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**MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
GOVERNMENT OF EGYPT**

**STUDY OF MAINTENANCE MANAGEMENT IN THE MINISTRY
OF PUBLIC WORKS AND WATER RESOURCES, EGYPT**

Rodney Vissia

A Report Prepared for the Study,

"Strengthening Irrigation Management in Egypt"

**International Irrigation Management Institute
Sri Lanka**

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PREFACE

This report was prepared as part of the Study, "Strengthening Irrigation Management in Egypt." The Study was carried out by IIMI and the Ministry of Public Works and Water Resources, Egypt, with the support of the United States Agency for International Development.

The study on maintenance was originally proposed to be a chapter in the final *Action Plan* produced under the Study. However, a subsequent decision was taken not to include this in the Action Plan, and to issue it as a separate report.

The Ministry assigned two professional engineers to work with IIMI on this maintenance study. They are Eng. Adel Mostafa Ibrahim Soliman, and Eng. Mohamed Mahmoud Abdul Latief, both part of the Preventive Maintenance Program in the Ministry. IIMI is grateful to them both for the hard work they did in carrying out the pilot study reported here, and developing the conclusions and recommendations. This was truly a collaborative effort between these two Task Force members and the IIMI consultant, Eng. Rodney Vissia. IIMI is grateful to the team for their work.

The paper reports the results of a pilot study of maintenance in one district, which was intended to validate the methodology and formats used, and to suggest hypotheses for further study. IIMI believes this study and the tentative conclusions may be useful to the Ministry; and recommends the Ministry consider carrying out the study on a larger scale.

Finally, IIMI expresses its appreciation to the Ministry for its support of this study, and USAID for its continued support.

Douglas J Merrey
Egypt Project Team Leader

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STUDY OF MAINTENANCE MANAGEMENT IN THE MINISTRY OF PUBLIC WORKS AND WATER RESOURCES, EGYPT

1. Background

The maintenance of water supply, delivery and disposal facilities is an important function in MPWWR. It is closely related to the operation of the water system facilities. Well maintained facilities provide better water service. A key factor in maintaining facilities is how maintenance activities are managed.

IIMI and the Ministry initiated an activity concerning this topic with the objective of developing a comprehensive program to review the way in which maintenance of system facilities is managed, and to seek opportunities for improving the management of maintenance.

This activity was implemented because the function of maintenance is key to three major IMS components (Preventive Maintenance-PM, Main System Management-MSM and the Irrigation Improvement Project-IIP). PM has been introduced in six Governorates, but only in the Irrigation Department and only for structures and roads; channel maintenance is excluded. PM has introduced some maintenance management software programs and a manual for maintenance management.

The MSM is a high-tech system and requires a type of maintenance not previously carried out by the Ministry. A well maintained water delivery system with a properly functioning telemetry system will result in improved operation of the system and better water service to water users.

IIP is being implemented under IMS and the World Bank. The extent to which IIP will be implemented as a national program has not yet been determined, but it also is a system that requires maintenance to continue functioning properly. In fact proper maintenance is probably more critical for IIP than for the existing system, because when its facilities are not operating properly it will be more difficult to deliver water in the IIP system than it would be through the existing system improperly maintained.

The review of maintenance management for the entire system operated by the Ministry was not possible during the timeframe of the initial IIMI/USAID agreement. Therefore, a review process was developed and tested in a pilot area. The area of the pilot study included the Gharbiya and Kafr El Shiekh Directorates of the Irrigation Department, the Gharbiya General Directorate of the Middle Delta Central Directorate of the Drainage Authority, and the area within the Gharbiya Governorate for the Mechanical and Electrical Department.

After the pilot study was completed, the decision was made to not propose implementation of the comprehensive program for reviewing and improving the management of maintenance throughout the entire Ministry. Instead, a decision was made to restrict activities related to management of maintenance to the areas selected for the irrigation operations action program. Maintenance management activities to be included in the irrigation operations action plan pilot area are a review of maintenance management, a review of the implementation of PM,

possible improvements in managing maintenance and means to improve the use of the techniques introduced under the Preventive Maintenance Program.

Should the Ministry decide, in the future, to review and determine ways to improve the management of maintenance throughout the Ministry, a proposal for a process to do this is included in this annex.

2. Results of Preliminary Study in One Pilot Area

As indicated above, the Gharbiya area was selected for the pilot study of maintenance management. The Gharbiya Directorate of the Irrigation Department is one of the Directorates in which the Preventive Maintenance Project has been implemented. A limited review of maintenance management was also made in the Kafr El Shiekh Directorate, because it is one in which the Preventive Maintenance Project has not been implemented. The areas for the Drainage Authority and the Mechanical and Electrical Department were selected because of their geographical location; their offices are in the same town as the Gharbiya Directorate of the Irrigation Department.

The purpose of the pilot study was to test the maintenance management review process and obtain a preliminary idea of some of the maintenance management activities which might be improved.

The following process was developed for reviewing the management of maintenance for the pilot study:

1. Fourteen data collection forms were developed for obtaining data through interviews of maintenance personnel and in written form. These forms are attached at the end of this annex.
2. The tools developed by the PM contractor, Morrison Knudsen Engineering Inc. were reviewed. They include a maintenance management handbook, the Management of Maintenance System (MOMS), the Spare Parts Inventory Control System (SPICS) and the Equipment Maintenance System (EMS). The last three items are computerized systems for managing maintenance of system facilities, managing the inventory of spare parts and managing the maintenance of the equipment used in system maintenance activities.
3. PM quarterly reports and workshop reports were reviewed.
4. Interviews were held with 21 MPWWR personnel from the Irrigation Department, the Planning Sector, the Drainage Authority and the Mechanical and Electrical Department. The consultant working on the Preventive Maintenance Project was also interviewed. Those interviewed are also listed at the end of this annex.
5. One IIMI team member and the two maintenance management task force members attended the PM Project workshop in Alexandria from June 12 to 16.

2.1 Information Collected

Information collected using the above described process appears in the following paragraphs.

2.1.1 Organizational Units with Maintenance Activities

There are seven units in the Ministry involved in maintaining the facilities of the water supply, delivery and disposal system. The field organizations, for those that have field organizations, differ in number and in the area covered by each field office. The number of field offices for each unit are as follows:

<u>Unit Offices</u>	<u>Number of Field</u>
Irrigation Sector (Irrigation Department)	23 Directorates
Reservoirs and Dams Sector (Irr. Dept.)	(1)
Mechanical and Electrical Department Central Directorates	4
Drainage Authority Central Directorates	5
Coast Protection Authority Central Directorates	3
High Dam and Aswan Dam Authority	(2)
Planning Sector	(3)

Notes:

(1) The Reservoirs and Dams Sector provides technical supervision to the Irrigation Department Directorates for maintenance of small barrages. The Reservoirs and Dams Sector has no field maintenance offices.

(2) The High Dam and Aswan Dam Authority is located at Aswan and it manages all maintenance activities of the High and Aswan Dams from its Aswan office.

(3) The MSM office of the Planning Sector carries out major maintenance of telemetry system equipment at its workshop located at the Delta Barrage. Preventive and minor maintenance of telemetry equipment in the field is carried out by the Irrigation Department Directorates under the technical supervision of the MSM office in Cairo. The MSM office in the Planning Sector has no field maintenance offices.

The boundaries of the 23 Irrigation Department Directorates do not coincide with the political boundaries of the 26 Governorates in Egypt. Likewise, the boundaries of the Directorates of each of the Ministry's units are different.

Although information concerning seven Ministry units is shown above, the pilot study provides more complete information for only three as previously discussed.

2.1.2 Pilot Study Units

The Directorate size for each of the Ministry units selected for the pilot study are as follows:

<u>Unit and Directorate</u>	<u>Area (feddans)</u>
Irrigation Department	
Gharbiya Directorate	523,410
Kafr El Shiekh Directorate	565,000
Mechanical and Electrical Department	
Gharbiya Governorate	327,000
Drainage Authority	
Gharbiya General Directorate	308,050

The Gharbiya General Directorate (Drainage Authority) is one of five general directorates in the Middle Delta Central Directorate of the Drainage Authority. All of the offices for the above listed entities are located in Tanta except the Kafr El Shiekh Directorate which is located in the town of Kafr El Shiekh.

