CHAPTER 2 DEVELOPMENT PLAN OF THE PRIORITY AREA

(Basic Concept of Development)

2.2.1 The development plan on irrigation improvement and water environmental conservation based on the establishment of farmers' organization in the Priority Area will be formulated to cope with the low agricultural productivity caused by the facts such as water shortage in the downstream area caused by over-irrigation in the upper part of canals and fall of on-farm irrigation efficiency, inequitable water distribution under the rotational irrigation system, old irrigation and drainage facilities, and aggravating water environment.

2.2.2 Considering the basic development concept in the Master Plan study of the Study Area, the development goal with more than 7,900 LE of farm household income would be launched considering 6,900 LE of the existing income and 45 % of the food expenditure ratio at the urban household. To achieve this goal, the agricultural development plan would be proposed considering water saving crops and water balance. Under this concept, the core of the development of the Priority Area is the participatory planning on WUA. The proposed facilities will be studied taking into account this concept.

(Methodology to Grasp farmers' Opinions and to Establish Farmers' Organization)

2.2.3 IIP inauguration and its implementation are to be actually based on the farmers' request with mutual consent among them. At least 1.5 to 2 years is to be spent for the above maturity and/or preparation period. For this purpose, PP Participatory Planning methodology is to be adopted.

(Technical Supports to Farmers' Organization)

2.2.4 The activity of the IAS staff' should drastically be changed from the on-going IIP to the proposed IIP to grasp the farmers' willingness by applying the PP (Participatory Planning) methodology. Through it, transformation of the farmers from nominal participants to the training courses, to facilitators and/or social organizers for IIP is also to be expected. From the long-term viewpoint, technical staff are to be released from the field offices of the government to the Federation of WUAs to strengthen its technical caliber.

(Financial Supports to Farmers' Organization)

2.2.5 The repayment periods for IIP are to be increased from the current 20 years (including 5 years' grace period) to 25 years (including five (5) years grace period) in the future. If farmers in a delivery basis agree on IIP implementation with temporary submission of request within limited years (e.g. three (3) years), they are to accept financial advantages

from the government. The government is to pay remuneration to Federation of WUAs as consignment allowance when it decides a turnover of O/M jobs.

(Government Commitment and Legal Framework)

2.2.6 The example of LWB (Local Water Board) in Fayoum is to be reinforced to Federations of WUAs to expand their authority/responsibility for O/M. The government is to promote establishment of a women's conference as an annex to a WUA, expecting its role as catalyst for better rural life including environmental issues. Interaction among related organizations are to be strengthened through an arrangement of correlative sections of irrigation, drainage, mechanics and agronomy etc. in a Federation of WUAs also through related Government organizations to a Joint Committee. "The carrot and stick policy" is to be introduced, endorsed by strong and high level commitment by the government.

(Implementation Procedure of IIP)

2.2.7 Preparation period for farmers' willingness and mutual consent for new IIPs is considered to be about 1.5 to two (2) years. Decision of interim leaders and temporary submission of IIP request are to be applied for new IIP in each delivery canal basis. A Joint Committee is to be set up which is composed of representative both from the government and farmer's side. The committee will promote necessary planning, design, bidding and supervision of construction jobs etc. under mutual collaboration between both sides. After one year's test running and defect correction period for the constructed facilities, the Federation of WUAs is to be officially established and registered to the ID. After the turn-over, a privilege period, probably limited within three (3) years, is to be offered to support the Federation of WUAs.

(Monitoring and Evaluation (M/E))

2.2.8 A stage-wise M/E is to be carried out by farmers under a contract between IAS and the Federation with reasonable payment. Data submitted by the Federation is to be included in the computerized database system by IAS.

(Proposed Crop and Cropping Pattern)

2.2.9 Rice area will be decreased by 57 % of the existing rice area, following the Master Plan. Summer vegetable will be increased by 12 % out of the rice reduction area. Maize and other summer crops will be cropped in the remaining rice reduction area.

2.2.10 Vegetables are proposed crops besides the existing major crop, and will be grown in three (3) years crop rotation. These vegetables are tomato, egg plant, etc. for summer crops, and onion, carrot, etc. for winter crops and flowers such as rose in green house.

(Proposed Crop Yield)

2.2.11 The average unit yields per feddan for the major crops of wheat, sugarbeet, berseem, cotton and rice are estimated at 18.00 ardab (6.43 ton/ha), 20.09 ton (47.83 ton/ha), 18.36 (43.71 ton/ha), 8.00kantar(3.00ton/ha) and 4.07 ton (9.69 /ha), respectively. The total crop production in Priority Area is estimated respectively at 55,600 ton of wheat, (increased by 15 % of the present production), 104,600 ton of sugarbeet (increased by 19 %), 394,300 ton of berseem (decreased by 5 %), 14,300 ton of cotton (increased by 49 %) and 53,200 ton of rice (decreased by 43%), respectively.

(Agricultural Supporting Plan)

2.2.12 The federation of WUA shall have an organization of "Farm Management Section" to collect and renew the basic data on water management of equitable distribution between upstream and downstream areas for timely and adequate irrigation. Farmers will be provided supporting services through this section from Agricultural Extension Centers and other related agencies to improve farming.

(Irrigation Efficiencies)

2.2.13 Current measurements had been done in 4 reaches dividing Bahr Tera canal within the Priority Area, the result of which gave very high conveyance efficiency ranging from 97% to 99 % except one (1) with 93 % (probably affected by weeds). On the other hand, on-farm efficiency may remain somewhat low as observed. The efficiency undertaken in the Priority Area is 0.56 for without project and 0.66 with project situation the same as the Master Plan, and a case study considering return flow is also studied.

(Water Balance and Development Plan of Irrigation and Drainage)

2.2.14 An annual amount of 118 MCM (10.5 % of 1,133 MCM) would be created with the IIP in the Priority Area, thereby mitigating water shortage in the downstream area, Mansour and Balteem Districts, of Bahr Tera. The 118 MCM would raise the cropping intensity of the downstream area by 8 % for winter crop and 11 % for summer crop, or otherwise supplement the area of 14,550 feddan (6,110 ha) currently irrigated by drainage only with the fresh water created.

(Hydraulic Simulation for Bahr Biyala Command Area and the Application)

2.2.15 Under the present rotational condition, it takes about 6 hours to fill the canals at the upstream area of Bahr Biyala, while it takes 24 hours or more to fill the canals at the downstream area of Bahr Biyala. Water level at the downstream of Bahr Biyala fluctuates widely and often remains low. The low water level makes it difficult to supply the water into Meska and canals branching from Bahr Biyala. To cope with this, the transfer from present rotational flow to continuous flow is necessary in IIP areas.

2.2.16 With the continuous flow of maximum 6.16 cu.m/s in July, the water level fluctuates with a small range of 0.4 m. This does not seem to create any noticeable problem. However, with the continuous flow of minimum 1.02 cu.m/s as shown in October, Meska and canals from Bahr Biyala can not take enough water since the water level in Bahr Biyala remained very low. This suggests the need for check gates.

(Objective of PC Network Plan)

2.2.17 This plan aims to materialize the open collaboration environment establishing the integrated information system to support water administration through the introduction of the Personal Computer (PC) Network Plan. To achieve the goal it is necessary to share organizational information and to make it open for advancement to overall administrative operations in terms of efficiency and quality of services.

(Organizational Setup and Subjects)

2.2.18 The Steering Committee, the top decision-making body will implement the PC Network Plan. The Steering Committee will set up the working group. The Working Group will conduct improved water distribution, standardization of drawing and document, monitoring and evaluation of improved IIP, building up water management database. The working group will also formulate 1) procurement and O&M plan of equipment and 2) staff training programs. The executing organizations are composed of the MPWWR Headquarters, the Irrigation Directorate/ the Irrigation Improvement Projects, the Inspection Office, the Water District Office and the Federation of Water Users Associations.

(Contents of PC Network Plan)

2.2.19 The contents of the PC Network Plan consist of the equipment configuration, the cost estimate, implementation schedule and training programs. To attain the above-mentioned targets an equipment configuration of hardware and software is proposed. The training programs are classified into the in-house training program, the external training program and the training program for improved irrigation management. The computer application technology should be able to attain its original objective through integrating the hardware, software and human aspect.

2.2.20 The O&M of terminal facilities including delivery canals will be taken over by the Federation of WUAs. An effective approach for the takeover process would be a complete correspondence of computer system to be introduced to the Water District Office and the Federation of WUAs Office.

(Irrigation Facilities Improvement Plan)

2.2.21 The flow area of the Rahabeen barrage would be enlarged with the reduction of the gate sill

height by 30 cm from the existing dammed-up height. The motorized double leaf gates would be proposed to ensure easy and remote gate operation. The concrete block with stones downstream will protect the scouring portion. The superstructure width will be widened by 12 m including sidewalk on both sides. The data of water level and gate opening will be sent to the water distribution sector in Tanta.

2.2.22 By utilizing existing water level observatory and telemetry system attached on both Bahr Tera intake and the Abshan lock, the remote control system will be introduced with motorized hoist system of gates for easy operation. The data of water level and gate opening will be sent to the water distribution sectors in Tanta etc. and the sectors will process and direct necessary data to operate the barrage to the field office. A total length of about 20 km from the Abshan regulator to the Hamoul town would be proposed for embankment of Bahr Tera right bank with 0.5 to 2.0 m height and 4 to 6 m of crest width to accommodate the flow of additional discharge.

2.2.23 Replacement of Hamoul MPS is conducted to 1) suction head water elevation (-5.0 m) as below 1.6 m from existing elevation and installed preventing device for air mixing at suction pit. 2) Pump capacity : 10 m3/s same as existing and others (2.000 mm bore, vertical axial flow pump). Removal of the pump station is proposed within the MED area of the existing pump station.

2.2.24 Check structures will be set to keep a desirable water level to branch water off to the secondary delivery canal and Meska. The structures to keep downstream water level stable will be designed regarding the prior water supply to the downstream reaches and night time storage.

2.2.25 In terms of easy and cheap maintenance and operation, and the construction cost shouldered by farmers in principle, the Meska improvement method will be proposed. A rectangular raised open Meska, trapezoid raised open Meska, pipe lines Meska and J shape raised open Meska are more advantageous than any other types.

2.2.26 Sub-surface drainage should be implemented at the north edge of the Priority Area, where the sub-surface drainage system is not introduced in about 13,350 feddan (about 5,610 ha). In some areas of about 2,500 feddan (about 1,050 ha) under the Foda delivery canal command area, rehabilitation of the sub-surface drainage will be required.

(Environmental Conservation Plan)

2.2.27 Monitoring of canal's water should first be implemented in Kafr El Sheikh Governorate through the establishment of water quality monitoring subdivision. With the progress of the projects, the monitoring subdivision will be established in the other three (3) governorates and the water quality will be monitored at before project, during the project, and after the

project.

(Cost Estimate)

2.2.28 The project costs are estimated based on the unit price prevailing in MPWWR in November 1998. Foreign exchange rate is adopted with an average ratio of the last half year 1998, according to the Central Bank of Egypt, that is, 1 US$ = 3.40 L.E.

Project Component	Cost (,000 LE)				
	Share				
	Beneficiary	Government	Total	(F/C)	(L/C)
1. Improvement of Major Irrigation and Drainage Facilities	-	100,141	100,141	(67,899)	(32,242)
2. Improvement of Delivery Canal	-	2,720	2,720	(1,900)	(820)
3. Improvement of Meska(56,930 fed (23,900 ha))	112,152	-	112,152	(44,860)	(67,292)
4. Improvement of Water Management	-	9,100	9,100	(8,416)	(684)
5. Field Drainage	9,390	-	9,390	(1,878)	(7,512)
6. Pilot Scheme	-	8,933	8,933	(4,083)	(4,850)
7. Demonstration Farm	-	293	293	(35)	(258)
8. Water Conservation	-	231	231	(208)	(23)
9. Repair Shop for Pump, Gate, and Apparatus	325	-	325	(195)	(130)
10. Cost Administration and Consultants	13,405	13,359	26,764	(13,382)	(13,382)
Grand Total	135,272	134,777	270,049	(142,856)	(127,193)

(Implementation Body)

2.2.29 IIS of MPWWR will be in charge of the projects for improvement of irrigation and drainage facilities. According to kinds of projects, General Egyptian Authority for Drainage Projects or MED will adequately be the implementation body. Regional offices of IAS at the four (4) governorates, MALR and relevant research agencies will support the concerned projects.

(Disbursement Schedule)

2.2.30 The duration of the project implementation will be 10 years. Improvement of the main facilities shall be implemented within five (5) years. Improvement of delivery canals will be accompanied by implementation of Meska improvement. The pilot scheme should be implemented urgently since the result will affect the Meska improvement in other areas. The sub-surface drainage improvement, rather independent, will be completed in four (4) years.

(Operation and Maintenance Plan)

2.2.31 Meska and delivery canals will be operated and maintained by WUA and Federation of WUAs after they obtain legal license as farmers' organization and after turn-over of the improved facilities from the government. MPWWR will support the WUAs technically or financially for large-scale repair due to emergency or unexpected accident. The other facilities will be operated and maintained as present.

(Project Evaluation)

2.2.32 The benefit of the project consists of reduction of O&M cost by establishing WUAs, unit yield increase and crop diversification effect brought about by the elimination of constraints on irrigation water and realized with the governmental policy of reducing the rice cultivated area, and the expansion of cropping intensity in the downstream reaches of the Priority area by supplying surplus water. With an evaluation term of 30 years, EIRR of 17.2 % and FIRR of 14.1 % are obtained. Both IRRs surpass the Egyptian economic opportunity cost of 12%. It indicates that the project at the Priority Area is feasible in terms of national economic situation and business situation.

