percent of soil chemical test-pits of 25 sites mentioned subsequently, will be selected by the Employer, and two soil samplings at each site, totaling in 20 samples shall be taken for physical soil tests for laboratory. The site shall be test-pitted by the sectioning method with 1.0 m deep in general and soil sections shall be observed, and samples with 100 cc of capacity shall be collected and analyzed.

##### 4) Physical Soil Tests

Soil shall be analyzed at a respective point of each of each soil type for each layer on the following physical items;

- Grain size composition,
- Real specific gravity (Sr)
- Apparent specific gravity (Sa)
- Porosity (P)
- pF-moisture relation

- Wilting point(WP)(field capacity (Fc) at pF4.2)
- Three-phase distribution

#### 5) Intake Rate Measurement

Intake rate measurement shall be observed by applying double-ring infiltration method at selected 10 sites mentioned above.

#### 6) Investigation Results

Following data on physical soil test shall be submitted to the Employer;

- Site conditions  
Thickness of plow layers and effective soil layers, soil texture, soil color, the place of gley horizon, the hard pan and its hardness, groundwater level and the distribution of crop roots
- Physical soil test (see Table-1)
- Intake rate test
- Photograph of test-pits

#### 1.2 Field Permeability Test and Groundwater Observation

##### 1) Procedures for Measuring Permeability

The measurement of permeability are made by infiltration direction. In case total infiltration is the major objectives such as for subsurface drainage, auger-hole method is appropriate, while for upward infiltration from well bottom, piezometer method is appropriate. Therefore, in this survey auger-hole method will be used.

Auger-hole method is applicable in case the groundwater table is high enough to show water surface in the hole, and is a simple method to measure permeability of surface horizons. Favorable size of the test hole is about  $2r = 10-15$  cm and  $d = 1$  m. Procedure for the measurement are as follows;

- Drain water several times to clean o the hole before measurement.
- Measure radius(r) and depth (D) of the hole.
- Leave the hole untouched for one to two days until water level in the hole is recovered and stabilized. Measure the depth of water level (B) in the hole as the groundwater level.

- Drain water from the hole to lower the water level and measure the depth(A).
- Measure depth of water level(R) in the hole after time( t)
- Calculate the coefficient of permeability by

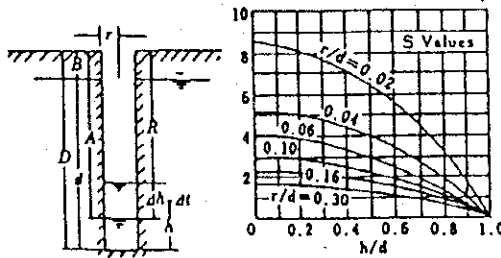
$$K = 0.617 \times r / (S \times d) \Delta h / \Delta t$$

where;

$$\Delta h = A - R, \quad d = D - B$$

S is the coefficient, which can be obtained from the following diagram.

- Repeat the above operation several times



## 2) Investigation Results

The following data on permeability measurement shall be submitted to the Employer;

### Permeability Measurement

Site	Conditions	B	A	R	h	d	K	Remarks
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Note; r = cm  
D = cm

## 2. Chemical Soil Survey

### 1) Objectives of the Survey

The objectives of this soil analysis are to grasp the characteristics of soils and to prepare the basic data for farmland improvement in the Study Area of 29,360 ha.

### 2) Scope of Works

#### a) Type of Working

- Auger boring
- Chemical analysis of soil samples
- Reporting

#### b) Auger Boring

The topographic maps of 1:50,000 scale shall be used as base map for the auger boring, at the grid of 1.2 km intervals, i.e., one per 144 ha. The soil profile, soil texture will be investigated by auger boring of 1.5 m depth. Soil samples for each representative layer in auger boring shall be checked their EC and pH by portable instrument. Other information of landform, vegetation, presence of CaCO<sub>3</sub>, limitation on land use shall be collected in each site of auger boring.