The management of the maintenance at the field level is described below for the entities examined in this pilot project.

Irrigation Department - Gharbiya Directorate:

Maintenance activities consist of channel maintenance and water delivery system structures and road maintenance. Channel maintenance is done primarily by contracts with public or private sector companies. These contracts are managed by the Administrative Officer who reports to the Director General. Roads and channel structure maintenance is the responsibility of the Director of the Preventive Maintenance Project. He is also responsible for maintenance of the preventive maintenance shops, shop equipment and equipment used for maintenance of roads and canal structures.

Irrigation Department - Kafr El Shiekh Directorate:

Maintenance activities are similar to those in the Gharbiya Directorate except for the Preventive Maintenance Project. This Directorate has three Inspectorates (Kafr El Shiekh with 5 Districts, Doussak with 4 Districts, Bayala with 4 Districts).

Mechanical & Electrical Dept. - Gharbiya Governorate:

The area within the Gharbiya Governorate is mostly within the Middle Delta Directorate. This Directorate has six Inspectorates. Inspectorates are divided into three to four Districts each. Each district has a maintenance team reporting to the District Engineer. The team consists of an Activity Manager, an Assistant Activity Manager, a Maintenance Engineer (Electrical or Mechanical), a Civil Engineer, an Electrician and a number of maintenance

workers, varying in number according to location. Building maintenance is managed at the Directorate level by the Administrative Office. Two Civil Engineers are assigned at the Directorate level for this purpose. There is no separate organization for building maintenance under the Administrative Office.

Drainage Authority - Gharbiya General Directorate:

This Directorate has eight districts. Each district is responsible for maintenance of facilities in an area of 35,000 to 40,000 feddans. Most districts have maintenance centers which are responsible for maintenance of facilities in an area of about 5,000 to 6,000 feddans. Each Center has three maintenance teams composed of an Agricultural Supervisor and staff for maintenance of covered drains and open drains.

2.1.3 Headquarters Maintenance Function

Offices at headquarters for the three Ministry units examined in the pilot study have different functions for maintenance activities in relationship to their field offices. The headquarters offices of the three Ministry units and their functions are discussed in the last three paragraphs of this section.

Field maintenance staff of the Irrigation Department report administratively to the Director Generals in the field Directorates. Field maintenance staff in the Drainage Authority and the Mechanical and Electrical Department report administratively to the Under Secretaries in the Central Directorates of these units.

Irrigation Department: The Central Directorate for Water Channel Maintenance and Preventive Maintenance, the Reservoirs and Dams Sector and the MSM project office in the Planning Sector all provide technical direction for maintenance activities of the field offices.

In addition to technical supervision of channel maintenance and management of the PM program, the Undersecretary for Water Channel Maintenance and Preventive Maintenance is also directly responsible for all maintenance activities on the main stem of the Nile River below Aswan Dam. This office also manages the overall maintenance budget for the Irrigation Department.

Mechanical and Electrical Department: The Technical Bureau and the General Department for Planning and Followup provide technical direction and manage the budget, respectively for the field maintenance activities.

Drainage Authority: The General Director for Planning, Monitoring and Followup and Evaluation manages the budget for maintenance activities.

2.1.4 Maintenance Planning, Scheduling and Activities.

Information concerning maintenance planning and scheduling and a description of the types of maintenance activities at the Directorate level for the three Ministry units examined in the pilot study are summarized below:

Irrigation Department:

Maintenance is planned and scheduled for three categories of facilities:

1. Canal banks, roads and structures.
2. Channels.
3. Maintenance equipment and vehicles.

The following procedures are used for planning and scheduling maintenance of the above three categories:

1. Canal banks and structures:

- The condition of canal banks and all the canal structures along the canal are checked by the responsible foreman and an engineer.
- Required maintenance is noted along with an estimate of required labor, equipment and supplies.
- The methodology for performing the maintenance is determined and the cost of the maintenance is estimated.
- District Engineers and Inspectors meet to combine all the prepared maintenance data and a proposed plan is prepared.
- The plan is reviewed by the Director General. All Directorate plans are reviewed at headquarters and final plans are approved.
- Plans are prepared for monthly, quarterly, semi-annual and annual time periods. Schedules are prepared for the plans.

2. Channels:

- Channels are identified for clearance and weed control.
- An annual plan is developed. The work is assigned to both Ministry forces and public and private sector companies. Most of the work is assigned to the companies.
- Specifications for the work is advertised for bids by private sector and public sector companies.
- One year contracts are awarded.

3. Maintenance equipment and vehicles:

- The Preventive Maintenance Project software "Equipment Maintenance System" (EMS) is used to assist in planning maintenance activities. This system contains data concerning the condition of the equipment and the hours of use.

- The responsible foreman and engineer also periodically check the condition of the equipment and plan required maintenance.
- Special forms are used to specify daily, monthly and periodic maintenance and spare part requirements.
- Cost estimates for maintenance and spare parts are prepared and a schedule of maintenance activities is prepared.

Information concerning maintenance activities is shown in the following tables:

<u>MAINTENANCE ACTIVITY</u>	<u>FREQUENCY</u>
Canal bank maintenance	Continuous
Channel weed and silt removal	Continuous
Canal structure maintenance & repair	Continuous
Equipment & vehicle maintenance	Continuous
Pitching	During winter closure
Grouting for soil stabilization	During winter closure
Submerged infrastructure maintenance	During winter closure

<u>WORK PERFORMANCE</u>	<u>% WORK</u>	<u>AVE. ANNUAL VALUE (LE)</u>	<u>AVE. NO. OF CONTRS./YR.</u>
<u>Gharbiya Directorate:</u>			
Public Sector Companies			
Channel maintenance	100	2,000,000	4
Weed control	80	200,000	2
Work force			
Canal bank maint.	100	500,000	
Canal struct. maint.	100	300,000	
Weed control	20	50,000	
Equip. & veh. maint.	100	350,000	
<u>Kafr El Shiekh Directorate:</u>			
Public Sector Companies	39	1,359,000	3
Private Sector Companies	31	1,087,000	5
Work Force	3	100,000	
Social Fund	27	957,000	5

Public and private sector companies performing maintenance work under contract use their own equipment.

Mechanical and Electrical Department:

Detailed information concerning the maintenance planning activity was not collected, however maintenance of machinery (pumps and motors) is scheduled according to hours of operation. A computerized program titled "Powerhouse" is used for maintenance scheduling of pumps and motors. It is also used to manage inventories of equipment and spare parts. Each General Directorate schedules its own maintenance activities. A maintenance schedule is prepared annually.

Normal Maintenance activities are described below:

<u>MAINTENANCE ACTIVITY</u>	<u>FREQUENCY</u>
Servicing pumps and motors	5,000 to 10,000 hours of operation
Supporting equipment maintenance (gates, cranes, fire suppression systems etc.)	Continuous
Building maintenance	Periodically
Vehicle maintenance	Periodically

If the maintenance teams and the central workshop cannot handle all the equipment maintenance, it is contracted out to private and public sector companies. Public and private sector companies use their own equipment when working for the Ministry under contract. Information concerning the percentage of work done under contract was not available.

Drainage Authority:

Maintenance planning and scheduling activities are:

1. Periodic review of facilities by District maintenance personnel and identification of maintenance work which cannot be handled by the District maintenance staff.
2. This extraordinary maintenance work is described in a report to the District Engineer. A proposed schedule for the maintenance work is included in the report.
3. The report is reviewed and approved by the General Director. Sometimes, for complicated or large extraordinary maintenance work programs, the program is sent to headquarters for approval.
4. The program approved at headquarters or by the Director General is sent back to the District Engineer for implementation.
5. Work outside the capacity of District maintenance crews is done by contract with public and private sector companies.

These maintenance plans are prepared every fiscal year.