(Cost Sharing by Farmers and Payment/Income Ratio)

2.2.33 The project cost shared by farmers is 2,996 LE/fed. The annual repayment method of the improvement cost is suggested as 1) no interest and 15 years' repayment (present IIP condition), 2) no interest and 20 years' repayment. For both alternative methods, there is a five (5) years grace period included. Accordingly the annual repayment cost to be shared by farmers is calculated at 200 LE in case 1), and 150 LE in case 2). Adding to WUA O&M cost of 72 LE/fed, the ratio of repayment cost per incremental income was calculated from 21 to 26 % that would be capable for farmers to repay.

(Financial Budget Analysis for the Representative Farm Household)

2.2.34 For representative farm household (2.1 feddan), 1,477 LE/year of agricultural income will be increased after implementation of the project. In addition to the agricultural income without project situation of 4,919 LE and the average non-farm income of 2,000 LE, the total farm household income will be 8,396 LE over the target income (7,900 LE) showing that the project is adequate for farmers in terms of farm-household economy.

(Other Socio-Economic Extend Effect)

2.2.35 The increment of agricultural labor requirements by agricultural production increase, improvement of transportation and prevention of the products from damages by improved administrative road of Meska, reduction of infectious disease by improved water environment realized by change to continuous flow, and improvement works of water quality in irrigation and drainage canals are expected as extended effects of the

project.

CHAPTER 3 PILOT SCHEME

(Objectives of Pilot scheme)

2.3.1 The Pilot Scheme should be implemented prior to the execution of the project in the Priority Area that is the core of the development plan of the Improvement of Irrigation Water Management and Environment Conservation in the North-east Region of the Central Nile Delta. Minimizing the risk that the farmers will join the new water management organization, the Pilot Scheme would be implemented as a showcase of countermeasures to promote the development plan. In the Scheme, the major activities are not only to educate IIS staffs including IAS staffs but also to demonstrate and verify the proposed facilities. The result of the Pilot Scheme will be feed-backed to IIP in the Priority Area.

(Technology Transfer on PP Methodology)

2.3.2 Several technical transfers to MPWWR staff including IIS Staff are expected throughout the PP procedure. Through such procedures, practical discussions and to consolidate participants' opinions according to a delivery canal unit will be expected towards farmers' self-governing irrigation and attendant effective use of water for the future.

(Agricultural Supporting Service on Improvement of Farm Management)

2.3.3 Technology transfer to MPWWR staff on the detailed soil and land classification for the promotion of crop diversification, soil improvement and land leveling, and collection and renewal of the basic data by WUA or Federation of WUAs on on-farm water management, will be conducted to verify agricultural production improvement with IIP. Crop consumption requirement data shall be accumulated with reference to the local conditions as well as according to new variety such as short duration rice or representative summer crops like cotton.

(Technology Transfer on Irrigation and Drainage Improvement)

2.3.4 To know the difference between before- and after-project and verify the saving of water, discharge measurements at the delivery intake shall be started at an early stage to cover at least one year-round discharge data. This annual discharge shall also be the basis for the allocation to the Federation of WUAs. Continuous flow shall be introduced to the delivery canal upon request from the farmers. The flow will be realized and verified with downstream water level control gate.

2.3.5 On-farm irrigation is the most probable area for irrigation efficiency to be improved. Irrigation over-dosage, flow of excess water, returns of excess water, as well as water

shortages shall be experimentally investigated. With the results, on-farm irrigation improvement associated with the introduction of new Meska system and land leveling shall be programmed.

2.3.6 The practice of group based rotational irrigation by division works unit (Marwa) will be necessary with the improved Meska. Technology transfer to and by MPWWR staffs, training on how group based rotational irrigation will be practiced, how often the irrigation shall be done, how long pump operation shall be done according to the crops and so on shall be provided to the farmers. This aspect is very important to mitigate inequitable water distribution strongly felt by the farmers at the upstream and downstream of Meska.

(O & M)

2.3.7 In line with the training, operation and maintenance of Meska shall be programmed, as an example to facilitate the farmers' owns O&M. Also, operation and maintenance of the delivery shall be programmed and tested together with the Federation of WUAs. Through the test run, standard operation and maintenance by the farmers themselves shall be proposed.

(Information Management)

2.3.8 The Monitoring and Evaluation of improved IIP in combination with the standardization of drawing and document under CALS concept are one of the major subjects under the Pilot Scheme. MPWWR staff will be provided the technology transfer on this aspect.

(Water Environment)

2.3.9 The water environmental conservation projects and their technology transfer proposed are: 1) periodic measurement of water quality of irrigation water, drainage water and water from crop field, 2) examination for water quality conservation measure etc.

(Plan of Operation)

2.3.10 Taking into consideration 1) farmers' willingness, 2) demonstration effects, etc., Bahr El Nour delivery canal command area of 4,000 feddan (1,680 ha)) is proposed to be the pilot scheme area.

2.3.11 GOE should form a project team to carry out the pilot scheme. The project team would be composed mainly of such experts as irrigation/drainage, water management, facilities/designing, and organization/rural sociology under the team leader. Also, the experts dealing with other fields are to be required during a certain period as the Pilot Scheme proceeds. The team shall mainly stay in Tanta and Cairo, so that IIS engineers and IAS officers working in MPWWR, responsible for IIP in the Middle Delta, can be

coordinated. Through the activities, the technologies shall be accumulated and referred to in the Priority Area's project.

(Cost Estimate)

2.3.12 The cost for the Pilot Scheme is estimated at 9,916,000 LE The items included in the project are as follows (exclude physical and price escalation contingency);

Item	Total Cost (,000 LE)	F/C (,000 LE)	L/C (,000 LE)
Earth work	8,785.6	3,514.3	5,271.3
Equipment	1,130.4	1,020.1	110.3
-Water quality	45.6	41.1	4.5
-Agriculture	508.5	458.4	50.1
-Irrigation and Drainage	304.2	274.2	30.0
-Water management	272.1	246.4	25.7
Total	9,916.0	4,534.4	5,381.6

(Pilot Scheme Duration)

2.3.13 Pilot scheme is to start with current measurement at the delivery canal concerned, and shall put emphasis on organizing WUG and the Federation of WUGs. It is envisaged that at least two (2) years is needed to form the federation based on participatory planning. The construction works are supposed to be completed during the 3rd year. With monitoring and evaluation period, five (5) years' duration is proposed for the Pilot Scheme.

Conclusion

Since implementation of the IIP in the Priority Area would save 118 MCM of water and show the direct effect of irrigation improvement in the downstream area of Bahr Tera command area, the projects proposed in the Priority Area will be considered as models that will showcase IIP. In the proposed farmers' organization plan, the new management system such as "Joint Committee", "Federation of WUAs" and "WUA and WUG" would be proposed as a participatory planning project. The Pilot Project scheme, which consists of demonstration and verification of the improved facilities with the new management system and training and technical transfer to IIS staff, etc., should be implemented prior to the implementation of all components of the Priority Area. This project is technically, financially and economically feasible.

Recommendation

1. Prior to the execution of the project in the Priority Area, it is recommended that the Pilot Scheme Project should be implemented. MPWWR has to organize "the Project Team" that shall compose of various engineers and experts for quick execution of the Pilot Scheme. MPWWR should seek cooperation and assistance from international agencies and/or development countries, if there are technical and financial constraints to implement the project.

2. The IAS staffs' activities should be shifted to considering the opinions and reaching agreement on willingness of farmers including influential persons and women in the rural area, for the smooth execution of the IIP.

3. The inhabitants in the rural area should be provided training and education on the value of environmental cleanliness and sanitation, specifically on the dumping of waste and garbage in the irrigation canals. Measures should be implemented to prevent dumping of waste and garbage in the canals and the use of the canals for washing and others to maintain quality of irrigation canal and smooth flow of water.

4. The groundwater is one of the precious water resources in not only the Nile delta but also Egypt. For developing the groundwater resources, the research/monitoring and analysis in all over the Nile delta area would be necessary.

ABBREVIATION

ARC	Agricultural Research Center
CAPMAS	Central Agency for Public Mobilization and Statistic
CID	Consortium for International Development
CSU	Colorado State University
EALIP	Egyptian Agriculture and Land Improvement Project
EIRR	Economic Internal Rate of Return
EPADP	Egyptian Public Authority for Drainage Project
EWUP	Egyptian Water Use Management Project
F/S	Feasibility Study
FAO	Food and Agriculture Organization
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GNP	Gross National Product
GOE	Government of Egypt
GOJ	Government of Japan
IAS	Irrigation Advisory Services
ID	Irrigation Directorate
IIP	Irrigation Improvement Project
IIMI	International Irrigation Management Institute
IMF	International Monetary Fund
IMS	Irrigation Management Systems Project
IWM	Irrigation Water Management
JICA	Japan International Cooperation Agency
M/P	Master Plan
MALR	Ministry of Agriculture and Land Reclamation
M/E	Monitoring and Evaluation
MED	Mechanical and Electricity Department
MOI	Ministry of Irrigation (formerly)
MOIC	Ministry of International Cooperation
MPWWR	Ministry of Public Works and Water resources
MSM	Main System Management
NIIP	National Irrigation Improvement and Rehabilitation Program
O&M	Operation and Maintenance
PBDAC	Principal Bank for Development and for Agricultural Credit
PD	Professional Development
PIM	Participatory Irrigation Management
PP	Participatory Planning
RIIP	Regional Irrigation Improvement Project
S/W	Scope of Work
SCF	Standard Conversion Factor
USAID	United State Agency for International Development
WRC	Water Research Center
WUA	Water User Association

CONVERSION AND GLOSSARY

Conversion

cm	centimeter (s)
℃	centigrade degree
cu.m	cubic meter (s)
cu.m/sec	cubic meter per second
fed	feddan (= 0.42 ha)
ha	hectare (= 2.38 fed)
hr	hour (s)
kg	kilogram (s)
km	kilometer (s)
sq.km	square kilometer (s)
lit/sec	liter per second
m	meter (s)
MCM	million cubic meter (s)
m/sec	meter (s) per second
okta	unit of cloudiness
%	percent (s)
ppm	part per million
t	ton (s)

Currency

LE	Egyptian Pond (s) = 100 Pt
Pt	Egyptian Piaster (s)
Yen (¥)	Japanese yen
US $	US Dollar (s)

Exchange Rate (November , 1998)

LE	= US$ 0.29
US$	= LE 3.40

Glossary

Marwa	Small Distributor, irrigation ditch
Meska (Mesqa)	Private ditch serving water from 10 to 300 fed and 10 to 200 farmers
Sakia (saqia)	Water wheel to lift water up
Study Area	area of the Master Plan Study ; 799,500 feddan (335,800 ha)
Priority Area	area of the Feasibility Study ; 62,015 feddan (26,000 ha)

List of Table

Part I Master Plan

Part II Feasibility Study

List of Figure

Part I Master Plan

PART 1 MASTER PLAN OF THE STUDY AREA

CHAPTER 1. INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

(1) National Economy and Agriculture Sector

The Arab Republic of Egypt (hereinafter call as to Egypt) which covers an area of about one (1) million sq.km, has a population of 59.3 million in 1996 with annual growth rate of 2.1%. The cultivated and residential areas occupying about four (4) % of the national land, are located in the Nile delta area and the narrow Nile valley.

GDP of the agriculture sector occupied 17.7 % in 1996/97 and considered as second position next to the mining and industry sector (18.1 %). The agriculture sector, however, plays important roles on national economy because the sector shares about 31.4 % of the total Egyptian workers and supplies raw materials to farm industries in Egypt.

The Nile delta is a region of high productivity with favorable climate and market conditions. It is considered the granary of Egypt. However, wheat, the major crop that used to be self-sufficient in the 1970s dropped by about 48 % in 1994/95. Therefore, agricultural development is required urgently from the viewpoints of society, economy and self-sufficiency of food supply. However, since the cultivated land per capita is very small, at only as 0.14 feddan (about 0.06 ha), the Egyptian government intends to expand farmlands in Sinai (about 620,000 feddan or 252,000 ha) and new valley (about 500,000 feddan or 210,000 ha) as large scale land reclamation projects.

In the fourth Five-Year Plan for Economic and Social Development (1997/98 - 2001/02) GOE intends to enhance the introduction of water-saving crops instead of cutting high-water-consumption crops, encouragement of reducing irrigation cost, prevalence of mechanization, development and extension of new variety and technology, etc. in order to raise GDP of agricultural sector to the level of industry sector.

(2) Present Condition of Water Resources

As it is said "Egypt is the result of the Nile River". It is no exaggeration to say that the economic activity in Egypt can not come into existence without the Nile River. In 1959, the Egyptian Government concluded the 1959 Nile Water Agreement between Egypt and Sudan. The agreement provided that Egypt could use the annual amount of 55.5 billion cu.m of water from the Nile River. Since water requirement of land reclamation projects and other

sectors, however, will be predicted to be increasing in the near future, the countermeasure to solve the problem, therefore, are urgently required. The Egyptian Government is implementing the Irrigation Improvement Projects (IIPs) financed by the World Bank, KfW and Egyptian Government in order to reduce water loss and improve irrigation efficiency. IIP is expected to contribute to the reduction of stress of future water shortage and the increase of agricultural production. To achieve these aims, effective use of exceedingly limited water resource is necessary and essential. However, due to the old irrigation canals and structures, the present situation of the irrigation and drainage system can not solve the problem on effective use of water resources. Also, on the matter of farmland, ineffective individual water management still remains unchanged. On water quality, there is a custom to dispose all excretion by flow of water that has caused the deterioration of irrigation water around the villages and damages to crops.

GOE plans to reduce the financial expenditure by transferring part of water management to farmers and/or their organization as one of the measures of retrenchment. The Egyptian Government has implemented many studies and improvement projects with international institutions and bilateral assistance for effective use of water resources, improvement of relevant facilities, improvement of maintenance and operation of the facilities and conservation of water environment.

1.2 Progress and Objectives of the Study

In order to solve these problems in the Central Delta, MPWWR requested the Government of Japan to extend technical cooperation in conducting the Master Plan Study for the Improvement of Irrigation Water Management and Environmental Conservation in the North-east Region of the Central Nile Delta in April 1996. In response to the request, JICA dispatched the Preliminary Study Team to the Study Area in August 1997 and signed Scope of Work (S/W) for the study. The JICA dispatched the Study Team for the field survey and the study in the field and Japan from March 1998 to March 1999.