#### c) Analysis of Soil Samples from Test Pits

Soil samples from every representative layer of 25 representative soil test pits (1m x 1m x 1m) shall be analyzed at laboratory for following items;

- (1) pH(H<sub>2</sub>O), pH(KCl)  
- 1:2.5 = soil: H<sub>2</sub>O ( volumetric ratio )
- (2) Electric conductivity(EC) ( mS/cm )  
- 1:2.5 = soil: H<sub>2</sub>O ( volumetric ratio )
- (3) Soluble salts ( Ca, Mg, Na, K, Cl, CO<sub>3</sub>, Cl, SO<sub>4</sub> ) ( meq/lit)
- (4) Cation exchange capacity ( CEC ) ( meq/100g dry soils)

- (5) Exchangeable cations ( Ca, Mg, Na, K )( meq/100g )
- (6) Organic Matter ( % )
- (7) Total nitrogen( mg/100g )
- (8) Available phosphate ( ppm )
- (9) Carbonate calcium ( CaCO3 )( mg /100g )
- (10) Exchangeable carbonate calcium ( CaCO3 )( mg /100g )

d) Reporting

- Survey method
- Location of auger borings and test pits
- Tabulation on landform, pH, EC, etc. by auger boring
- Soil profile
- Standard of land classification and result of land classification
- Tabulation on chemical analysis for typical soils
- Recommendation on farmland improvement with drainage project
- Photograph of auger boring and test pit sites

3. Bill of Quantities

The bill of quantities of soil survey are shown below;

BILL OF QUANTITIES

<u>Items</u>	<u>Descriptions</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u> (LE)	<u>Amount</u> (LE)
1001.	Physical Soil Survey and Intake Rate Test	sample	20(10sites)		
1002.	Field Permeability Test	site	10		
1003.	Auger Boring	site	200		
1004.	Chemical Soil Survey	sample	75(25sites)		
1005.	Preparation of Map and Report Overhead Total	LS			



Physical Features of Soil

Table-1

Site Location	Condition	Soil Depth (cm)	Soil Texture	Real Specific Gravity (Sr) (g/cm <sup>3</sup> )	Apparent Specific Gravity (Sa) (g/cm <sup>3</sup> )	Porosity (P) (%)	Field Capacity (Fc), PF 4.2 (%)	Wilting Point (WP) (%)

Soil Survey Data Sheet (Auger Boring)

PROFILE DESCRIPTION

Auger Hole No. \_\_\_\_\_

Depth (cm)	Colour	Mottling O.K.	Texture	Structure	Moisture & Consistence			Gypsum CaCO <sub>3</sub>
					Dry	Moist	Wet	


Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# Soil Survey Data Sheet (Test Pit)

Profile No. \_\_\_\_\_ Date: \_\_\_\_\_

Surveyor: \_\_\_\_\_

Survey Area: \_\_\_\_\_

Physiographic Unit: \_\_\_\_\_ Slope: \_\_\_\_\_

Landform: \* flat-very gently undulating  
 \* gently undulating  
 \* undulating

Microrelief: density \_\_\_\_\_ height \_\_\_\_\_

Parent material: \_\_\_\_\_

Surface feature (stoniness, salt crusts etc.): \_\_\_\_\_

Vegetation & land use: \_\_\_\_\_

Type of profile: (sandy, gravelly, loamy, clayey)

Disturbing layer: absent or starts at \_\_\_\_\_ cm  
 (rock, gravel, gypsum, texture, others \_\_\_\_\_)

Drainage: \_\_\_\_\_ Water table: \_\_\_\_\_ cm

Water-holding capacity: ( good, moderate, poor, very poor )