Routine maintenance activities performed by the Drainage authority are described in the following table:

<u>MAINTENANCE ACTIVITY</u>	<u>FREQUENCY</u>
Flushing pipelines	Twice a year (April-October)
Removing silt from manholes	Every two
Desilting open drains	Once a year as needed
Weed removal in open drains	Annually (April-October)
Road repair	Continuous
Manual weed control	Continuous
Cleaning of syphons	As required
Pitching operations	Annually during winter closure
Building maintenance	Annually
Survey activities for quantity estimates	Annually
Equipment and vehicle maintenance	As needed

Major maintenance work is primarily done by contract. Ninety five per cent of the work is done under contract with public sector companies and five per cent of the work is done by force account labor. One contract covers the Gharbiya General Directorate. The average total annual value of contract work is LE 1,100,000.

Contractors use their own equipment for maintenance work except for vehicles used for construction supervision if the contract is less than LE 10,000. In this case the Drainage Authority furnishes the vehicles for construction supervision.

2.1.6 Maintenance Personnel.

Numbers and types of maintenance personnel in the Directorate offices located in Tanta for the three entities reviewed in the pilot study are as follows:

<u>TYPE</u>	<u>NUMBER</u>			
	<u>Irrig. Dept.</u>	<u>M & E Dept.</u>	<u>Drain. Auth.</u>	
	<u>K. D.</u>	<u>G. D.</u>		
Civil Eng.	29	4	1	14
Elec./Mech. Eng.	2	5	10	2
Electronic Tech.	3	2	3	0
Administrative	15	22	22	72
Laborers	35	14	54	661
Other	260	91	0	4

The four civil engineers listed for the Gharbiya Directorate of the Irrigation Department are only those in the Preventive Maintenance Project. Numbers of other civil engineers involved in maintenance activities was not available. In the Gharbiya Directorate of the Irrigation Department, seven of the staff are half time and 32 are part time. Similar staff data was not obtained for the Kafr El Shiekh Directorate of the Irrigation Department. The Drainage Authority also has part time staff, but the numbers were not available.

2.1.7 Budget and Financial Accounting Process

The budget and financial accounting processes followed by the three entities examined in this pilot study are according to standard Ministry procedures. These procedures are summarized in the following paragraphs:

Chapter 2 of the Ministry budget concerns maintenance service and materials. The following steps are followed in the budget process:

1. Maintenance funding requirements are collected by headquarters from the Directorates. Fund requirements are prepared according to the categories of costs in Chapter 2 of the budget.
2. These fund requirements are compared with the average expenditure of the previous three years.
3. Fund requirements are escalated to account for inflation.
4. The budget proposal is prepared with written justification.
5. The budget is sent to the Ministry of Finance.
6. After approval of the budget by the Ministry of Finance, budget allocations are made to the Directorates.

The financial accounting process is as follows:

1. Expenditures are recorded at the Directorate level in Book No. 81G.A. From this account, monthly and annual expenditure totals are obtained.
2. Vouchers and reports are sent to headquarters to the Accounting Department.
3. Vouchers are recorded in Book 55G.A showing the Directorate sending the vouchers, their dates and value.
4. Vouchers are reviewed by the Accounting Department before payment is approved.
5. Voucher information is recorded also in Book 224G.A according to creditor and debtor accounts. The accounts name and type appear in this journal.

More detailed information concerning budget and financial accounting procedures can be found in the IIMI report on financial management systems (Lewis and Hilal 1995).

2.1.8 Procurement Process

According to interviews of field personnel, the supply and equipment procurement process is as follows:

Irrigation Department - Gharbiya Directorate:

For the Preventive Maintenance Project, the following procedures are followed;

1. Spare parts for equipment and vehicles and supply requirements are placed in four categories which are given below in order of priority:
 - a. Requirements from the annual maintenance plan.
 - b. Desired additional quantities not in the maintenance plan.
 - c. Special spare parts and materials.
 - c. Spare parts and materials needed for the general reserve.
2. The spare parts and supply requirements are forwarded to headquarters.
3. Purchase of equipment is done by the Central Administration for Channel Maintenance in the Ministry.
4. Purchase of materials is decentralized; a committee at the Directorate level approves purchases of materials.

Equipment, parts and materials can be purchased from either public sector or private sector companies. In Law 9, levels of authority for procurement are given for four methods of procurement:

Method 1. Direct purchase

Method 2. Direct competitive bidding (bidders compete in an open meeting)

Method 3. Local tender

Method 4. General tender.

<u>TITLE</u> <u>METHOD</u>	<u>LEVEL OF AUTHORITY BY PROCUREMENT</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
			(LE 1000)	
Head-Centr. Admin.	4	50	40	200
Director General	4	20	20	50
Project Manager	4	20	20	50

The length of time to purchase spare parts averages about two days. Purchase time for materials averages from one to two weeks. No information was received concerning the average purchase time for equipment except that the time differs depending on local purchase versus purchase from outside the country.

Mechanical & Electrical Dept. - Gharbiya Governorate:

Annually, the District Engineers specify what supplies and equipment they need. Their requests are forwarded to the Directorate and headquarters levels. Much of the equipment and supplies are purchased by headquarters and distributed to the Directorates. Consumable items are purchased annually and equipment is purchased as needed. Law 9 is followed for setting delegated levels of authority for procurement. The average time for the procurement process depends on the type of procurement and whether it is procured in-country or offshore. For larger procurements the average time, from the time a request is initiated, until the items arrive on site is about 50 days.

Drainage Authority - Gharbiya General Directorate:

Annually, the District Engineers specify what supplies and equipment they need for the maintenance centers in their area and forward their request to the Director General. Director Generals forward these needs to headquarters as part of budget requests. When budget allotments are made, supplies and minor equipment are purchased by tender at the Directorate level. Large equipment is purchased by tender by headquarters. The length of time for the procurement process depends on what is being purchased, but 2 - 3 months is approximately the average time. Major purchases are made annually, and limits of procurement authority is according to Law 9. As previously reported in the IIMI Objectives report, this law is considerably out of date and the limits of authority for purchases are very low.

2.1.9 Building Maintenance

Buildings maintained by the Directorates of the entities examined are as follows:

Irrigation Department - Gharbiya Directorate :

<u>TYPE</u>	<u>NUMBER</u>	<u>LOCATION</u>
Offices	1	Tanta
Equipment sheds	2	Tanta
	1	Mahalla
Central workshop	1	Tanta
Main workshop	1	Mahalla
Sub workshops	7	Basyon, Alkasaba, Beltag, Kafir Alzayat, Kottor, Beshbish Alsanta
Supply depots	1	Tanta
Housing	1	Tanta

Irrigation Department - Kafr El Shiekh Directorate:

<u>TYPE</u>	<u>NUMBER</u>	<u>LOCATION</u>
Offices	17	
Equipment sheds	0	
Workshop	1	Kafr El Shiekh
Supply depots	4	Kafr El Shiekh, Enshan, Dessouk, Kellene
Housing	85	All locations

Mechanical & Electrical Dept. - Gharbiya Governorate:

<u>TYPE</u>	<u>NUMBER</u>	<u>LOCATION</u>
Irrigation pump stations	4	
Drainage pump stations	26	
Small irrigation pump stations	55	Hamol & Mansour
Electric well houses	68	
Diesel driven well houses	45	
Garages	2	
Apartments	422	

Drainage Authority - Gharbiya General Directorate:

<u>TYPE</u>	<u>NUMBER</u>	<u>LOCATION</u>
Offices	29	8 Districts & Directorate headquarters
Equipment sheds	8	8 Districts
Supply depots	11	2 - Mahalla 2 - Samanod 7 - Tanta
Housing	10	4 - Tanta 2 - Samanod 3 - Mahalla 1 - Santa

2.1.10 Equipment Inventory

Information concerning maintenance equipment inventories for the three entities examined are as follows:

Irrigation Department - Gharbiya Directorate:

<u>TYPE</u>	<u>NUMBER</u>	<u>USE (hrs)</u>	<u>FUNCTIONAL</u>	<u>LOCATION</u>
Pickups	14	1500KM/mo.	yes	-
Truck (2 ton)	14	1000KM/mo.	yes	-
Truck (7 ton)	1	1000KM/mo.	yes	-
Truck (10 ton)	2	1000KM/mo.	yes	-
Dump truck	2	750KM/mo.	yes	-
Jeep Cherokee	1	1500KM/mo.	yes	-
Microbus	2	1000KM/mo.	yes	-
Truck (wk shp)	2	500KM/mo.	yes	-
Grease rig	2	60/ea.	yes	-
Loader (5 ton)	2	400KM/mo.	yes	-
Winch (25 ton)	1	80	yes	-
Grader	1	100	yes	-
Dozer	2	80/ea.	yes	-
Excavator	1	90	yes	-
Fork lift	4	20/ea.	yes	-