1.2.1 Formulation of Master Plan and Feasibility Study

The Study consists of two (2) phases, namely Phase 1 and Phase 2. The objectives of each Phase of the Study are as follows:

1) Phase 1 Study

The Master Plan carried out during Phase 1 Study, aims to improve irrigation and

drainage facilities and water management in the Study Area with the overall goal of achieving more efficient use of limited water resources in the Nile delta. In the course of the Study, the Priority Area was selected for feasibility study in the following second phase.

2) Phase 2

The feasibility study of the Priority Area(s) will be formulated to justify the project implementation of the Priority Area(s) during the Phase 2 stage.

1.2.2 Technology Transfer

The technology transfer relevant to the Study will be carried out to the counterpart personnel through on-the-job training in the course of the Study.

CHAPTER 2 BACKGROUND

CHAPTER 2 BACKGROUND

2.1 National Level

2.1.1 Land and Population

(1) Land

Egypt has a land of 239,200 thousand feddan (100,200 thousand ha) with the world's longest river, the Nile crossing the country from south to north. In 1997, 7,800 thousand feddan (3,280 thousand ha), about 4% of the total land is being utilized for agricultural land. Most of these areas are the existing cultivated land areas with irrigation water in the old and new lands. Adding the new cultivated land of 3,400 thousand feddan (1,430 thousand ha) which will be newly reclaimed by the government, expected future horizontal expansion plan, the existing agricultural land will reach to 11,200 thousand feddan (4,700 thousand ha) in 2017. The per capita irrigated agricultural land of the nation is so small as only 0.14 feddan (0.06 ha). Including the planned newly reclaimed land, the per capita irrigated agricultural land is expected to increase to 0.19 feddan (0.08 ha). (Refer to Appendix B.1, Table B.1.1)

(2) Population

In 1996, Egypt has a total population of about 59,272 thousand and a population density as high as 1,686 people/sq.km. About 57 % (33,800 thousand) of the total population are living in rural areas and 43 % (25,470 thousand) in urban areas. In the past ten years, this population ratio between rural and urban has not changed. As a result of the government's population control policy conducted to prevent population increase in the small arable and residential land, the annual average growth rate during the last decade was about 2.08 %. (Refer to Appendix B.1, Table B.1.2)

2.1.2 National Economy

(1) Economic Policy

The Government of Egypt has encouraged liberalization of the Egyptian economy. It aims to abolish radically the controlled economic policy under the leaderships of the public sectors, shifting to the market economy, attracting foreign investments and privatizing foreign trade from 1991 onwards, under the support of IMF and World Bank. In accordance with the agricultural sector, the government control on farm output prices, cropping pattern and procurement quotas have been liberalized.

(2) Gross Domestic Products (GDP)

In 1996/97, Egypt has a nominal GDP of 239,500 million LE (at the price of 1996/97), of which 42,325 million LE (17.7 %) belong to agricultural sector. At the sector level, industry and mining sector takes first place with 18.1 % followed by the agricultural sector. In the last five years, the annual average growth rate of real GDP (at the constant prices of 1991/92) is 4.3 %. The per capita real GDP of the nation in 1996/97 is 2,725 LE (4,041 LE at current price). This is higher than that of 2,302 LE in 1991/92, in accordance with the progress of liberalization of the Egyptian economy.

Meanwhile, the rate of the agricultural sector remains at a low rate of 3.1 %. Although the share of the agricultural sector to GDP is decreasing, the production values in agricultural related industries whose raw materials are farm products, occupy the majority of industrial production values. Hence, the agricultural sector still plays vital role in the national economy. The content of total values of the agricultural production in 1996/97 is the plant production of 70.9 %, the animal of 22.0 % and the piscine of 7.1 %. For main crop production, vegetables occupy first place with 19.0%, followed by fruit with 15.1 %, maize with 9.3 %, cotton with 9.1 %, wheat with 9.0% and rice with 7.7 %. (Refer to Appendix B.1, Table B.1.3 and B.1.7)

(3) Trade Balance Account(Current Balance Account)

The Egyptian trade balance account usually has deficit status with excess of imports. In 1996/97, export occupies 4.3 % of GDP, while import occupy 12.8 %. As a result, the excess of import reached 34,000 million LE. The deficit in the trade balance account has been covered with the surplus in service balance account such as tourism and Suez Canal tolls, in production revenues balance account and in remittances balance account. Accordingly, the Egyptian current balance account is surplus every year, except in 1995/96 due to substantial excess in imports. (Refer to Appendix B.1, Table B.1.8)

As for the export and import of farm products, the main products imported are wheat, maize, vegetable and dairy. The import of these items are relatively increasing since 1980s. In 1997, import of vegetable, wheat, maize and dairy products occupies 12.6 %, 6.0 %, 2.9 % and 1.1 % of the total import values, respectively. Items of main export are cotton, vegetable, rice and potatoes. The export of these items are also relatively increasing by year. In 1997, export of cotton, vegetable, rice and potatoes occupies 12.4 %, 6.3 %, 1.8 % and 1.1 % of the total export values, respectively. (Refer to Appendix B.1, Table B.1.9)

(4) Food Self-sufficiency Ratio

Egyptian people intake 3,700kcal daily calorie per capita in 1991. The per capita per year share from food-stuff has been increasing yearly. Wheat has been increasing from 167.6 kg in 1990/91 to 190.8 kg in 1995/96, rice from 38.6 to 48.2 kg; bean from 4.2 to 7.0 kg; potato from 22.0 to 29.0 kg; vegetables from 136.8 to 175.7 kg and fruits from 44.9 kg to 68.3kg. The food self-sufficiency ratio of Egypt become 87.7 % and the cereal imports extend to 4,910 thousand metric tons in 1993. The self-sufficiency ratio of wheat is the lowest with 47.9 % in 1995/96, followed by maize and beans with 74.3 and 80.7 %, respectively. In spite of the importance as staple food, its self-sufficiency is correspondingly lower while its import is increasing. The ratio of livestock and fisheries are 90.8 and 72.8 %, respectively. On the other hand, the self-sufficiency ratios of potatoes, rice, fresh vegetables, and citrus exceeded 100 % in 1995/96. (Refer to Appendix B.1, Tables B.1.10 to 12)

(5) Price Fluctuation

The percent of change in consumer price index (Urban: 1986/87=100) in 1996 and 1997 were 7.2 and 4.6. While in 1993 and 1994 it was 12.1 and 8.1, respectively. Wholesale price index (1986/87=100) in 1997 was 4.2 while in 1993, the value was 7.4. Accordingly, the price has stabilized in recent years, as the market economy system is advancing in Egypt. (Refer to Appendix B.1, Table B.1.13)

(6) Employment and Labor Force

In 1996/97, the total labor force (age 15 to 64 years) is 17,358 thousand, of which about 91.2 % or 15,825 thousand are employed and 8.8 % or 1,533 thousand are unemployed. The unemployed labor ratio decreased from the 10.0 % figure in 1992/93. As above-mentioned, though the agricultural labor has decreased to about 30 % or 4,747 thousand of the total Egyptian employed labor in 1996/97 (from about 33 % in 1991/92) it still employs the most labor. It is followed by the service sector which employs about 23 % or 3,577 thousand. The labor of industry whose majority is the agricultural related industry is 2,038 thousand, except for petroleum, electricity and construction sectors. Therefore, the agricultural sector provides a lot of opportunity for employment. (Refer to Appendix B.1, Tables B.1.14 and 15)

2.2 Provincial Level

2.2.1 Land and Population

(1) Land

The entire land in Egypt is partitioned into four (4) regions, that is, Urban Governorates, Lower Egypt Governorates, Upper Egypt Governorates and Frontier Governorates. The Lower Egypt is located in the Nile Delta region spread in the north of Cairo. It has only about 2.8% or 27.7 thousand sq. km of total land. However, the available land for agricultural and residential area in the Lower Egypt occupies about 63% of Egypt or 22.2 thousand sq. km. Besides, the Nile Delta has the most fertile land with favorable climate and water, utilized intensively for agricultural use. Therefore, Lower Egypt is the Egyptian social, economic and agricultural core area.

The Lower Egypt is divided further into East Delta, Central Delta and West Delta. The Study Area is located in the northeastern part of Central Delta. The Study Area consists of four(4) Governorates which are Gharbia, Dakhalia, Kafr-El-Sheikh and Damietta. The area of the four (4) governorates is 9,439.4 sq. km. It occupies about 34% of the total land of the Lower Egypt, which covers about 43 % of available land for agricultural and residential area in Lower Egypt. (Refer to Appendix B.2, Table B.2.1 and B.2.2)

The existing agricultural land with irrigation in the four (4) governorates is 2,017 thousand feddan (847 thousand ha) in 1994/95. This corresponds to about 26% of the total agricultural land of Egypt. However, the per capita irrigated agricultural land is 0.188 feddan (0.079 ha). (Refer to Appendix B.2, Table B.2.3)

(2) Population

In 1996, the four (4) governorates have a total population of 10,766 thousand, and occupy about 42 % of the Lower Egypt. The population distribution are 3,405 thousand in Gharbia; 4,222 thousand in Dhkahlia; 2,223 thousand in Kafr-El-Sheikh and 914 thousand in Damietta. In the four (4) governorates, the population density is 1,141people/sq.km which is nearly the same of that of the inhabited area of Lower Egypt. In 1996, about 28 % (2,993 thousand) of the total population of the four (4) governorates are living in urban areas and about 72 % (7,723 thousand) in the rural areas.

The annual average growth rate during the last decade (1986-1996) of the four (4) governorates is about 1.90 %. Regionally urban rate is 2.0 % and rural is 1.9 % showing only

a slight difference. However, in Dakhalia and Damietta, the difference between urban and rural rate is higher, as 2.6 % and 1.7 % in Dakahlia and 3.0 % and 1.8 % in Damietta, respectively. In both Governorates, the total urban population has increased rapidly. This is attributed to the capital cities of Mansoura and Damietta where the demand of agricultural products is expected to increase. (Refer to Appendix B.2, Table B.2.4)

In terms of occupation (aged 15 years and over) based on population census, the workers in agriculture and fishery occupy about 40 % of the total workers of the Four (4) governorates in 1986. Particularly, in Kafr-El-Sheikh, the workers in agriculture and fishery occupy about 54 % of the all workers. Also, it has a per capita irrigated agricultural land of 0.239 feddan (0.100 ha). Therefore, considering all, Kafr-El-Sheikh is the more excellent agricultural area in the four (4) governorates. (Refer to Appendix B, Table B.1.2 and B.2.5)

2.2.2 Provincial Economy

In 1994/95, the GDP (at 1994/95 prices) of the Lower Egypt is estimated at about 70,800 LE million which occupy about 38 % of Egyptian GDP and made the first production values in all region of Egypt. The GDP of the four (4) governorates (provincial level) is estimated at 36,400 LE million, which occupy about 47 % of the GDP of the Lower Egypt.

By governorate, GDP of Gharbia is 11,700 LE million, Dakahlia, 15,200 LE million, Kafr-El-Sheikh, 6,400 LE million and Damietta, 3,100 LE million. The per capita GDP (at 1994/95 prices) of Lower Egypt is 3,064 LE. In the same year, that of the four (4) governorates (provincial level) is 3,395 LE. By governorate, the per capita GDP (at 1994/95 prices) of Gharbia, Dakahlia and Damietta are 3,391 LE; 3,604 LE and 3,405 LE, respectively. That of Kafr-El-Sheikh is only 2,817 LE, which is even lower than that of the Lower Egypt. (Refer to Appendix B.2, Table B.2.6)

2.3 National Development Policies (the Fourth Five-Year Plan for Economic and Social Development (1997/98 - 2001/02))

The Government of Egypt carried out the economic improvement to shift from the former economic policy controlled under the leadership of the public sectors to the free market economy based on the Third Five-Year Plan for Economic and Social Development (1992/93-96/97) under the support of IMF and World Bank.

With the fruitful result of the economic liberalization and increase of agricultural production, GOE had formulated the Fourth Five-Year Plan for Economic and Social Development (1997/98-2001/02) in April 1997 to progress further liberalization and economic development. It aims at an annual economic growth rate of 6.9% and GDP of 335 billion LE (at the constant prices of 1996/97) in 2001/02. On agriculture sector, the annual growth rate is targeted at 4.2% over the present 3.1%, bringing 52 billion LE (15.5% of GDP) of production. To achieve the target, 45.9 billion LE, which occupies 11.5% of total investment (400 billion LE) in the five years, will be invested in the agricultural sector. The contents are proposed that 30.9 billion LE (67.3%) will be allocated for land reclamation and agricultural development and 15 billion LE (32.7%) for irrigation and drainage projects.

2.3.1 Agriculture

(1) Intensification of Land Use

Almost all agricultural lands depend exclusively on the Nile River system for irrigation water supply. The construction of the High Aswan Dam has provided year round irrigation and facilitated nearly 200 % of cropping intensities in the old land. However, the cropping intensity in the reclaimed land is lower mostly due to the shortage of irrigation water. The increase of cropping intensity in the reclamation area is needed to increase agricultural production in Egypt. Irrigation improvement, which is currently implemented by the MPWWR on a relatively large scale is one of the most important projects for the efficient water use under the conditions that water resources for irrigation is limited in the country. The main objective of the program is to increase the overall irrigation efficiency and ultimately crop production.

As it has mentioned above, the land per capita is limited not only for existing but also expected to reclaim. Under this condition, the increase of production per unit area became inevitable through more efficient land use.