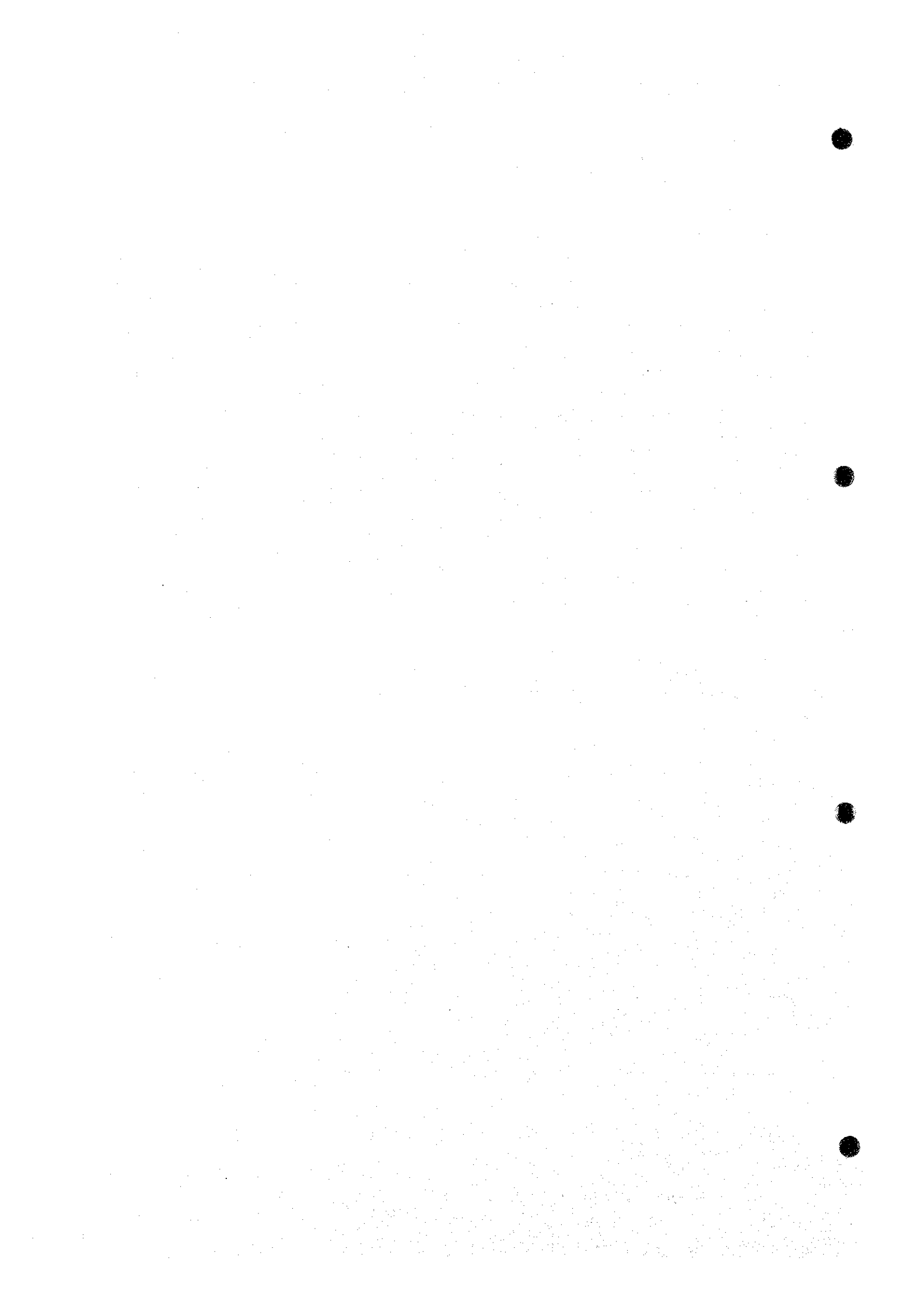
(Disturbed Sample)				(Core Sample)	
Depth	No.	EC	pH	CaCO <sub>3</sub>	Core No.