The warehouse foreman and his staff manage the inventory of spare parts supplies and materials. The SPICS system is not presently being used, but is to be implemented in the future. The EMS program is used for equipment management. The following records are used for inventory management:

- Warehouse journal (115ah)
- Index record for permanent assets (118ah)
- Invoice record for items entering the warehouse (114ah)
- Purchases record (68ah)
- Communications record (291ah)
- Item request form (111ah)
- Item return form (187ah)
- Cost estimate form (112ah)
- Inventory statement (190)
- Record for totals and sales (121)

Irrigation Department - Kafr El Shiekh Directorate:

<u>TYPE</u>	<u>NUMBER</u>	<u>USE (hrs)</u>	<u>FUNCTIONAL</u>	<u>LOCATION</u>
Winch	1	576	no	Kafr El Shiekh
Loader	1	1007	yes	Kafr El Shiekh
Dozer	1	10	yes	Kafr El Shiekh
Loader/backhoe	1	116	yes	Kafr El Sheikh
Grader	1	6	yes	Kafr El Shiekh
Backhoe	1	50	yes	Kafr El Shiekh
Amph. weed mch.	1	100	yes	Kafr El Shiekh
Amph. weed mch.	1	30	yes	Kafr El Shiekh

Each piece of equipment, building and structure has a file of its status. These files are used in planning maintenance. The manager of the warehouse and the inventory controls the inventory. He is also the Deputy Director of the Directorate.

Mechanical & Electrical Dept. - Gharbiya Governorate:

<u>TYPE</u>	<u>NUMBER</u>	<u>USE (hrs)</u>	<u>FUNCTIONAL</u>	<u>LOCATION</u>
Pickup	1		yes	Mehallet Rouh
Welder	1		yes	Mehallet Rouh
Compressor	1		yes	Mehallet Rouh
Drill Machine	1		yes	Mehallet Rouh
Winch (5 tons)	4	Av.-30,000	yes	Mehallet Rouh
Winch (10 tons)	5	Av.-21,000	yes	Alsagahia
Winch (10 tons)	5	Av.-41,000	yes	Shark Almenofia
Winch (7.5 tons)	4	Av.-10,000	yes	Almahalla Kobra
Hand Tools				All locations

A software program called "Powerhouse" is used for equipment and spare parts inventory management and for scheduling maintenance of wells, pumps and motors.

Drainage Authority - Gharbiya General Directorate:

<u>TYPE</u>	<u>NUMBER</u>	<u>USE (hrs)</u>	<u>FUNCTIONAL</u>	<u>LOCATION</u>
Tractors	14	-	yes	-
Flushing Mach.	13	-	yes	-
Excavator	1	-	yes	-
Loader	1	-	yes	-
Car/Pickup	17	-	yes	-
Truck	2	-	yes	-
Limousine	1	-	yes	-

The inventory contains equipment spare parts, tools, axes, barrels and supplies. Specific spare parts allotments for each piece of equipment is kept in storage. The warehouse specialist maintains the inventory. Drainage Directorate personnel did not respond to the query on Form 9 concerning the inventory process (records, equipment in and out process, use records, equipment status, spare parts in stock etc.)

2.1.11 Facilities Maintained

The facilities maintained by the Gharbiya Directorate of the Irrigation Department are shown below:

<u>TYPE</u>	<u>QUANTITY</u>
Canals	1320 KM
Regulators	100
Barrages	55
Gates	517
Weirs	4
Road	2100 KM
Aqueducts	896
Syphons	11
Weed Barriers	38
Bridges	714
Locks	6
Data Collection Platforms (1)	41

(1) Preventive and minor maintenance only.

The facilities maintained by the Kafr El Shiekh Directorate of the Irrigation Department are as follows:

<u>TYPE</u>	<u>QUANTITY</u>
Canals	1475 KM
Regulators	600
Gates	1200
Weirs	400
Roads	2950 KM
Data Collection Platforms (1)	50

(1) Preventive and minor maintenance only.

The facilities maintained in the Gharbiya Governorate of the Mechanical and Electrical Department are as follows:

<u>TYPE</u>	<u>QUANTITY</u>
Large irrigation pumping stations	4
Small irrigation pumping stations	55
Drainage pumping stations	26
Electrically driven wells	68
Diesel driven wells	45
Gates	5

The facilities maintained by the Gharbiya General Directorate of the Drainage Authority are shown below:

<u>TYPE</u>	<u>QUANTITY</u>
Open drains	938 KM
Gates	1
Drain banks	1876 KM
Weed barriers	59

2.1.12 Preventive Maintenance

The Preventive Maintenance Program supported by USAID is located in the Irrigation Department of the Ministry. The program has been implemented in ten Irrigation Department Directorates in six Governorates (Qalubia, Gharbiya, Menufia, Bahira, Dakahlia, Minia). This program covers maintenance of all irrigation system structures except canals. Workshops have been constructed in the six Governorates for maintaining equipment in the water delivery system and equipment used for maintenance activities. Equipment purchased for the Preventive Maintenance Project include machine shop tools, earth moving equipment (dozers, graders, excavators) and vehicles. In the six Governorates in which the project is established, a Project Director manages the program. Preventive Maintenance Project staff are separate from other maintenance staff in the Governorates.

Preventive maintenance is scheduled annually at the end of the fiscal year, and the total preventive maintenance budget for 1994/1995 is LE 5,971,510 (LE 3,660,000 - government funds and LE 2,311,510 - USAID funds). The 1994/1995 preventive maintenance budget for Gharbiya Directorate is LE 490,838 (LE 420,454 - government and LE 70384 - USAID).

Maintenance management tools which have been developed include the Maintenance Management Handbook, the Equipment Maintenance System (EMS), the Management Operations for Maintenance Systems (MOMS) and the Spare Parts Inventory Control System (SPICS). The Maintenance Management Handbook was developed to assist in planning, scheduling and monitoring maintenance of water system facilities. Maintenance standards and repair procedures are provided and a process of sequencing the planning of tasks and monitoring and reporting maintenance activities is provided.

The MOMS program was developed to store maintenance information on infrastructure facilities and produce reports which maintenance managers can use to more effectively plan and manage maintenance activities. The SPICS program stores data concerning the spare parts inventory for equipment and vehicles, and is used for ordering and distributing spare parts to the different Directorates. It also produces reports concerning the status of the spare parts inventory. The EMS program was developed for the management of maintenance of equipment and vehicles. It stores data concerning types and frequency of equipment servicing and types and amounts of parts used in maintenance of the equipment and vehicles. It produces reports on the operational status of equipment and vehicles and a record of the repairs and service received. The MOMS, EMS and SPICS programs were arabized in March, 1995, and training of staff in the use of the arabized version of the program has begun.

The MOMS program is not yet fully integrated into the management of maintenance. Presently, data are being entered into the program and training of personnel in its use is underway. The SPICS program has not yet been integrated into the inventory management process. The English version of the EMS program is being used, and the Maintenance Management Handbook has been used since 1994.

PM Project personnel have indicated that the EMS program has helped them plan and schedule preventive maintenance of equipment and vehicles and make reports to management concerning this activity. They indicated that the SPICS program should assist them in managing the inventory of spare parts for equipment and vehicles. The Handbook has provided them a standard format for planning and scheduling maintenance work thoroughly and efficiently.

The Kafr El Shiekh Directorate of the Irrigation Department, the Drainage Authority and the Mechanical and Electrical Department do not use the maintenance management tools developed in the Preventive Maintenance Project. However, the Mechanical and Electrical Department does use a software program called "Powerhouse" which was developed for it by an outside contractor. This program includes an inventory system for managing spare parts and preparing related reports, and a system for scheduling maintenance activities.