(2) Needs on Efficient Water Utilization

The perennial irrigation has provided new opportunity for more intensive crop production as explained in the above, but at the same time , it has generated new problems of water logging. The excess water over a period of time, raises the water table and increase the level of salinity in the soil, affecting the yields of almost all kind of crops and forcing farmers to grow more tolerant but lower value crops. The establishment of proper water management as well as development of the subsurface drainage becomes very necessary to increase crop production with improved cropping pattern. An early survey in 1975 concluded that the percentage of salt affected soils to the cultivated lands at the regional level is 60 % in the north delta, 25 % in the middle delta, and 20 % in upper Egypt. A recent inventory concluded that about 35 % of whole agricultural land are suffering from salinity, wherein electrical conductivity of the saturated soil extract is higher than 4 mmhos per centimeter.

The Fourth Five-Year Plan for Economic and Social Development (1997-89 to 2001/2002) has crop production target, where rice area is decreased to 0.9 million feddan (0.38 million ha), a decrease of 36 percent from 1.406 million feddan in 1996/97. The Plan expects that rice production within this area will still have some amount of marketable surplus for export even with the planned reduction in rice area.

2.3.2 Irrigation and Drainage

(1) Irrigation and Drainage Development relating to the Fourth Five-Year Plan

In the Fourth Five-Year Plan, the policies and direction for irrigation and drainage development are mentioned, in relation to the agricultural development, which are contained in "Section Three, General Outline, Section Six, Regional Development, and Chapter 1, Agricultural Sector, in Section Seven, Economic Sectors". The main issues mentioned related to irrigation and drainage development are as follows:

1. To support projects of improving and maintaining agricultural lands of low productivity and to coordinate between programs of improvement and restoration of fertility of agricultural lands by implementing sub-surface drainage projects,

2. To encourage and induce the selection of crops that consume less irrigation water, and to benefit from the knowledge of genetic engineering in this concern,

3. To encourage the contribution of self efforts and individual initiatives in operation costs and the maintenance of irrigation networks,

4. To maximize the return of reclaimed lands, and to provide farmers with services to whom lands have been distributed, in addition to expanding the operations of land reclamation,

5. To improve the management and efficiency of using irrigation water and to make available detailed designs for irrigation projects in order to raise the efficacy of agricultural productivity, halting land deterioration and maximizing the benefit from different water resources,

6. To continue the advanced training and agricultural extension programs for the reuse of waste materials and for minimizing chemical usage, and to provide the opportunity for women's participation in field activities which constitute a huge working force in the agricultural sector,

7. To rehabilitate barrages, canal locks, utilities and other civil works on the River Nile and her branches, and to construct barrages at a distance of 35 km from the old Naga Hamady Barrages (1930 erected at 354 km downstream of Aswan high Dam),

8. To replace or renew pumping stations and other civil works such as intakes, gates, weirs, etc. on the irrigation and drainage networks, in addition to lining canals and combating weeds, in order to increase the efficiency of irrigation networks and thereby to create a saving of around one billion cu.m* water,

   * This figure may have been estimated on bases of original plan of Irrigation Improvement Projects, and with revised plan it is estimated at 560 million cu.m (about half of the one billion cu.m).

9. To develop water resources by reusing agricultural drainage water and treated sewerage in irrigation, exploiting groundwater, and increasing cooperation with the Nile Basin countries, in order to increase the available amount of water,

10. To line canals as required, complete canal coverage and divert their courses outside of the inhabited centers and also convert individual inlets to main ones,

11. To implement public drainage projects for an area of 600,000 feddan (250,000ha) and sub-surface drainage projects for 800,000 feddan (340,000 ha) aside from replacing and renewing drainage networks in 350,000 feddan (150,000 ha), and

12. To establish laboratories for conducting studies relating to improving the water quality from re-used agricultural drainage water and working for the purification of well and sea water.

The following items meet the objectives of this Study; namely, replacement, rehabilitation, improvement of irrigation related civil works, lining canals, and converting individual inlets to main ones (same as one point lifting pump Meska system initiated by USAID) which lead to increasing irrigation efficiency. Diverting canal courses outside of the inhabited centers contribute to environmental improvement. Also, cost recovery by the beneficiaries is proposed though limited to operation and maintenance.

(2) Present and Future Water Demand Forecast

In terms of water demand in Egypt, the agricultural sector represents the largest component. The gross water demand of irrigation is in the order of 54.5 billion cu.m/year, including all application, distribution and conveyance losses. With this amount of irrigation water, 7.4 million feddan (3.1 million ha) of arable land is currently irrigated, while the area cropped annually is 14.7 million feddan (6.1 million ha), giving a cropping intensity of 199%.

To cope with increasing water demands, the Aswan High Dam with allocation of 55.5 billion cu.m annually has been supplemented by other means like the re-use of drainage water, groundwater from Nile aquifer, improvement of irrigation efficiencies, limitation of high-consumption crops (specially rice), re-use of wastewater and non-renewable groundwater. Saad and Farid gave a summary of present and future overall water balance in Egypt at the 16th International Congress on Irrigation and Drainage, 1996. The total amount of water is estimated at 63.9 billion cu.m in 1996 and 79.5 billion in 2017.

A revision of the summary is made with the latest overall plan of Irrigation Improvement Projects. According to the latest plan proposed in 1998, about 3,480,000 feddan (1,461,600 ha) of old land is to be improved (annual average is 145,000 feddan) until year 2017, with a water saving of about 2.5 billion cu.m water (about 4.5% of the 55.5 billion cu.m). With this and other means, such as, limiting the cultivation of high-consumption crops likewise, the water balance in Egypt could narrowly meet water requirements until year 2027 (Refer to Table 2.3.1).

2.3.3 Institutional and Legal Framework

Relating to the Egyptian policy of economic reform and deepening the role of the private sector in production and service activities, some crucial points such as 'Integrated rural development focusing on supporting the activities', 'Encouraging the contribution of self efforts and individual initiatives in operation costs and the maintenance of irrigation networks', 'Rationalizing water use, protecting it from pollution, upgrading its utilization' etc. are

earmarked in the Fourth Five Year Plan for Economic and Social Development (1997/98-2001/02) in the field of agriculture and rural development (In more detail, see Appendix J.1).

In this connection, participatory irrigation management(PIM) at the each terminal irrigation and attendant increases of both irrigation efficiency and agricultural production through mobilization of the farmers' incentive have become one of the most important policy in Egypt. In line with this political requirement, the Irrigation and Drainage Law has been strengthened from 1977 onwards throughout its revisions. Major revisions are shown below:

1)Revised Irrigation and Drainage Law No. 12 (1984): General revision including application of permission system in using new pumps at any places other than private lands etc. By this, the preceding Laws such as No. 74 (in 1971) and Article No.11 of the Law No. 143 (in 1981) were invalidated from the viewpoints of rationalization of water use and its saving.

2)Ministerial Decree No. 14717 (1987): Regarding the strengthening the above issues etc.

3)Ministerial Decree No. 53 (1989): Regarding the establishment of IAS and its role etc.

4)Revised Irrigation and Drainage Law No.213 (1994): Regarding the farmers' role for water management through WUAs etc.

5)Ministerial Decree No. 14900 (1995): Explanation in detail on the above No.213, i.e. stage-wise development and roles of WUAs

Through these revisions the WUA(Water Users' Association) has been endorsed as a legal entity and defined as "an association of water users who own, operate, control and manage their private WUAs for their benefits in improving irrigation water control for achieving improved production possibilities for increased net farm income". For these purposes, the WUA is expected to owe following roles:

1)To participate actively in planning, designing, implementing and acceptance of improved Meska

2)To operate, maintain and manage the Meska and branch canal

3)To develop and implement rational plans for irrigation schedule, to purchase, operate and maintain WUA's pumps and to implement regular Meska maintenance

4)To improve Meska water delivery and decrease return flow to drainage

5)To increase irrigation efficiency by measures above

6)To make local rules regarding roles and responsibilities for each member and council for improving water use efficiency and resolving water related conflicts

7)To develop and maintain close coordination and good relationship in working with organizations such as banks, equipment firms, laser/leveling firms, local village councils and their leaders, agricultural extension services and so forth

8)To keep a formal functional linkage with the irrigation departments through branch canal federations especially for demonstrations, training programs, seminars and workshops

9)To federate WUAs to the branch canal level and to link with the irrigation departments in improving system performance

10)To mobilize and manage finances for pumps, equipment and meska maintenance

For the final goal of WUA's functions, stage-wise procedures are adopted in preparing, establishing and implementing the WUA under the supporting services undertaken by the IAS (Irrigation Advisory Service). They are

Phase 1: Entry activities

Phase 2: Organizational activities

Phase 3: Preparation for mesqa improvement activities(Design stage)

Phase 4: Preparation for mesqa improvement activities(Construction stage)

Phase 5: Regular operation and maintenance

Phase 6: Federation on the branch canals

Phase 7: Continuous monitoring and evaluation

For reference, there is nothing in the WUA legislation or by-laws which hinder WUAs' entering into any type of contract, business venture or other activities which are deemed appropriate by its members, and it may bring more economy-oriented activities in the future of WUAs.

Table 2.3.1 Modified Present and Overall Water Balance in Egypt

	1,996	2,017	2,027	Remarks
Demand, BCUM/year				
Agriculture	54.5	67.0	69.1	To increase with reclamation
Industrial	5.9	8.3	9.0	
Municipal	2.7	3.5	3.9	
Total Demand	63.1	78.8	82.0	
Resources, BCUM/year				
Nile River	55.5	55.5	55.5	
Re-use of Drainage	3.7	7.5	7.5	
Groundwater from Nile Aquifer	4.1	7.5	7.5	
Irrigation Improvement Projects		**2.6**	**2.5**	Equivalent to 3,460,000fed impr. (17cm)
Limitation of High-consumption Crops		**3.0**	**3.0**	Rice: 1.6 Mfed to 0.7 Mfed (79cm in depth)
Re-use of Wastewater	0.6	1.14	2.4	
Non-renewable Groundwater		2.4	3.9	
Total Resources	63.9	79.54	82.3	
Balance, BCUM/year	0.8	0.7	0.3	

Note: 1) This table referred to the original presented by Saad & Farid in 1996.
2) Other figures than IIP in 2017 were interpolated by original figures in years of 2000 and 2027.

2.4 Review of Preceding IIP

2.4.1 Outline of Preceding Projects in the Central Delta

There are two (2) preceding projects in the central delta, namely the Irrigation Improvement Projects (IIPs) of the Kahwagi and the Bahr El Saidi with a command area of 12,000 and 26,000 feddan, respectively. These two (2) IIPs were constructed for a period of eight (8) years from 1990 to 1997. The Kahwagi IIP area is located adjacent to the Study Area. Meska in the Kahwagi IIP with an area of about 20% (2,700 feddan) were improved. However, 80 % of the area has not been improved due to shortage of budget. A part of the remaining area has been improved from April 1998 by the local budget. All on-farm level facilities of the two (2) projects were already turned over to Water Users Associations (WUAs). The improved Meska are 45 in the Kahwagi and 213 in the Saidi areas. About 75 % of farmers in Kahwagi and 58 % in Saidi areas, served by the improved Meska are members of the WUAs. The total length of the improved Meska are 30.9 km in the Kahwagi area and 154.2 km in the Saidi area. There are two (2) types of improved Meska, the buried pipeline Meska and the raised open canal Meska in both areas. The ratio of pipeline Meska is about 90 % in both areas. The average area served by the Meska is 64 feddan (about 26.9 ha), with an average length of about 720 m and canal density of 26.7 m/ha.

Besides the above projects, the Bahr El Wasat and Monaifa IIP areas with a command area of 75,000 and 42,000 feddan, respectively, are now under construction (since April 1998) with financial assistance from the World Bank, KFW and Egyptian Government. (Refer to Figure 2.4.1)

2.4.2 Farmers' organization

Regarding the following issuers, data/ information were gathered mainly from Balaqtar, Bahr El Saidi and El Kahwagi projects neighboring to the Priority area, and they were used for the purpose of grasping major problems hampering satisfactory performance of the current IIP, in accompanying with data/ information gathered through field survey. (Refer to Table 2.4.1)

(1) Farmers' Willingness and Establishment of WUA

Present project inauguration on IIP is determined by IIS with the Minister's approval according to annual implementation plan. The name of area by delivery canal unit is inaugurated and directed to each irrigation directorate in concern. According to the order from the central government, IAS staff will conduct a reconnaissance of the area and give

explanation to the beneficiary farmers. At the same time, the IAS staff will collect information on influential persons to be board members of WUA in the future.

Although the necessary condition to implement IIP under Law No.12, namely agreement of more than one-third of related farmers or more than 30 % of the service area, is not fulfilled, the government persuades the farmers in consideration with the Minister's approval to participate in the project through the governorate or a cooperative by showing preceding successful project area. This preparatory term by establishing a WUA takes three (3) to six (6) months. A WUA consists of four (4) councilors including the chairman, and some representatives of Marwa. These personnel are supposed to be elected by the WUA members. However in actual situation, since at the initial stage, the members of WUA were not fixed yet, the influential persons who are found by IAS staff had been elected by mutual vote.

Before IIP, only two (2) to seven (7) % of farmers knew about IIP. However after having explained, more than 70 % of the farmers expected certain benefit from IIP, especially on increase of water supply. Also most of the farmers expected to participate in planning water distribution discussing with water district officers after IIP. In contrast, 70 % of farmers indicated not to participate in IIP if the effect of IIP is only improvement of equitable distribution without increase of water supply. In relation to the matter of farmers' willingness, farmers were not interested in the irrigation improvement on farm level, which forms an important part of the effect of the project.

According to the regulation agreed between MPWWR and USAID in June 1986, fulfillment of the following condition in more than 80 % of the delivery canal service area is required to start the constraction.

1) the councilors have been elected and responsibility of each farmer have been defined.
2) The board of councilors has been working.
3) The regular meeting among the members has been held.
4) The regular meeting between the board members and government engineers has been held and the opinion on design and implementation plan of Meska has been sent to the engineers.

However, in Kahwagi area, the construction had started without fulfilling these conditions. Accordingly though on the planning and designing stage (Phase-III) in the preceding IIP, opinions of farmers have been collected for setting the position of pump stations and division works (valves) and selecting either raised open Meska or buried pipeline Meska, the farmers' opinion on the propriety of the project has not been necessarily regarded.