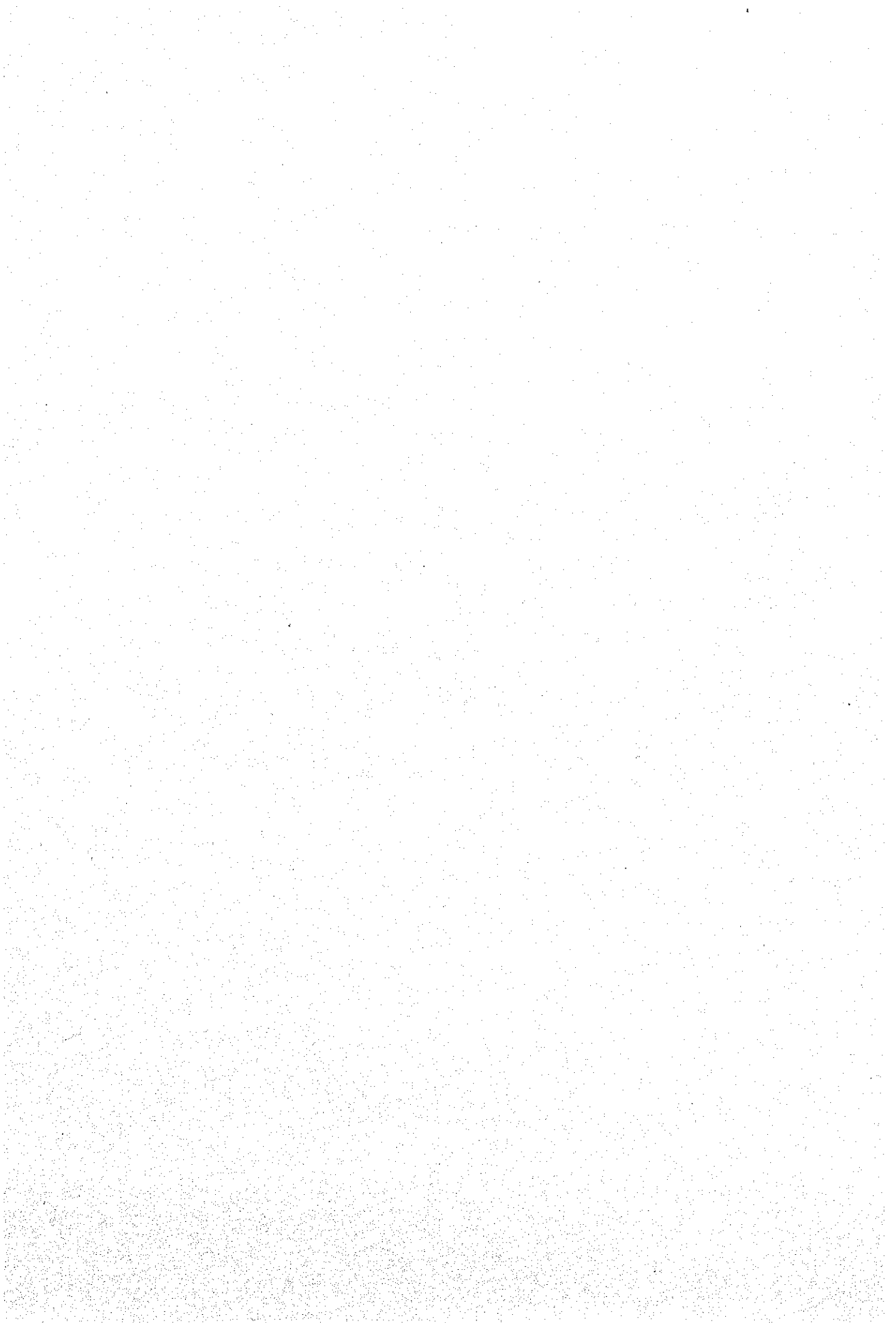
(Water Sample)		
Depth	Temp.	pH

## PROFILE DESCRIPTION

Test Pit No. \_\_\_\_\_

Depth (cm)	Colour	Mottling	Texture	Structure	Moisture & Consistence			Stoniness Cracks	Concretions	Pores Roots	Gypsum CaCO <sub>3</sub>	Org. Matter	Boundary
					Dry	Moist	Vol						





JICA