2.1.13 Main System Management

The IMS component "Main System Management" (MSM) has introduced a new high-tech array of equipment to be maintained by the Ministry. The equipment to be maintained is primarily electrical, electronic and mechanical and is dispersed throughout the water delivery and disposal system. MSM has three components. A meteor burst system collects water level data from some 200 sites and transmits the data to two centers every two hours. This system is installed and operating. A voice and data communication system is being installed and tested. It provides communication capability between field offices and field staff and collects five types of data from irrigation structures and pumping plants. This system is almost totally installed, and much of the system is operating. Completion of installation should occur before the end of 1995. A computerized data management system collects and manages the data. It is installed and operating.

The organization installing the system, and managing its transfer from installation to operation by the Irrigation Department, is located in the Planning Sector. Maintenance of the system consists of a preventive and minor maintenance activity and a major maintenance activity.

During initial operation of the telemetry system, the MSM organization in the Planning Sector maintained the equipment in the field. Subsequently, small maintenance teams were assigned to each General Director of an Irrigation Directorate. These teams include one or two civil engineers, an electrical engineer and electronic specialists. These teams report administratively to the Director General at the directorate level, but receive technical supervision from the MSM Unit in Cairo in the Planning Sector. These teams conduct preventive maintenance activities and perform minor maintenance of equipment for the telemetry system stations on both the water delivery system and the drainage system. After these teams took over the preventive and minor maintenance activity, the reliability of the system dropped from 95% to 75%. Some of the reasons given by Directorate personnel for this drop in reliability were lack of sufficient training and lack of transportation. The MSM organization subsequently provided additional vehicles and is to supply more vehicles over the next year. The MSM organization also set up seven maintenance teams which travel to the field every two months to work with the Directorate teams to perform preventive and minor maintenance. These seven teams cover seven groups of Directorates. They are training Directorate maintenance teams during this process. The MSM organization expects to continue sending these teams to the field for another year, at which time Directorate staff should be sufficiently trained and have adequate transportation.

Major repairs or maintenance is accomplished at the MSM workshop located at the Delta Barrage and operated by the MSM Unit in Cairo. Often equipment units are taken to the workshop and a replacement unit is taken back to the field for installation while the defective piece is being repaired. Occasionally, maintenance staff from the workshop travel to the field to perform major maintenance. After installation of the system is complete, and it is totally operational, a decision will be made concerning the organizational location of the MSM workshop; in the Planning Sector or the Irrigation Department.

A maintenance data base has been developed for recording maintenance information concerning problems, dates they occurred and the types and numbers of spare parts used in repairing equipment. A parts and equipment inventory system is to be developed.

The original Terms of Reference for the technical assistance contractor for this component contained the task of examining the possibility of maintenance of the MSM system by the private sector under contract with MPWWR. However, this contract requirement was removed, and no activity is presently planned for exploring this possibility.

The present Project Director would like to use the excess capacity of the workshop to provide electronic maintenance services to others outside the MSM organization such as NWRC which has electronic equipment in its laboratories. Initially, this activity would be restricted to MPWWR units, but could eventually be expanded to serve clients outside MPWWR if this program proves successful. The objective of this program is to sustain the MSM system financially by using the income from serving other clients to provide incentives to maintenance staff and procure new equipment and parts for the system.

2.1.14 Coordination

Responses by field personnel concerning coordination of maintenance activities, supplies and equipment between Ministry units are summarized in the following paragraphs:

Irrigation Department - Gharbiya Directorate:

Question 1: Do you share equipment and/or supplies with other Authorities or Departments for maintaining facilities? If so, what types of equipment/supplies and how often?

Response: The 25 ton winch is shared with other Authorities and Departments, and the backhoe trailer is shared with others for the transport of backhoes.

Question 2: Do you share staff with other Authorities or Departments? If so, what types and how often?

Response: No

Question 3: Do you coordinate your maintenance schedule and activities with other Authorities and Departments? If so, is this on a regular basis or only occasionally for special cases?

Response: No

Question 4: Do you share equipment storage buildings and supply warehouses with other Authorities and Departments? If so, which ones?

Response: No

Irrigation Department - Kafr El Shiekh Directorate:

Question 1: Do you share equipment and/or supplies with other Authorities or Departments for maintaining facilities? If so, what types of equipment/supplies and how often?

Response: In urgent situations the Coast Protection Authority and the Drainage Authority use trailers from this Directorate to transport heavy equipment.

Question 2: Do you share staff with other Authorities or Departments? If so, what types and how often?

Response: No

Question 3: Do you coordinate your maintenance schedule and activities with other Authorities and Departments? If so, is this on a regular basis or only occasionally for special cases?

Response: No

Question 4: Do you share equipment storage buildings and supply warehouses with other Authorities and Departments? If so, which ones?

Response: No

Mechanical & Electrical Dept. - Gharbiya Governorate:

Question 1: Do you share equipment and/or supplies with other Authorities or Departments for maintaining facilities? If so, what types of equipment/supplies and how often?

Response: Only some buildings are shared.

Question 2: Do you share staff with other Authorities or Departments? If so, what types and how often?

Response: Most of the Ministry's mechanical and electrical engineers work in this Department. Consequently, these engineers are sometimes loaned to other Ministry units for their technical specialty.

Question 3: Do you coordinate your maintenance schedule and activities with other Authorities and Departments? If so, is this on a regular basis or only occasionally for special cases?

Response: Coordination occurs in some maintenance activities. For example, if a drainage pump station shuts down, the Drainage Authority is requested to divert the flows in the drain into another drain while the pump is inspected and repaired.

Question 4: Do you share equipment storage buildings and supply warehouses with other Authorities and Departments? If so, which ones?

Response: No

Drainage Authority - Gharbiya General Directorate:

Question 1: Do you share equipment and/or supplies with other Authorities or Departments for maintaining facilities? If so, what types of equipment/supplies and how often?

Response: Occasionally there is coordination in the transportation of heavy equipment from one site to another. Some buildings are shared with staff from other Ministry units.

Question 2: Do you share staff with other Authorities or Departments? If so, what types and how often?

Response: In the past staff was shared with the Preventive Maintenance Program of the Irrigation Department.

Question 3: Do you coordinate your maintenance schedule and activities with other Authorities and Departments? If so, is this on a regular basis or only occasionally for special cases?

Response: Only in grass maintenance and occasionally on private mesqas. Most equipment, trash rack and trailer maintenance is done by Drainage Authority staff or external workshops, but occasionally the Preventive Maintenance workshop in the Irrigation Department is used. However, there is a strong relationship between irrigation and drainage engineers.

Question 4: Do you share equipment storage buildings and supply warehouses with other Authorities and Departments? If so, which ones?

Response:

Occasionally Drainage Authority sheds are used to store tractors and Preventive Maintenance equipment of the Irrigation Department.

3. Preliminary Conclusions and Possible Opportunities for Change

Preliminary conclusions concerning the management of maintenance in MPWWR based upon the results of the pilot study are presented in the next section (3.1). Possible opportunities for change are presented in Section 3.2.

3.1. Preliminary Conclusions

Organization and Coordination:

Presently six major organizational units in the Ministry are responsible for maintenance activities. Four units maintain facilities of the water delivery and disposal system: the Planning Sector (telemetry system); the Irrigation Department (canals and associated structures); the Mechanical and Electrical Department (wells and pumping plants); and the Drainage Authority (drainage system). The High Dam and Aswan Dam Authority maintains the major water storage facilities and the Coast Protection Authority maintains coast protection works. Each unit has its own maintenance staff, equipment, storage sheds and workshops. In the Gharbiya and Kafr El Shiekh Directorates of the Irrigation Department, there are no formal organizational structures for the maintenance function.

Although the three organizational units reviewed in the pilot study all maintain facilities on the same water delivery and disposal system, very little coordination occurs between these maintenance organizations. In the pilot study, there was no evidence of coordinating maintenance planning and scheduling. Only minor sharing of equipment, staff and workshops was noted. The process for sharing resources and coordinating maintenance was stated as being very bureaucratic. Consequently, any coordination that does occur is between managers who have a good personal relationship.