Whereas in the recent IIP, Bahr Mahumudia area under the World Bank finance, a questionnaire survey was conducted to collect farmers' opinion on degree of water shrotage, facility condition, direct irrigation, water quality, farm budget and so on after implementing IIP.

(2) Technical Support to Farmers' Organization

The technical support to the farmers' organization is carried out by IAS staffs. The IAS staffs are trained and educated to up-grade their knowledge and technique using various manuals and textbooks.

The major jobs (90%) of IAS staffs are to train farmers in IIP areas, checking ledgers, and treating farmers' complaints. On allocation of irrigation water, Irrigation directorate is responsible for it and IAS staffs work for only informing the farmers' request on the allocation of water to the directorate. There is little attention to work on enlightening and hearing from farmers outside the IIP areas. After inauguration of IIP, following five (5) training courses have been carried out to the representative of WUA, councilors, and representatives of Marwa (eight (8) in total) and these are held after the fourth stage (construction stage).

Item	Tenn	Remark
1) Orientation Course	1 to 2 days	The fourth stage
2) Advanced Course	-do-	-do-
3) O/M Course	-do-	The fifth stage
4) Federation Course	-do-	The fifth stage
5) On-Farm Course	-do-	The fifth to sixth stage
Total	5 to 10 days	Total 40 to 80 man/day

The number of the IAS staffs in concern consists of four (4) field agents and an agricultural engineer per 5,000 feddan (2,100 ha) (1,000 fed (420 ha)/capita, about 10 Meska/capita) in IAS Middle Delta directorate in Kafr El Sheikh. The number of IAS staffs in 1998 are 32 (914 fed (384 ha)/capita) for Kahwagi and Bahr El Saidi area, and 11 (1,045 fed (439 ha)/capita) in Balaqtar. These numbers are less than the average density of IAS staff disposition in national level (total number is 278 staffs, 625 fed (263 ha)/capita). The total training man/day for IAS is 11,134 man/day (total cost of 1,281,404 LE) and calculated at 40 days/capita (4,600 LE) on national average. Despite these efforts, 41 IAS staffs (one (1) out of seven (7)) had been transferred to the other sections from 1989 to 1996.

(3) Financial Support to Farmers' Organization

In the above IIP areas, the procurement of one-point lifting pump had been in trouble since the early stage. The original plan was to procure the pump by WUA themselves financed by PBDAC. Because this plan was failed, the progress of the IIP implementation was

considerably delayed. As the countermeasure, to include the cost of the pump into the project cost has been carried out by USAID since 1994. On performance of O & M cost collection by WUA in the IIPs above, it is reported that 70 % of WUAs collected full necessary O&M cost and 30 % of WUAs collected a half of it. However, 107 of WUAs out of 311 improved Meska namely one-third of WUAs were only registered with Irrigation Directorate, it is actually counted that only one-fourth of WUAs fully collected their necessary O&M cost. The major reason for default is the fact that farmers do not feel necessary having one-point lifting pump by IIP since they have their own pumps.

According to the result of "Monitoring and Evaluation of Water User Association Finances, 1995" which conducted to 40 WUAs in Herz Nomaniya, Beni Efeid, Ashrouba, and Qiman Arus area in upper Egypt, their performance of collecting cost or bank saving is as good as regarding as a model case. The outline of the 40 WUAs are as follows;

- Scale of WUA : 44 fed/WUA
- -do- : 26 households/WUA (1.7 fed/household)
- Revenue of WUA : about 3,000 LE/year (255 LE/month)
- Levy per fed : about 70 LE/year
- Levy per household : about 120 LE/year

The items of the annual expenditure of WUA is as follows;

Item	Ratio (%)	Annual expenditure (LE/year)	(LE/fed/year)
Personnel (Pump operator etc.)	15	460	10
Pumping Cost (fuel, oil etc.)	40	1,220	28
Canal Maintenance (dredging, weeds cut etc.)	5	150	4
Contingency (Pump replacement etc.)	40	1,220	28

Note: The contingency above will be required around 2,000 LE ordinarily considering regular check and unexpected damage of pump.

In the meantime, the example of O&M cost for a delivery canal at Hamoul Water District Office is as follows;

- Terminal operator : 10 Bahari, 30 permanent workers, hence 40 in total
- Salary to terminal operator : 120 LE/month × 12 months × 40 persons = 57,600 LE/year
- Command area : 41,855 feddan (about 1,000 feddan per terminal operator
- Canal Length : 116 km (3 km per terminal operator)

- Operator Cost per canal length : about 500 LE/km/year
- Canal Maintenance Cost (dredging and weed control) : 1,500 LE/km

Note: According to an interview, the canal maintenance was reported as 1,000 LE/km. However, studying "Local Water Boards in the Fayoum, 1998 Report" and other information, the cost was decided as 1,500 LE/km. When Local Water Board contracts the dredging and weed control, it costs 850 LE/km.

After all the O&M cost of a delivery canal is 2,000 LE/km (500 LE/km/year for operator and 1,500 LE/km/year for canal maintenance) Unusual cost such as replacement of gate (3,000 LE/ton), painting, etc. will be undertaken by Irrigation Directorate.

(4) Government Commitment and Legal Framework

The Forth Five-Year Plan for Economic and Social Development (1997/98 – 2001.02) encourages the contribution of self-efforts and individual initiatives in operation and maintenance of irrigation networks to reduce such irrigation costs. In relation to the matter, according to the Law Decree No.263 in 1997, LWB (Local Water Board), a farmers' self-organization, was established and started functioning in 10 delivery canals in Fayoum governorate. The LWB in Fayoum is a voluntary group based on "Rais El Munawaba System", a traditional community following customary law "Haq El Arab" in association with gravity irrigation Meska (The system is to manage water supply with the discussion between a leader called "Mowwaz El Fatha" and representatives of small groups called "Tarraf"). The LWB has been managed through a Joint Committee with the Government. The representatives of the Joint Committee from the Government side are the District engineers and Drainage engineers. According to the Law Decree No.263, the duty of LWB is to contract with the Government for maintaining a delivery canal such as weed control and dredging. The role of LWB is expected to expand.

As another important information, the government commitment on the drainage management should be taken account. EPADP (Egyptian Authority for Drainage Projects), which administrates the drainage management, has 29 Directorates over the nation, 162 Maintenance Center (40,000 fed (16,800 ha)/center), and 427 Sub-center (15,000 fed (6,300 ha)/center). Area Drainage Engineer, the chief of Maintenance Center, and staff of Drainage Sub-center are correspondent to the District Engineer and Field Agent in irrigation sector. The annual budget for drainage management is 44 million LE and the total length of the concerned drain was 11,500 km (4,000 LE/km). In the head quarter in Cairo, DAS (Drainage Advisory Services) corresponding to IAS in irrigation sector is in charge of supporting farmers. The main activities of DAS are guidance for farmers to implement sub-surface drainage, establishment and support of CUA (Collector User Association) after installing the sub-surface

drainage and turnover the collectors. Enlightening and campaigning on water conservation of open drain are the other activities. The government is now studying about the unified turnover of terminal O&M for irrigation and drainage by establishing IDUA (Irrigation and Drainage User Association) combining WUA and CUA.

(5) Monitoring and Evaluation (M/E)

Monitoring and Evaluation (M/E) after the implementation of IIP has conducted in upper Egypt such as Herz Noaniy area from 1992 to 1995. However a series of M/E has not been continuously carried out. Especially fragmental information on M/E in the Nile delta appears only about Kahwagi area in "Quarterly Rapid Appraisal Report on Status of Fully Operational Meskas" (by IAS, 1993) and "Adaptation of Egyptian Water Users in IIP Improved Area" (by Abou El Fatoh etc., 1998) (In Balaqtar area, it is said that an interview survey to beneficiary farmers after IIP was conducted. But the detail is unknown).

The Rapid Appraisal mentioned in the report above, is an operation at the third stage (planning and designing stage) of the IIP procedure. The content of the operation is to report four (4) times a year to IAS head quarter about interviews to councilors of WUA on adequacy of water distribution taken every month by IAS staff. Meantime, M/E section of IAS made a planning document "IIP Monitoring & Evaluation" to conduct M/E of after IIP and before IIP in 18 areas including Kahwagi and Balaqtar. This documents aims to evaluate comprehensively each improved Meska by scoring with more than 100 items. However, the Rapid Appraisal has not been continuously carried out except for five (5) IIP areas including Kahwagi in March 1993. Also the M/E in 18 IIP areas has not been conducted.

(6) Present Situation of WUA

So far 311 meskas have been improved for 15,817F of farmland (i.e. around 50F per meska) and 226 WUAs (i.e. 70F per WUA) have been established in IIP area of Balaqtar, Bahr El Saidi and El Kahwagi, neighboring to the F/S site(as of 1998). Out of the above mentioned numbers, however, only 73% of improved mesuka is operational and 47% of established WUA only is collecting O/M fees with registration to the Irrigation Department. In Kahwagi area, in particular, only 33% of farmers is satisfied to the improved water distribution by IIP, the ratio relying on one-point lifting pump is 5% only and 87% of farmers is still forced to continue night irrigation (Refer to Table 2.4.1).

This low efficiency in the existing IIP projects causes disappointment and attendant several complaints/requests to farmers aiming at more successful IIP implementation. As is

summarized in the results of the group meetings, farmers are mainly calling for adequate water distribution and reasonable crop price cum input costs, and this tendency coincides well to the results obtained from the questionnaire survey executed in the phase I and II studies as well as to the categorized magnitude of individual farmers' opinion gathered through the group meetings (In more detail, see Appendix J.7).

2.4.3 Water Management

It is general practices in the preceding projects that a project starts from the downstream area of the delivery canal, and then it extends sequentially toward the midstream and upstream areas. Such practices aim at demonstration effects for the continuous flow to farmers in the midstream and upstream areas where the farmers' incentive is less than the downstream area. However, several negative consequences happen as follows.

MPWWR as management body of the delivery canal is responsible position to continue the rotational flow to Meska in the midstream and upstream areas up to the final completion of the entire IIP project. Such additional gate operations at the Meska intake cause to suppress the daily management operations of MPWWR. It is also ironic result that the farmers along the midstream and upstream sections of the delivery canal can easily pump up illegal water directly from the delivery canal where the continuous flow has been already practiced.

The prolonged coexistent period of the continuous flow and rotational flow due to variation of situations can be hardly foreseeable at the planning stage. The variation of situations refers to the water stage fluctuation in the main canals due to deterioration of canal structures, changes of cropping patterns and subsequent estimation of water requirement, unused old canal land and insufficient night storage capacity. These issues are able to overcome through a database arrangement of basic information, a hydraulic simulation and an establishment of monitoring and evaluation system for the improved IIP projects.

2.4.4 Agriculture

According to the result of Farm Economy Survey which have 12 of sample farmers in each area of areas have about 200 % of the annual cropping intensities which comprise about 60 % of rice and small areas of vegetables. Respectively the El Kahwagi and Bahr El Saidi have similar condition to these in the upstream and the downstream in Study Area .The crop yields of major crops in both areas are higher than these in Study Area by 0% to 10 % of the crop yields.

In both areas, there are about 20 of sample farmers who have the troubles among farmers in the upstream and the down stream. In the conditions that the farmers did not participate to IIP fully, they have difficulties in improvement of cropping pattern as well as increase of crop yields. Moreover, the there is an inadequate coordination among the concerned agencies on agricultural supporting services for the improvement of saline soils and the agricultural extension in IIP area. There are no formal farmers organization to have these supporting services along with implementation of IIP.

2.4.5 Irrigation and Drainage System

(1) Irrigation Efficiencies and Water Requirement previously Applied

IIP and Project Preparation Department (PPD) under MPWWR had prepared a Preparation Reports for Mahmoudia, El Wasat and Manaifa irrigation improvement projects in March 1994. The IIPs applied 0.44 to the overall efficiency for without-project (with-project is 0.66). These projects are now funded by the WB and KFW. The WB had reviewed the irrigation efficiencies in July/August 1994 and undertook an overall irrigation efficiency of 0.50 for without-project, and 0.61 for with-project.

With the efficiencies for without-project, an overall deficit is estimated as below. In case of Preparation Report, 45 to 60% water deficit shows up, and in case of World Bank funded project, 19 to 48%. Taking into consideration of present agricultural situation endorsed by relatively high yield and high cropping intensity in the Nile Delta, such kind of severe water shortage may not be accepted. Therefore, these low efficiencies applied may lead to an idea that the effect in terms of water saving by IIP would appear very attractively, which is more than the actually expected.

Project	Available, MCM	Requirement, MCM	Deficit,%
El Wasat			
Annual	526	965/651	45/19
Peak Month	79	157/114	50/31
Manaifa			
Annual	242	542/375	55/35
Peak Month	35	89/67	60/48

Note ; The former figures for Preparation Report (Ep=0.44), the latter for Appraisal Report by the WB (Ep=0.50).

(2) Water distribution system

The continuous flow system is applied after the completion of the IIP. The intake discharge is still controlled by traditional manual gates at the intake point of the canal.