There appears to be considerable opportunity to make more effective and efficient use of equipment, spare parts, supplies and staff by a coordinated program for planning and scheduling maintenance and sharing resources. Coordination of these resources should lead

to accomplishment of more maintenance work in the same period of time with the same resources and perhaps even with a reduction in the cost of maintenance.

Maintenance Activities, Planning and Scheduling.

In the Gharbiya Directorate of the Irrigation Department, almost all channel maintenance and weed control is done by contract with public sector companies. Structure and road maintenance and some weed control is done by the PM unit. In the Kafr El Shiekh Directorate of the Irrigation Department, most channel and weed maintenance is done by contract with private and public sector companies and the Social Fund. Ninety five percent of the maintenance work of the Drainage Authority is done by contract. In the Mechanical and Electrical Department, the work that cannot be done by the maintenance teams and the workshops is done by contract. Most of the work done by the Ministry units and public sector companies is by manual labor. Building maintenance seems to get less attention than maintenance of water system facilities.

All three units have their own system of planning and scheduling maintenance activities. The system used by the PM unit in Gharbiya Directorate seems to be the most structured and complete. The PM unit plans to improve their planning and scheduling process by implementing the software program, MOMS. There appears to be an opportunity to examine the planning and scheduling processes of all the units and deriving a standard process for all, or at least alter existing processes by adopting the best features of all three units' processes.

There also appears to be room for improving the types and features of channel maintenance contracts to more effectively accomplish channel maintenance activities.

There is a difference in the mix of personnel disciplines for the Irrigation Department Directorates and the Gharbiya General Directorate of the Drainage Authority, even though they both maintain similar facilities. A review of management of personnel of these two units may lead to some standardization and improved efficiencies of maintenance crews.

Maintenance Management Tools:

A maintenance management handbook and three software programs were developed as part of the PM Project. The handbook and the EMS program are being used by Irrigation Department Directorates where the PM Project has been implemented. The SPICS and MOMS programs are still in the process of being implemented. It appears that none of the other Irrigation Department Directorates or other organizational units of the Ministry use these tools. The Mechanical and Electrical Department has developed its own planning and inventory software. These technologies could be adopted in other units of the Ministry to improve the management of maintenance activities.

Equipment and Spare Parts Inventories:

The EMS and SPICS equipment management and software programs have been developed as part of the PM Project. Only the EMS program is in use at this time in the Directorates of the Irrigation Department which have implemented the PM Project. The Mechanical and Electrical Department has a software program called "Powerhouse" for managing its spare

parts inventory. All other equipment management and spare parts management is done with some type of manual system. There is considerable opportunity to improve equipment and spare parts management through the adoption of modern management tools. Furthermore, none of the equipment and spare part inventories are linked; not even the inventories maintained by the Irrigation Department Directorates that have implemented the PM Project. Linking inventories of equipment and spare parts could cut down on equipment down time and save costs by buying spare parts in greater quantities and reducing transport time and distances for major equipment.

Budget and Accounting Processes:

The budget preparation process is basically one of using past budget amounts and escalating these amounts for inflation for submittal for the next year's budget request. The budget and accounting systems classify the costs into four categories (labor and wages, materials and overhead, investment, and capital transfers). The present process does not provide good resource management information. It is, therefore, not very useful to managers for planning budgets and preparing solid justifications for their budget requests. The budget and accounting functions would serve management better if restructured on a "functional" basis. A system of this type is outlined in the IIMI report by Lewis and Hilal (1995).

Procurement Process:

All Ministry units appear to follow essentially the same procedures in procurement of equipment, parts and supplies. Law 9 governs the procedures and sets financial levels of delegated authority for procurement. The levels of delegated authority are considerably out of date. The Directors of donor funded projects get some exceptions from the rules of Law 9. There may be an opportunity to save money by buying in large quantities if the procurement of equipment and supplies is coordinated between Ministry units.

Training:

Although training of maintenance personnel was not specifically investigated during the pilot study, some of the staff interviewed indicated that training programs for laborers are needed and improved training of mechanics of major and hydraulically operated equipment is needed.

Preventive Maintenance:

The Preventive Maintenance Project under IMS has resulted in a routine procedure for maintenance of canal structures and roads, purchase of maintenance equipment and the development of workshops for equipment maintenance and fabrication of maintenance equipment such as weed barriers. Management tools have been developed for planning and scheduling maintenance activities, managing equipment and managing inventories of spare parts. However, only the handbook and the EMS program are presently being used. The other programs are still in the process of being implemented.

This project has been implemented as a separate activity in the six Governorates rather than as an integral part of the overall maintenance function at the field level. Preventive

maintenance in most countries is a specific maintenance procedure that is part of the overall maintenance program. It is a procedure of routine servicing and minor repair of facilities and maintenance equipment to prolong the lives of these items and reduce the frequency and amount of major maintenance required. The preventive maintenance procedure should be incorporated into the maintenance programs of all units, not operated as a separate activity in a separate organizational unit.

Telemetry System Maintenance:

Maintenance of this high-tech equipment is a new and different activity for the Ministry. The MSM unit is trying to turn over the maintenance of the system to the Irrigation Department Directorates. The process has been slow and difficult. It appears that in some Directorates the maintenance turnover is not occurring as quickly as programmed, because the Irrigation Directorate staff are not totally convinced that the system will assist them in their operations activities. The problem seems to be more than the commonly stated reasons of lack of training and vehicles, because the MSM Director has tried to supply the needed training and vehicles.

3.2. Possible Opportunities for Change

The ideas presented in this section are preliminary and need further investigation. Some of the ideas will be examined and tested in the irrigation operations action plan. Others would need further investigation in a comprehensive review of maintenance management, should the Ministry undertake such a review.

Organization and Coordination:

The following paragraphs are alternative possibilities for improving the management of maintenance through organizational changes and coordination mechanisms.

1. The operation and maintenance of all water storage, delivery and disposal facilities could be placed under one organizational unit in the Ministry. The operation and maintenance of coast protection works could also be placed in this unit. The headquarters office of this unit would supervise the operation and maintenance activities of newly formed Directorate offices for this new organization.
2. An alternative to No. 1 is to combine the operation and maintenance of all facilities of the water delivery and disposal system under one unit in the Ministry. Operation and maintenance of storage facilities could stay with the High Dam and Aswan Dam Authority, and operation and maintenance of coast protection works would stay with the Coast Protection Authority. The headquarters of this unit would supervise the operation and maintenance activities of newly formed Directorate offices for this new organization.
3. The existing Ministry organizational units with maintenance functions could be improved by reviewing the way in which the maintenance function is organized. Organizational structures for the maintenance function either need to be formulated or improved.

4. A formal procedure could be developed for the coordination of maintenance planning and scheduling; equipment management; and sharing of equipment, staff, spare parts and supplies to more efficiently use the resources available to the Ministry for maintaining water system facilities. A coordination unit representing all the existing organizational units performing facility maintenance activities would probably be needed at headquarters. Resource information would need to be combined in one management system and equipment and spare part inventories would need to be linked.

Maintenance Management:

1. Existing maintenance planning and scheduling processes and programs could be collected from all the units in the Ministry which maintain water system facilities. The information concerning these processes could be examined and a uniform system for maintenance planning and scheduling based on the best features of all the systems could be developed and improved. This management system would then be used by all the organizational units with only minor alterations, if necessary, for any unique activities for a particular organizational unit.
2. The MOMS, EMS and SPICS programs and the maintenance management handbook developed under the PM Project should be used for a year or two and then reviewed to determine if changes or updating are needed to improve these management systems. They could then be made available to all Directorates in the Irrigation Department and to other organizational units.
3. Maintenance managers of the different organizational units in the same geographic area could meet after their maintenance plans and schedules are prepared to compare them and coordinate them to:
 - a. Avoid working in the same area at the same time.
 - b. Coordinate their equipment and staff utilization schedules to see if sharing of these resources during certain times of the year would result in more work accomplishment and reduced costs.
 - c. Learn about any water system activity that may affect their maintenance plan and schedule.
 - d. Reduce manual maintenance activities by making maximum use of equipment through coordination.
 - e. Coordinate workshop workloads and share workshop capacities to maximize the use of this resource.
 - f. Use their spare part inventories as one inventory, sharing parts as needed to avoid equipment down time.