However, the Avis gate constructed 50 m downstream of the intake gate is not used to control the discharge. The following restrictions on water users between improved Meska and the traditional Meska are carried out. The users of the improved Meska under IIP avail irrigation water for 24 hours by using one-point lifting pump. However, the users of the non-improved Meska use the rotational irrigation system by the newly attached intake gate at the head of Meska. Water management thus becomes complicated for the MPWWR because of the presence of the two systems. Before the IIP, only an intake gate at the beginning of the Kahwagi canal was controlled by MPWWR for an 'on-off' operation for water distribution to the whole command area. However, after partial implementation of the IIP with Meska improvement, all head gates of the Meska that were not included in the IIP have to be controlled by the MPWWR. (Refer to Figure 2.4.2)

(3) Water level records

The rotational irrigation system with 5-days on-off was executed before the IIP. WLs at DS of the intake gate shows irregular rotational water supplies with 4-days 'on' and 7 days 'off' and/or 2 days 'on' and 3 days 'off', etc. These operations were executed for the period of the peak water demand for rice and cotton planting period as major summer crops in the areas. After this peak water demand period, the regular rotational system with 5-days 'on' and 5-days 'off' were executed. WLs of the tail end of the canal were synchronously fluctuating with WLs at DS of the intake gate. While during the 'off' period, WLs rapidly dropped to 0.0 m at the tail end. These fluctuation phenomena of WLs show that beneficiaries near the tail end of the canal were perfectly under the rotational irrigation system with 5-days 'on' and 5-days 'off'. A night storage in the delivery canal is not recognized. (Refer to Figure 2.4.3)

The design WL of the Kahwagi canal on IIP was WL 4.30. However, WLs at DS of the intake gate have not reached the design water level until now. Therefor, the Avis gate to maintain the design water level of 4.3 m at DS, is not functional, because the WL have not exceeded the design water level. The design water level on the Avis gate is not adjustable when the required water is less than the design water level. At the tail end, the water level with IIP is stable. There is no report or observation of spillage from the tail. (Refer to Figure 2.4.3)

(4) Review from point of view on discharge

Since there are no available data on discharge in the Kahwagi canal, review on water saving effects by IIP on intake discharge for the Kahwagi command area is not possible. For the future IIP proposed area, the discharge measurements at the beginning and middle point

and WL at the end point should be observed and recorded before IIP. These data will be useful as basic data for future evaluation of IIP.

(5) Review of night storage

The night storage availability was reviewed based on the data of cross section and longitudinal profile on the design water level. The night storage volume is calculated at about 36,500 cu. M (equivalent to 16.7 % of the total volume of about 218,200 cu. M) at the maximum water level. Since water levels and hourly water level records of each section are not available, the actual night storage effect can not be measured. (Refer to Table 2.4.2 and Figure 2.4.4)

(6) Water shortage situation

At present, water shortage problem does not occur, hence, a stable water distribution is carried out in the Kahwagi IIP area. WLs of about 4.0 to 4.1 m at the maximum and 3.8 m at the normal period are experimentally controlled. These WLs are not justified based on the unit water requirement and the actual cropped acreage. Since there are no complaints from the farmers and no water spillage at the tail end, it is said that the original design water level of 4.3 m is higher than the optimum water level.

(7) Problems on Irrigation and Drainage Facilities

The precast concrete block and /or other forms are not in good condition due to poor production management and difficulty to collect concrete materials. The length of the precast concrete block is only 20 cm due to the plain concrete and precondition of labor work, so there occurs many construction joints. Using bricks for canal construction should be also considered.

The pipeline Meska has advantages to compare with the open Meska in terms of water loss and land acquisition. On the other hand the pipeline Meska costs more than the other type. Selection of the pipeline Meska should be considered in case of the topography conditions or land acquisition unsuitable for open Meska.

The Meska Improvement consists of an intake, pump with an apparatus and a pump house, new Meska canal and a small turnout box to the Marwa. These are small structures and needs innumerable amount to implement over the Study Area. The site work for these structures do not have suitable workmanship caused by the scattered site work. Accordingly, to improve the present workmanship, these small structures have to make at a manufacture. For these objectives, the preparation for the design standard for easy work and better

workmanship under the IIP specifications at the manufactures will be required.

An existing check gate installed in the delivery canal has not been reached to their objectives due to drop the hydraulic canal flow function caused by reducing the available canal flow area and the water head loss. Accordingly for those improvement matter, the establishment of check work will require to conduct the design standard and specifications for procurement of the steel gate work.

There exist many traditional Meska along the improved Meska as emergency water source. The farmers still follow the traditional way of lifting water from the traditional Meska by private pump. However, there are many legal and illegal pumps directly lifting irrigation water from the delivery canal. This is one of the reason why farmers do not join the WUA.

About 70 % of improved Meska are partially operated. The major reasons why the systems are partially operational are: 1) high cost of pump operation, 2) small pump capacity, 3) water is available exists near the field, 4) trouble exist among WUA members, 5) non completion of improved Meska works and 6) illegal direct irrigation.

Existing WUAs have been organized within one Meska unit only. However, there are no communication among WUAs at the upstream and downstream. Consequently, water distribution problems will likely occur among WUAs on the delivery canal in the future.

There are no existing facilities to remove floating and submerged obstructs, such as, weeds, chemical products, etc. in the canal. Such obstructs disturb the perfectly close and/or control the gate opening in order to control the downstream water level. Since there are no open transition structures placed between the canal and the structure at the upstream and downstream, the hydraulic loss head becomes bigger.

On the pipeline of Meska, the cap of an alfalfa valve is usually damaged or lost, because the farmers do not understand the proper operation method and the purpose of the valve installed for supplying water to the field. There is no maintenance workshop for one-point lifting pump equipment and a particular person or engineer to take charge. Some broken equipment of the pump is left in the pump house unattended. Since the project has been provided as a grant-in aid project, the broken pump equipment is left unattended. This is because the farmers do not feel the need nor the sense of ownership for the project.

The improved Meska are not fully operational throughout the year but only seasonally operated. The poor utilization of the improved Meska under IIP will provide

undesirable and/or adverse influences to other farmers not only this area but also in other remote areas. These Meska facilities should be rehabilitated and improved to meet the farmers desires as much as possible. Since the farmers' will have to pay the project cost, the proposed facilities to be provided in the future should consider easy operation and maintenance and cheaper cost. Especially, maintenance works by farmers' themselves should be taken into consideration.

Table 2.4.1 Dimension of "before IIP" and "after IIP"

Items	Dimension	Balaqtar	Bahr El Saidi	El Kahwagi	Remarks
General Description					
(1)Projected IIP Area in 1990	F	12,000	42,000	13,000	Document *1(as of 1990)
(2)Planned IIP Area in 1998	F	3,422	14,237	2,720	Document *2(as of 1998)
(3) = (2)/(3)	%	29	34	21	
before IIP					
(4)Maintenance condition of Branch canal		good	moderate	moderate	Document *1(as of 1990)
(5) -do- of Meska		good	poor	poor	Document *1(as of 1990)
(6) -do- of Drain		moderate	poor	poor	Document *1(as of 1990)
(7)Night irrigation ratio(winter)(summer)	%	(57)(58)	(39)(67)	(45)(70)	Document *1(as of 1990)
(8)Contribution in grouping actibities		high	?	?	Document *1(as of 1990)
(9)Advance information on Meska O/M	%	21	15-30	15-30	Document *1(as of 1990)
(10) -do- on change of date/ discharge regarding water distribution	%	17	15-30	15-30	Document *1(as of 1990)
(11)Previous knowledge of IIP	%	7	2	5	Document *1(as of 1990)
(12)Willingness to participate in IIP	%	majority	70	79	Document *1(as of 1990)
after IIP					
(13)Area completed IIP by 1998	F	3,422	10,442	1,953	Document *2(as of 1998)
(14) =(13)/(2)	%	100	73	72	
(15)Completed Mesqa number		42	224	45	Document *2(as of 1998)
(16)Operational Mesqa number		42	144	40	Document *2(as of 1998)
(17) =(16)/(15)	%	100	64	89	
(18)Number of WUAs reached to phase V		42	144	40	Document *2(as of 1998)
(19)Number of registered WUA		40	44	23	Document *2(as of 1998)
(20) =(19)/(18)	%	95	31	58	
(21)Satisfaction on water availability	%			33	Document *3(as of 1998)
(22) -do- on reliable water supply	%			from 78 increased to 85	Document *3(as of 1998)
(23) -do- on water supply adequacy	%			from 48 increased to 70	Document *3(as of 1998)
(24) -do- on time reduction for irrigation	%			56	Document *3(as of 1998)
(25)Persons doing night irrigation	%			87	Document *3(as of 1998)
(26)Night irrigation due to water shortage	%			from 80 decreased to 30	Document *3(as of 1998)
(27)Owing of private pump	%			from 77 increased to 95	Document *3(as of 1998)
(28)Percentage relying on single-point pump installed by IIP	%			5	Document *3(as of 1998)
(29)Cost per meska	LE	87,720	75,145	62,296	Document *4(as of 1993)
(30) -do- feddan	LE	870	1,038	863	Document *4(as of 1993)
(31) -do- meter	LE	98	96	75	Document *4(as of 1993)

Note:
Document *1: Socio Economic Study of Egypt's Irrigation Management Improvement Challenge, by USAID Consultants(1990)
Document *2: JICA Interim Report on the Central Nile Delta(1998)
Document *3: Adaption of Egyptian Water Users in IIP Improved Area, by Abou El Fatoh,N.Z. and Ali,A.S (Conference on Coping with Water Scarcity, 1998)
Document *4: Evaluation of the IIP Component of the IMS Project,by USAID consultant(1993)

Table 2.4.2 Calculation of Night Storage Volume at Design Water level of Kahwagi Canal under IIP

Items	unit	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Total
KM (US)		0.05	4.50	10.00	11.10	12.00	13.60	
KM (DS)		4.50	10.00	11.10	12.00	13.60	16.20	
Distance	m	4,450	5,500	1,100	900	1,600	2,600	16,150
Bottom EL	m	2.00	1.80	1.80	1.80	1.80	1.70	
Bottom Width	m	8.00	6.00	6.00	4.00	3.50	2.00	
Max WL	m	4.34	3.91	3.45	3.45	3.45	3.45	
Min WL US	m	4.25	3.84	3.38	3.26	3.20	3.15	
Min WL DS	m	3.95	3.47	3.35	3.20	3.15	3.10	
Water Surface Width								
- US at Max WL	m	12.68	10.22	9.30	7.30	6.80	5.50	
- DS at Max WL	m	12.68	10.22	9.30	7.30	6.80	5.50	
- US at Min WL	m	12.50	10.08	9.16	6.92	6.30	4.90	
- DS at Min WL	m	11.90	9.34	9.10	6.80	6.20	4.80	
Water Depth between Max and Min								
- US	m	0.09	0.07	0.07	0.19	0.25	0.30	
- DS	m	0.39	0.44	0.10	0.25	0.30	0.35	
Storage Area at								
- US	m2	1.133	0.711	0.646	1.351	1.638	1.56	
- DS	m2	4.793	4.303	0.92	1.763	1.95	1.803	
Total Storage Volume	m3	13,185	13,789	861	1,401	2,870	4,372	36,478
Water Volume at Min WL (US)	m2	23.063	16.402	11.976	7.972	6.86	5.003	
Water Volume at Min WL (DS)	m2	19.403	12.809	11.703	7.56	6.548	4.76	
Total Storage Volume at Min WL	m3	94,487	80,330	13,023	6,989	10,726	12,692	218,247
Ratio of Night Storage	%	14.0	17.2	6.6	20.0	26.8	34.4	16.7