Budget and Accounting Processes:

Employ a consultant to implement a budget and accounting system like the one recommended by IIMI (Lewis and Hilal 1995) to make the information of these systems more useful to maintenance managers in preparing cost estimates and budget justifications.

Procurement Processes:

1. Prepare recommended revisions to Law 9 to improve the rules governing procurement and forward these recommendations to the proper government entity for consideration.
2. Combine the procurement of supplies and equipment by the various organizational units with facility maintenance responsibilities to save money through quantity buying.
3. Review public and private sector contracts for channel maintenance to determine if more effective and less cost maintenance could be accomplished by:
 - a. Multiple year contracts with one contractor.
 - b. Contracts with one contractor that works on facilities of more than one organizational unit in the same geographic area.
 - c. Penalties for late work completion and awards for completing work ahead of schedule.
 - d. Contracts for building maintenance covering large numbers of buildings for all organizational units of the Ministry in specific geographic areas.

Telemetry System Maintenance:

1. Explore the possibility of maintaining telemetry equipment through private sector contracts.
2. Develop more fully the Project Director's idea to use the excess capacity of the MSM workshop to serve others in and outside the Ministry, charging service fees and using this income to maintain skilled maintenance staff through payment of incentives. Perform a feasibility and market study of this proposal.
3. Examine more fully the institutional issues related to the difficulty of integrating the telemetry system into the normal operational activities of the Irrigation Department. Develop programs to overcome these issues (see chapter 4).

Training:

Conduct a training needs assessment of maintenance personnel and identify what and how much training is needed. Enlist the Training Center staff to conduct the assessment and work with maintenance managers to prepare the necessary training programs.

4. A Proposed Process for a Comprehensive Review and Improvement of Maintenance Management

The initial review for management of maintenance conducted in the Pilot Study, the results of which are summarized in the preceding section, provided experience for designing the analysis process for maintenance management for the entire Ministry. The pilot study covered only one Directorate each for three separate Ministry units which are responsible for some maintenance activities. As described in Section 2, there are six major Ministry units responsible for maintenance of facilities in the water storage, supply and disposal system and for shore protection. The maintenance management review program described in this section concerns review of the management of maintenance activities of all six Ministry units responsible for facility maintenance.

Some lessons learned during the pilot study are as follows:

1. The data collection forms and the interview process used need to be restructured to obtain more details and a better description of the maintenance planning and scheduling activities, the equipment and spare parts management and inventory process, maintenance personnel training, the type and management of public and private sector company contracts for maintenance work and management of building maintenance. This restructuring would need to be done by whoever implements this program.
2. Copies of maintenance management documents need to be collected and studied to better understand the management process.
3. Time must be scheduled to revisit offices, as necessary, in order to clarify some of the information received or obtain additional information.

Following are the proposed steps for conducting a review and analysis of management of maintenance in all sectors of the Ministry.

1. Identify the Governorates or areas in which the various units maintain water service facilities.
2. Review the data collection forms designed for the Pilot Study maintenance management review and alter as necessary based upon the Pilot Study experience. Expand the data collection forms to include consideration of types of facilities maintained by Ministry units which were not examined in the Pilot Study. Restructure the review process to be closely coordinated with the data collection forms. Interviews may be required both before and after completion of the data collection forms to ensure complete understanding of the maintenance management process and to obtain additional information based upon review of completed data collection forms.

3. Meet with the maintenance managers at the headquarters for the Coast Protection Authority, the Authority for the High Dam and the Aswan Dam and the Irrigation Department (Reservoirs and Dams Sector). Maintenance managers at headquarters for the other units were met initially during the Pilot Study. Brief them about the maintenance management study, obtain information concerning their responsibility for the unit's maintenance activities and in the case of the Coast Protection Authority, arrange for field visits to one of its field offices. Gather any reports concerning management of maintenance for these units.
4. Select a Directorate of the Coast Protection Authority to visit and schedule a field data gathering trip to that location. The High Dam and Aswan Dam Authority has no field offices so all data can be collected at their main office in Aswan. The Reservoirs and Dams Sector of the Irrigation Department has no field offices. It provides technical supervision to Irrigation Department Directorates. Information concerning its maintenance management responsibilities can be obtained from its office in Cairo.
5. Conduct interviews with maintenance staff of the units named in "4" above. Leave data collection forms with these managers to obtain information which could not be collected through interviews. Set a schedule for completion of the data collection forms. Obtain appropriate maintenance management documents for analysis.
6. Determine whether other Directorates of the Coast Protection Authority should be visited. This determination would be made based upon the information collected at headquarters and the first field office visited. Schedule visits to other Directorates as necessary.
7. Visit field offices in upper and middle Egypt for the Irrigation Department, the Drainage Authority and the Mechanical and Electrical Department; and collect information through interviews, data collection form completion and collection of existing documents concerning management of maintenance.
8. Determine, based upon information collected from previous visits, whether more field offices in other locations should be visited for collection of information.
9. Assemble and analyze all the data and information collected through interviews, data collection forms and review of reports and maintenance management documents.
10. Identify opportunities for improving the effectiveness and efficiency of managing maintenance.
11. Compare management of maintenance in Directorates where PM is practiced to management of maintenance in Directorates where it is not practiced to determine the difference in effectiveness of managing maintenance and in the condition of water system facilities. Some indicators of the effectiveness of PM would be the condition of service roads, functional canal structures, proper water deliveries from tail reaches of canals, absence of weeds in canals and fewer farmer complaints.

12. Formulate recommendations for improving maintenance management in the Ministry. These recommendations can include processes for planning and scheduling maintenance; processes for inventories of facilities, equipment and parts for equipment; improved preventive maintenance procedures; coordination processes for more efficient use of equipment and staff between Ministry units; use of the private sector for conducting maintenance; contracting procedures for private sector maintenance work and purchase of equipment and supplies for maintenance activities; water user involvement in maintenance activities; administrative processes and reorganization proposals.
13. Develop an action plan for testing as necessary, and implementing the recommendations for improved maintenance management. This plan would contain such activities as training, development of manuals, software improvements, institutional changes, etc.
14. Develop a monitoring program which can be used to determine whether newly implemented maintenance management processes result in improved condition and operation of water service facilities and to identify implementation problems and possible solutions.

The estimated time for this program is 8 months. The anticipated schedule of activities is:

Develop the review program.	3 weeks
Develop data collection instruments.	2 weeks
Interviews at headquarters.	1 week
Field interviews and data collection.	4 weeks
Assemble and analyze information.	4 weeks
Identify opportunities for change.	3 weeks
Analysis of the PM program.	4 weeks
Formulate recommendations and action plan.	4 weeks
Develop monitoring program.	4 weeks
Prepare final report.	3 weeks

This program can be conducted by local consultants with the assistance of MPWWR staff. Twelve man-months of consultant help is estimated; eight man-months for the program director and four man-months for an assistant. The local consultant must be an expert in maintenance management and preventive maintenance techniques for water delivery systems

of the type operated by MPWWR. He should be completely familiar with computerized programs of maintenance management, planning and scheduling and inventory management. He should have knowledge and experience in information collection and data analysis methods.

The assistant to the program director should be a local consultant with a management and institutional background. He would assist the program director in reviewing MPWWR maintenance management systems and procedures. He would also assist in developing improved management systems (inventory, scheduling, financial etc.).

The Ministry should furnish two mid-level maintenance engineers to assist in data collection and interpretation. These two engineers would be needed for at least 15 weeks during the course of the program.

Outputs expected from a comprehensive review of management of maintenance are:

- * A description of how facility maintenance is managed by the different units in the Ministry.
- * A description of maintenance management systems used by the different units in the Ministry.
- * A comparison of the quality of maintenance of irrigation structures in Directorates which have the PM program and Directorates which do not have the PM program.
- * A determination whether units outside the Irrigation Department have their own form of preventive maintenance activities.
- * A description of the coordination of maintenance activities between the different Ministry units (planning; scheduling; sharing of equipment, staff, spare parts and supplies; joint contracts for maintenance etc.).
- * A description of budget and financial accounting activities for the maintenance function in each of the Ministry units.
- * A prioritized list of the recommendations and an action plan for improving the management of maintenance (manuals, inventory systems, planning and scheduling, coordination processes, reorganization and monitoring systems are some of the areas in which recommendations may be made).

Impacts that can be expected include:

- * An expansion of the preventive maintenance principle throughout the Ministry.
- * Improvement of the condition of system facilities through improved maintenance.
- * Improvement of water service through an improved ability of the system to deliver water.

- * An increase in the awareness of Ministry management concerning the maintenance function and its importance.
- * Improved performance of IIP developments and the telemetry system.
- * More value received from funds budgeted for maintenance.

ATTACHMENTS - ANNEX 2

FORM 1 - MAINTENANCE OF FACILITIES

Authorities, Departments and other units responsible for maintenance of facilities.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

FORM 2 - MAINTENANCE OF FACILITIES

Authority or Department _____

Directorate Offices

<u>Name</u>	<u>Area (feddans)</u>	<u>Name</u>	<u>Area (feddans)</u>
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	
6.		6.	
7.		7.	
8.		8.	
9.		9.	
10.		10.	
11.		11.	
12.		12.	
13.		13.	

FORM 3 - MAINTENANCE OF FACILITIES

Authority or Department _____

Headquarters:

Location _____

Staff at Headquarters dedicated only to maintenance activities:

<u>Number</u>				
<u>Civil</u>	<u>Mech./Elec.</u>	<u>Electron.</u>	<u>Admin.</u>	<u>Other</u>

How is the budget for maintenance activities prepared?

How are financial accounts for maintenance expenditures kept?

FORM 4 - MAINTENANCE OF FACILITIES

Authority or Department _____

Maintenance planning, scheduling and work:How is the maintenance plan and schedule prepared?When is it prepared (frequency)?

<u>Type</u>	<u>Maintenance Activities:</u>	<u>Time of the Year Performed</u>
1.		
2.		
3.		
4.		
5.		

<u>Who does the Work?</u>	<u>% of Work</u>	<u>Ave. Value(LE)</u>	<u>No. Contr</u>
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Public Sector Companies

Private Sector Companies

Work Force

FORM 5 - MAINTENANCE OF FACILITIES

Authority or Department _____

Directorate

Number of Maintenance Personnel

Civil Elec/Mech Electron Adm Labor Other

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.
- 21.
- 22.
- 23.
- 24.
- 25.
- 26.

FORM 6 - MAINTENANCE OF FACILITIES

Authority or Department _____

Directorate _____

Budget and Financial Accounting Process:

What is the process for preparing the budget for maintenance (supplies, equipment, personnel, contracts, etc.)? (How are cost estimates made?, Who makes them?, Input from water users?, Approvals?, etc.)

What is the process for keeping financial accounts of maintenance costs? (equipment, supplies, personnel, contracts etc.) (Who keeps cost accounts?, What cost documents are prepared?, Reviews, approvals and audits? etc.)

FORM 7 - MAINTENANCE OF FACILITIES

Authority or Department _____

Directorate _____

Supply and Equipment Procurement Process

What is the process for procuring supplies and equipment?

What level of authority for procurement is delegated to the Directorate?

How frequently are supplies and equipment purchased?

What is the average length of time for procuring equipment and supplies?
(from the time it is realized that equipment or supplies are needed until the items arrive in the Directorate)

FORM 8 - MAINTENANCE OF FACILITIES

Authority or Department _____

Directorate _____

<u>Type</u>	<u>Maintenance Buildings Number</u>	<u>Location</u>
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Offices

Equipment Sheds

Workshops

Supply Depots

Housing

Note: List only those buildings which are actually maintained by the interviewee's Department or Authority.

FORM 9 - MAINTENANCE OF FACILITIES

Authority or Department _____

Directorate _____

Equipment Inventory:

<u>Location</u>	<u>Type</u>	<u>Number</u>	<u>Use(hrs)</u>	<u>Functional(Y/N)</u>
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What is the inventory process? (who does it?, how often is it done?, what records are kept?, how are the inventories used? ie; planning future procurement of equipment and parts, preparing budget cost estimates, scheduling equipment maintenance, scheduling equipment use for facility maintenance) (see also Form 14)

FORM 10 - MAINTENANCE OF FACILITIES

Authority or Department _____

Directorate _____

System Facilities that are Maintained:TypeQuantity(Km, No. etc.)

Canals

Drains

Regulators

Barrages

Gates

Weirs

Pumping Plants

Communications Systems

Data Collection Platforms

Roads

Buildings

Other

FORM 11 - MAINTENANCE OF FACILITIES

Authority or Department _____

Preventive Maintenance Program

1. Names of Directorates in which the program is implemented.
2. Types and numbers of PMP staff employed at each Directorate.
3. Are these staff separate from other maintenance staff in the Directorate?
4. Who supervises PMP staff?
5. What shops/equipment, if any, are specifically for PMP?
6. Budget amounts, sources of funds and budget process?
7. How and when is maintenance scheduled?
8. What Authorities/Departments use the preventive maintenance program?

FORM 12 - MAINTENANCE OF FACILITIES

Authority or Department _____

Main System Management

1. Who is responsible for overall supervision of the maintenance program?
2. Concerning maintenance of equipment, what is the relationship of the MSM unit in the Planning Sector and the Irrigation Department Directorates maintenance organizations?
3. Types and numbers of MSM maintenance staff and Irrigation Department staff assigned to maintenance?
4. Equipment inventories and depots? Who manages depots?
5. How is maintenance scheduled and by whom?
6. Budget/Financial Accounting process?
7. Private sector involvement?

FORM 14 - MAINTENANCE OF FACILITIES

Irrigation Department - Irrigation Sector (normal maintenance program and preventive maintenance program units)

Drainage Authority

Directorate _____

Do you use any of the following systems?

1. The Management Operations for Maintenance System (MOMS).

2. The Equipment Maintenance System (EMS).

3. The Spare Parts Inventory Control System (SPICS).

4. Maintenance Management Handbook (September 1993, MK Engr. Inc.)

5. If so, has it helped improve your management of maintenance? (Answer for each system used).

PERSONS INTERVIEWED

Irrigation Department:

Engineer Zeinab El Gharably, Undersecretary of the Central Administration of Channel Maintenance and Preventive Maintenance.

Engineer Fouad Sultan, a consultant to the Preventive Maintenance Program.

Engineer Hasab El Nabi Khafaga, General Manager for Irrigation in Gharbiya Directorate.

Engineer Fayez Hamoda, Preventive Maintenance manager in Gharbiya Directorate.

Engineer Mosaad Alkakaa, General Manager for Irrigation in Kafr El Shiekh Directorate.

Engineer Abd Elfattah Kashef, Telemetry Engineer, Kafr El Shiekh Directorate.

Engineer Mohamed Abdel Khalek, Irrigation Activity Manager, Kafr El Shiekh Directorate.

Engineer Mohamed Zahid, Head of the Mechanical Section, Kafr El Shiekh Directorate.

Engineer Hamada Abo Shadi, Mechanics Section, Kafr El Shiekh Directorate.

Planning Sector:

Engineer Soliman Abou Zeid, Project Director for MSM.

Drainage Authority:

Engineer Eisa Mohamed Ahmed, Vice Chairman for the Drainage Authority.

Engineer Taha Tawfik Aly Naser, Head of the Central Administration for the Gharbiya General Directorate.

Engineer Fouad Fahmy Nagib, the General Manager for Drainage, Gharbiya General Directorate.

Engineer Hassan Ahmed Alhinidi, Gharbiya General Directorate

Mechanical and Electrical Department:

Engineer Askar, First Under Secretary, Head of the Department.

Engineer Karam Abbas, Manager for the Technical Bureau.

Engineer Nazia Anwar Mostfa, General Manager for Planning and Follow-up.

Engineer Abdel Rahman Tahar Yehia, General Director of the Management Information System.

Engineer Kamel Abo El Seoud, General Director of the Technical Bureau.

Engineer Wahba Tahbit, Under Secretary, East and Middle Delta Central Directorate.

Engineer Sayed Al Nawam, General Manager for Pumping Stations, Middle Delta Directorate.

Engineer El Said Eshra, Middle Delta Directorate.