Source: Design Drawings of Kahwagy Canal under IIP, MPWWR

Figure 2.4.1 Location Map of Proceding Projects
around the Study Area

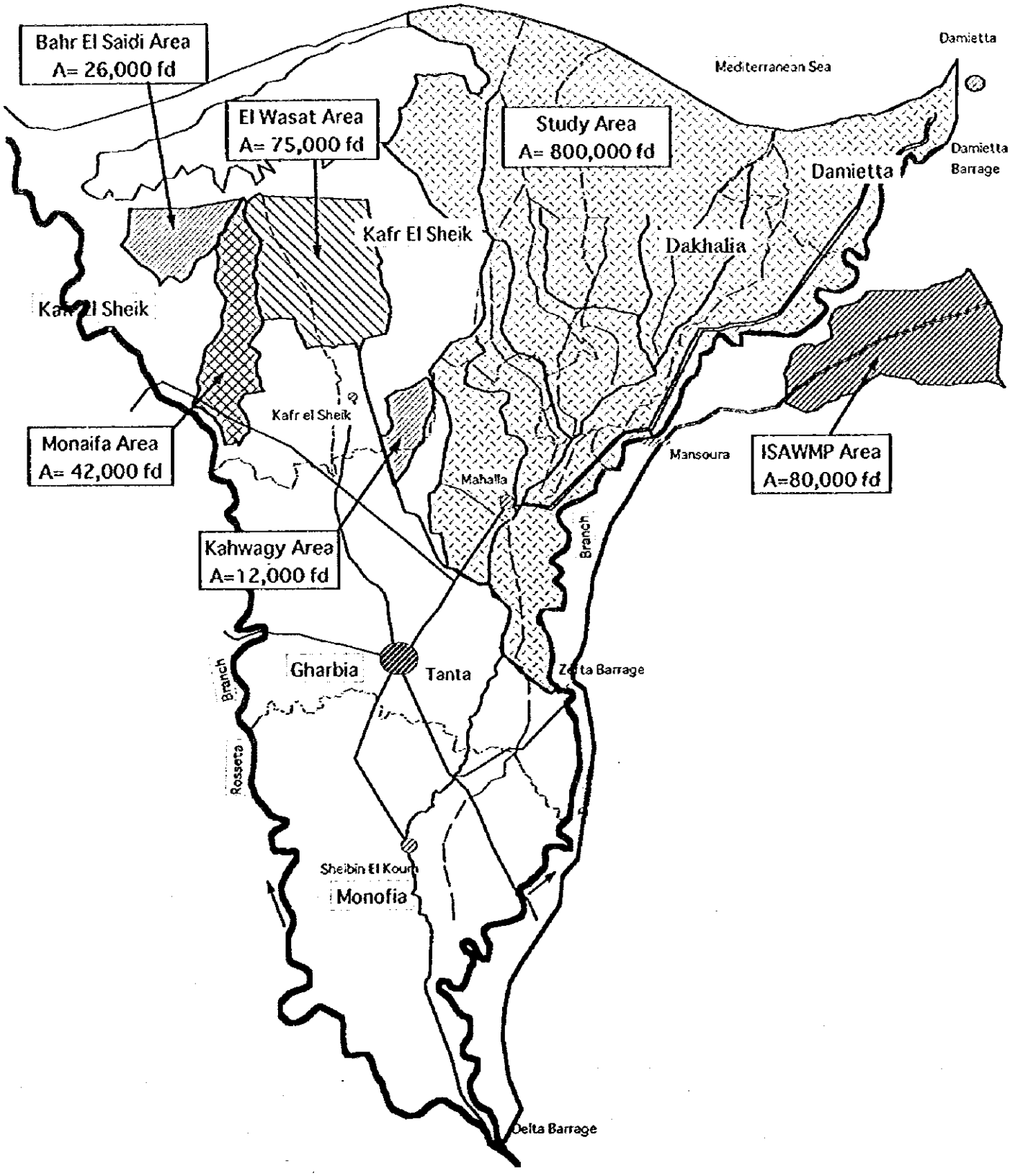


Figure 2.4.2

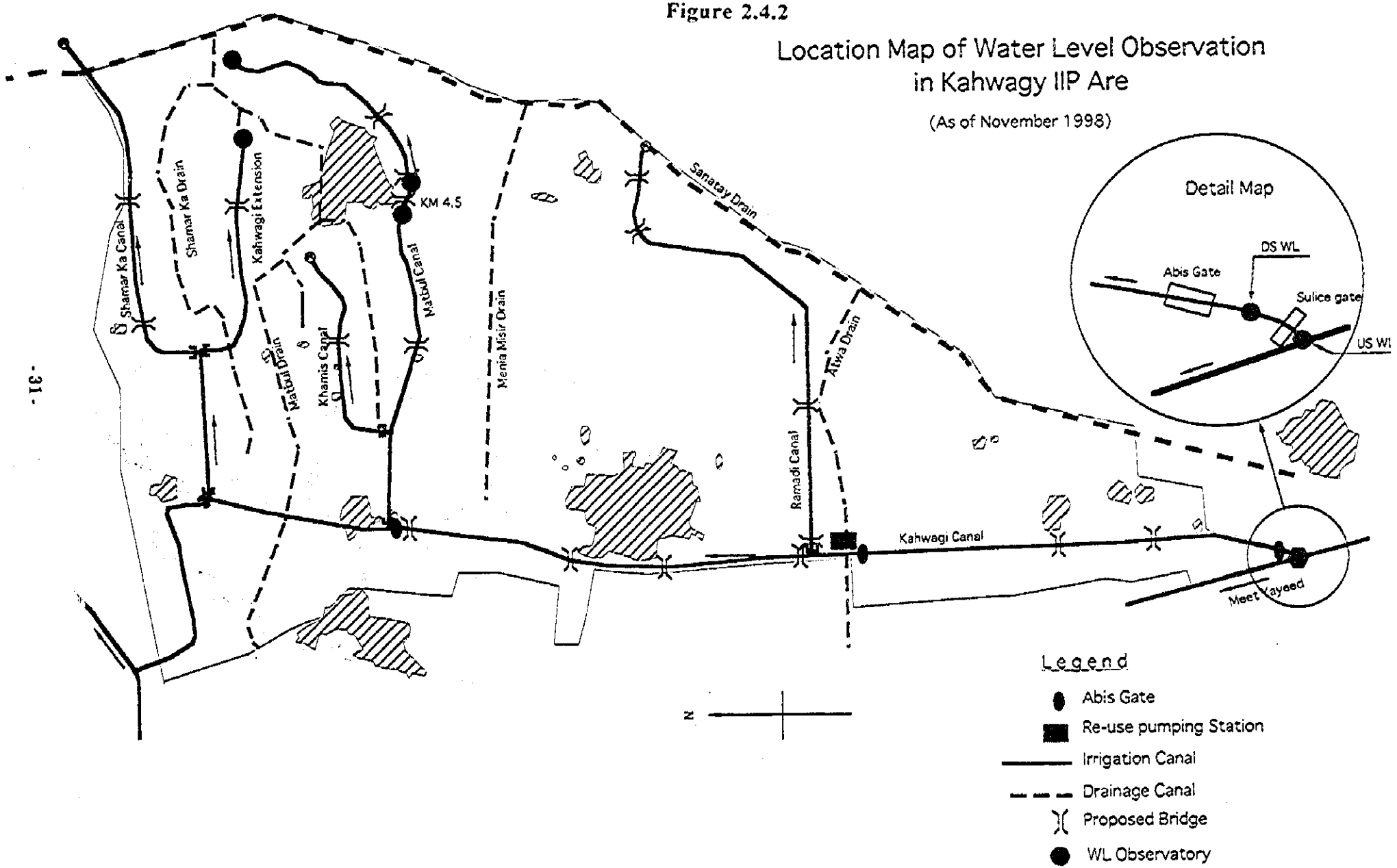
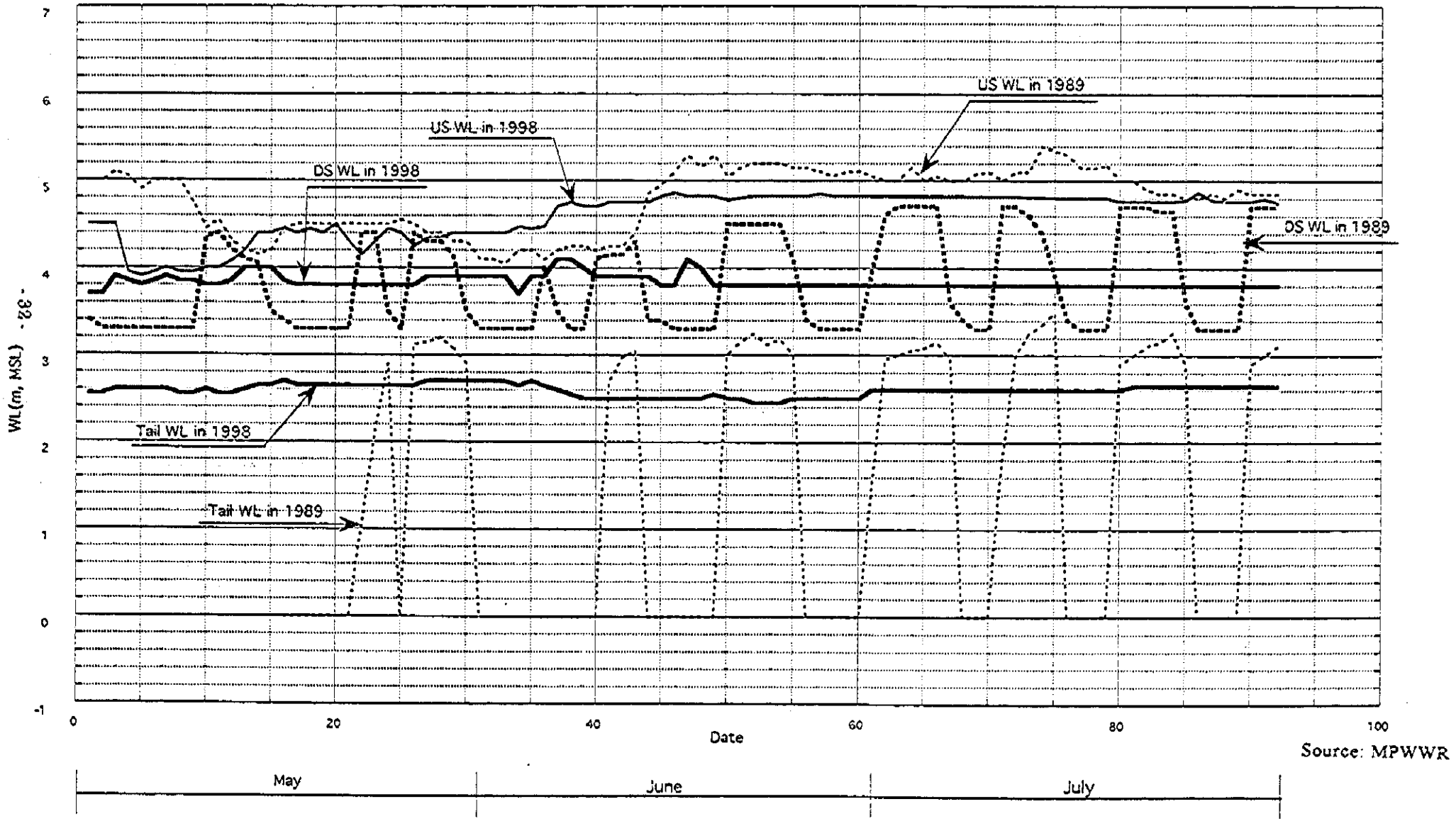
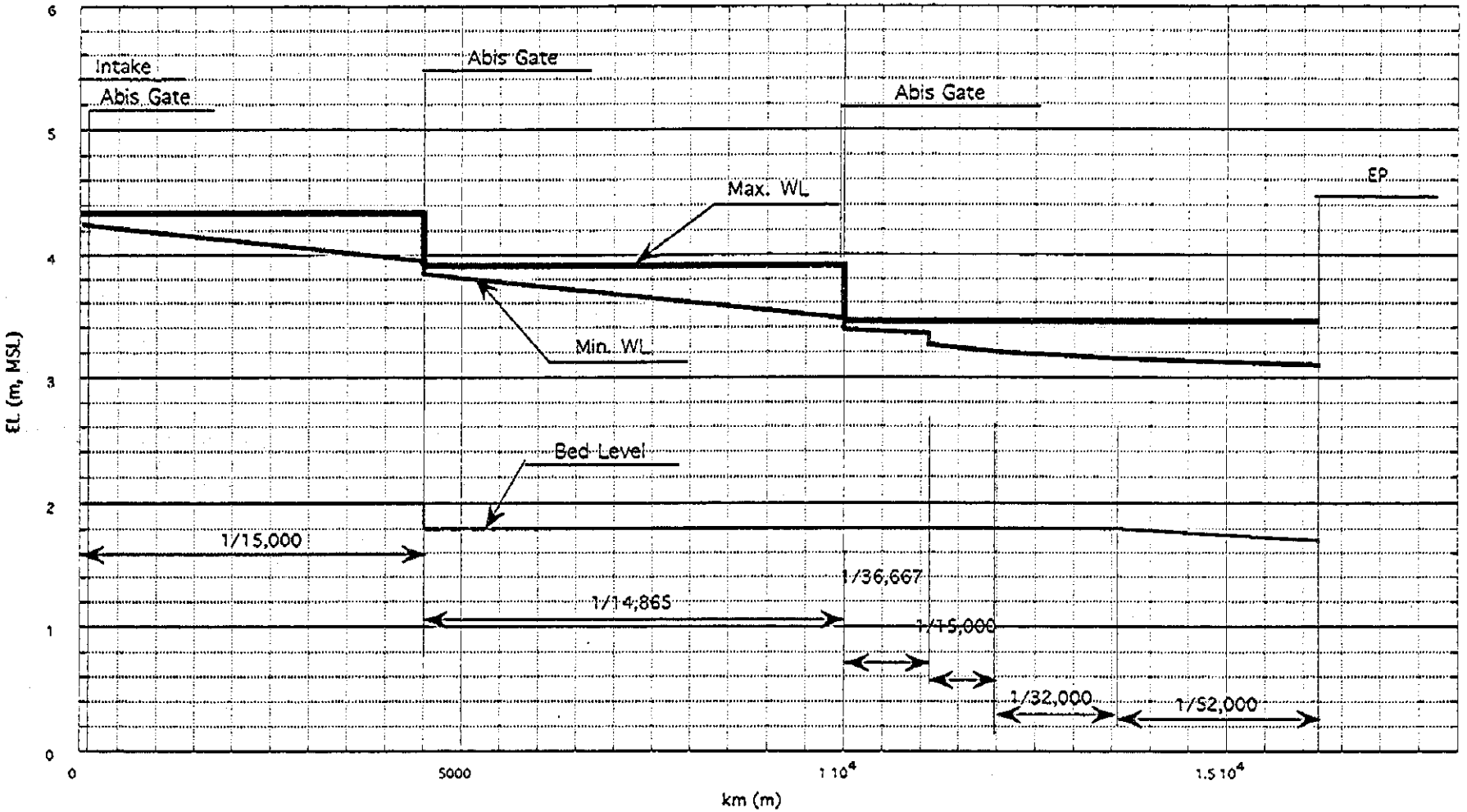

Location Map of Water Level Observation
in Kahwagy IIP Are
(As of November 1998)
Detail Map
DS WL
Abis Gate
Sulice gate
US WL
Shamar Ka Canal
Shamar Ka Drain
Kahwagi Extension
Matbul Drain
Khamis Canal
Matbul Canal
KM 4.5
Menia Misir Drain
Sanatay Drain
Atwa Drain
Ramadi Canal
Kahwagi Canal
Meet Kayeed
N
Legend
Abis Gate
Re-use pumping Station
Irrigation Canal
Drainage Canal
Proposed Bridge
WL Observatory

Figure 2.4.3 Comparison of WL at Intake and Tail of Kahwagy Canal in 1989 and 1998



Source: MPWWR

Figure 2.4.4 Longitudinal Profile of Qahwagy Canal in IIP



CHAPTER 3 THE STUDY AREA

CHAPTER 3 THE STUDY AREA

3.1 Location and Natural Conditions

3.1.1 Location and Acreage

The Study Area with coordinates of 31°15'N and 31°15'E at the center is located at the north-east edge of the Central delta area. The Area is bounded by the Mediterranean Sea on the north, by the Garbia drain on the west, by the Meet Yazied canal on the south, and the Damietta Branch on the east.

The Study Area of about 799,500 feddan (about 335,800 ha) is located at the north-east region of the central delta area. The Area covers part of four (4) Governorate areas, such as, about 150,200 feddan (about 63,100 ha) in Gharbia, 252,400 feddan (about 106,000 ha) in Kafr El Sheikh, 310,300 feddan (about 130,300 ha) in Dakahlia and 86,600 feddan (about 36,400 ha) in Damietta. Most of the Area is under the command area of Bahr Shebin principal canal that intakes water from the Damietta Branch at the upstream of the Zifta Barrage.

The Area consists of two (2) types of farm land, the old land and new reclaimed land. The old land occupies about 503,100 feddan (about 211,300 ha), equivalent to 63 % of the total Area. The reclaimed area of about 296,400 feddan (about 124,500 ha), equivalent to 37 %, is located at the northern part of the Study Area.

3.1.2 Geographical Conditions

The land of the Study Area inclines to the north from the south with a gentle slope of 1/7,000 to 1/8,000. The elevation of the Area ranges between nine (9) m MSL at the intake point of the Bahr Shebin Canal and zero (0) m MSL at the northern edge of the old land. Although the new reclaimed area is mostly flat plain, the coastal area is characterized with low hills. Most of the area has already been reclaimed, settled and cultivated by the farmers.

3.1.3 Climate Conditions

The Delta area, where the Study Area lies, is predominantly characterized by Mediterranean climate (especially in the coastal belt). The cool season is between October and April. Summer begins at around May, accompanied by high humidity. The mean monthly temperature ranges between 12 ℃and 27 ℃. The relative humidity is surprisingly high for an area falling in the arid zone, ranging from 52 % to as high as 72 %. The average annual rainfall on the Mediterranean coast varies from 150 mm to 200 mm but this falls only in narrow strip along

the the coastal area.

Mean monthly wind speed of the Area ranges between 7.5 and 12.5 km/hr with an annual mean of 10 km/hr. The wind direction blows mostly from north, north-west and north-east towards the inland of the Delta. It is also well known that strong and hot wind, called Khamsin, blows during the spring season from east-south direction.

Sunshine-hour is about 11 to 12 hr/day during summer and 6 to 7 hr/day even during winter. The annual average sunshine-hour in the Area are from 9.0 to 9.5 hr/day, thus assuring long sunshine hours preferable to crop growth. Mean daily evaporation, measured in pitch tube, reaches to as much as 5 to 6 mm/day in summer due to the long sunshine hours and hot weather. This becomes about 2 to 3 mm/day during winter season. Annual evaporation is about 1,420 to 1,480 mm.

3.1.4 Soil

In alluvial fan areas, the soil pattern is extremely complex. Most of the soils in the Delta are of recent alluvial origin that, when adequately drained and managed, are highly productive. In general, the proportion of sand decreases while that of clay increases northwards in the Study Area. The Study Area shows different soil types, where the alluvium varies from light to heavy clay, with the heavier clay occurring towards the north. Exception to the dominance of clay can be found along the Damietta branch and scattered throughout the central delta where silty clay and sandy clay loams exist.

The strip of new reclamation area, north of the Delta, is an extensive belt of sand dunes composed of fine sands most probably derived from the river. Alluvial soils are deep and have clay content ranging from 30 to 80 % and low to medium electric conductivity. The drainage of these soils are possible because of this permeability, which varies from less than 10 cm/day in heavy soils to 50 cm/day or more in lighter soils.

3.2 Socio-Economic Conditions

3.2.1 Population and Household

The population in the Study Area in 1996 is estimated at about 3.1 million. By region, 1.2 million people live in Gharbia, 1.0 million in Dakahlia, 0.5 million in Kafr El Sheikh and 0.4 million in Damietta. The distribution between the urban area and the rural area is 0.9 million (28%) and 2.2 million (72%), respectively. The population density in the study area is about 920 persons per sq. km. The labor force population (from 15 years old to 60 years old) in 1996 is about 61% of the total population. The number of households in the Study Area in 1996 is 662,924 and the average family size is calculated as 4.4 persons per household in the urban area and 4.8 persons in the rural area. (Refer to Appendix B.3, Tables B.3.1 and B.3.2)

3.2.2 Land Tenure Status and Farm Size

About 80% of the farm households are managing their own lands in Dakahlia, Kafr El Sheikh and Damietta To the contrary, in Gharbia farm households managing their own lands occupy 60%, more farm households renting lands compared to the other governorate. Share of farm households with more than 2.0 feddan (0.84 ha) in Gharbia, Dakahlia, Kafr Elsheikh, and Damietta, is 34%, 44%, 64 % and 59 %, respectively. (Refer to Appendix B.3, Table B.3.3 and B.3.4)

3.2.3 Living Conditions

(1) Expenditure

According to the Expenditure and Consumption survey 1995-1996, the average annual expenditure of households in the rural area are estimated as 6,900LE in Gharbia, 6,400LE in Dakahlia, 6,700 LE in Kafr El Sheikh and 6,400 LE in Damietta. The average expenditure on the four (4) governorates is 6,600 LE. These amounts are 84 % to 91 % of the urban areas. The expenditure per capita in the rural area is highest in Damietta with 1,369LE and lowest in Kafr El Sheikh with 1,159 LE. This amount is over the national average of 1,038 LE per capita. (Refer to Appendix B.3, Table B.3.5)

(2) Unemployment

Based on data in the rural area by governorate, the unemployment rate of the Study Area

are estimated at 10.6 % in Gharbia, 15.7 % in Dakahlia, 11.5 % in Kafr El Sheikh and 9.0 % in Damietta in 1995. The average ratio of the four (4) governorates is so high as 11.7 %.

(3) Education

The rate of literacy (10 years old and above) in the Study Area in 1996 shows higher rate in the urban area than the rural area. On the average, about 60 % of the people in the rural area can read and write. On the other hand, the basic and secondary enrollment in 1994/95 is around 90% in the Study Area. The educational condition has been improving in the Study Area.

3.2.4 Social Infrastructures

(1) Water, sewerage, electricity and gas

In 1995 the ratio of the households in rural area with access to piped water is 87.9 % in Gharbia, 77.1 % in Dakahlia, 95.8 % in Kafr El Sheikh and 94.9 % in Damietta. Municipal water supply is equipped till the new land area. The sewerage system has not been progressed in rural area. The houses with electricity have been over 90 % of total households since 1986 and the propane gas is the main energy for heating in local cities such as Biyala and Hamoul. In 1998, The city gas system has been on progress in Tanta city and it will start working from 1999. In small villages, the energy for heating is propane gas, kerosene, and second products of crops such as wheat straw. (Refer to Appendix B.3, Table B.3.6)

(2) Road condition

The paved road density in 1997 is the highest in Dakahlia with 0.43 km/sq.km and lowest in Gharibia with 0.23 km/sq.km. On the north-south direction, there are some main connecting roads, one of which runs from Damietta city in north to Cairo in south via Mahalla El Kubra city and Tanta city and another one runs between Tanta city and Kafr El Sheikh city. On the east-west direction, there is a main connecting road from Mahalla El Kubra in east to Kafr El sheikh in west. The transport access between east to west is less convenient than north-south direction. There is an on-going international road project along the coastal area, namely the International Mediterranean Sea Road. This road starts from Rafah city in the east boundary of Egypt and ends at El Salloum city in the west boundary across the Central Nile Delta. The parts of the road from Rafah city to El Ariesh city in Sinai and from Alexandria to El Saloum city are being used now. The remaining part of the road is expected to finish within a period of three (3) years.

3.2.5 Strata of Rural Society

Regarding the strata of rural society, some conventional customs should be taken into consideration as vulnerable to farmers' activities. They are

Umda: In the long history of Egypt, "Umda"s, or village chiefs as well as leaders of village councils, have had roles as catalysts to coordinate with the relationship between the government and farmers. In this context, considerations whether Umdas are to be assigned by the government or to be elected by farmers have been by far one of the most prerequisite matters in Egyptian policy. At present, Umdas have been assigned by the government from 1992 onwards although there are some exceptional cases. Incidentally, under Public Law 52 each village council must have at least 17 members.

Aila: One of the most vulnerable components in ruling rural societies in Egypt is an "Aila" which is usually comprised of 100-200 families which have been derived from same origin in its historical background. Even now, a village as an administrative unit, usually composed by 5,000-10,000 families, is comprised of unified Aila bases in which "Shaykh al balad" is a most influential person in controlling each small cell. Therefore, it is conceptually stipulated that an Umda as a leader of unified Aila societies (and at the same time assigned by the government) rules a village with mutual supporting from several Shaykh al balads as representatives from each Aila.

Mosharka: Separate from family-oriented society, there is an another component named "Mosharka"(or "Motarafa" in some cases) which means a small and mutual association to help and cooperate with each other by virtue of supplemental allocation of such as lands, money, labor, machines, materials, techniques and information etc. in accordance with resources each member has. Regarding irrigation activities concerned, this Mosharka has been effectively functioned in rural areas, and moreover, under the recent background of privatization policy and farmers' incentive for the more profitable agriculture this kind of people-oriented system might be vitalized again.

Subsequently, to study the strata of Egyptian rural society, a past and present situation of a tenant farming system should also be taken into consideration. In Egypt, most of the land reclamation and irrigation/drainage development had been implemented from 19 century onwards principally by large-scale landlords. In this context, the landlords have given rather advantageous

circumstances to the tenant farmers in protecting their rights and subsistence through the decision of tenant farming systems. However, after the revision of Agrarian Reform Act in 1975, landlords, especially rather small-scale ones who keep more or less 20 feddan (8.4 ha) of farmland only, have lost their powers to spare such advantages to the tenant farmers, and accordingly, tenant farming systems have been directed in inclining to protect such small-scale landlords from then on.

Moreover, in recent years, rapid changes of social and economic background have been taken place in the manner of privatization, land and water scarcity, cost hike for agricultural inputs, labor shortages, land purchasing by farmers who worked seasonally in outside countries etc. In this connection, regulations as per tenant farming systems have been changed drastically in 1992, and have been promulgated in the late 1997 after the 5 years' buffer periods.

Under the newly effectuated systems, which are stipulated in Article 33 of the revised Agrarian Reform Act, a bald re-examination of land tax(around L.E.22/F, in average), increase of rental rates(by 22 times of land tax, in maximum), procedures of rental contract and its dismissal, diversification of ways of contracts etc. are implicated. As a whole, it is assumed that the new systems are rather enthusiastic in overcoming conventional fixation of rental contracts so far seen, thus in mobilizing more dynamic vitalization of Egyptian agriculture. It is said that the reaction from tenant farmers against the new system has not been extreme so far.

3.3 Agriculture

3.3.1 Crop Production

(1) Land Use

The Study Area is divided into three areas, namely upstream, midstream and downstream areas according to irrigation boundary of water district and also to the kind of irrigation water source. Severe water shortage especially occurs in the downstream area because the irrigation water hardly reach the area. The downstream area has 56,000 feddan (24,000 ha) of land under reclamation. No water right is yet allocated for the area. Excluding the land under reclamation, there are about 695,200 feddan (291,900 ha) of the total cultivable area in the Study Area. The area consists of 167,400 feddan (70,300 ha), 223,900 feddan (94,000 ha) and 303,900 feddan (127,600 ha), respectively, in the upstream, midstream and downstream areas. (Refer to Appendix E Figure E.1.9)

The ratio of the cultivable land to the total area is about 94 % of the gross total area. About 38.2 % of the total cultivable area are classified into the first and second class land classification according to the various factors including the degree of soil salinity. The downstream area have large shares for the lower class land mainly due to the saline soils with high ground water table. More than 50 percent of land in the upstream and midstream areas have too fine soil texture to grow potato and many kinds of vegetables, although the soils are fertile with less salinity. On the other hand, there are relatively large area which have light textured soils suitable for growing various kinds of vegetables. At present, vegetable growing areas are very limited mainly due to lack of water and poor quality of water in the downstream area. The actual cultivated area are estimated at about 81 % of the total cultivable area. The gap between the actual cultivated and the cultivable areas include the land under reclamation, temporary fallow land in the land reclamation areas, and fallow land. The 96.7 % of the actual cultivated area are planted to annual crops, while the remaining 3.3 % of the area are cultivated with perennial crops like orchard. (Refer to Appendix D, Table D-1-3)

(2) Crop and Cropping Pattern

The cropping intensities in the upstream, midstream and downstream are estimated at 200 %, 185 % and 148 %, respectively, based on the district-wise data. The cropping intensity means the ratio of annual cropping area to the total cultivable area. The three areas in Study Area

have the same kinds of major crops in both the winter and summer season. The major crops in the winter season are wheat, long season berseem, short season berseem and broad bean. Crops planted in the summer season are cotton, maize, rice and other crops like sugar beet and flax. Sugar beet are grown mostly in the downstream as well as a part of midstream areas. Flax is a minor crop which is distributed almost throughout the Study Area. Recently, onion is grown as major kind of vegetable during the winter season, while potato and tomato are planted in rather large areas as major summer vegetables in the upstream and midstream areas . The fruit trees grown are orange, grape, banana and guava (Refer to Figure 3.3.1 and Appendix E Figure 3.3.2 to 3.3.4).

(3) Farm Inputs

The farm inputs per feddan area were estimated for fertilizers, chemicals, labor, animal power, machinery use and other inputs, based on the result of the Farm Economy Survey. The data shows that inputs of nitrogen for grain crops are as large as 60 kg/feddan (143 kg/ha) and 65 kg (155kg/ha), respectively, for wheat and rice. About 30 % of farm inputs are distributed to the agricultural cooperatives through farm credit under governmental control. (Refer to Appendix E Table E.2.16)

(4) Unit Yield and Crop Production

It is observed that there is a lower crop unit yield in the downstream area, as compared with those in the upstream and midstream areas. The statistical crop yield data on the basis of sampling survey are available only at the level of the Governorate and the whole country. Although there are unofficial data at district or village level, these are not accurate because the related data area collected directly from the limited number of farmers. The collected data at district level are revised with the concerned data at Governorate level to estimate the crop unit yield in the upstream, midstream and downstream areas. The crop unit yield in the upstream and downstream are almost at the same level as the national average. However, the unit crop yield in the downstream is lower than the national average for almost all crops, due to problems of water shortage and poor water quality. The total crop production in the Study Area are estimated at 487 thousand ton for wheat and 860 thousand ton for rice (paddy). (Refer to Table 2.4.1 and Appendix E Tables E.3.1)

3.3.2 Crop Rotation and Water Distribution

The cropping plan is prepared in each crop rotation blocks by the staff of agricultural

cooperatives. The crop rotation block has 50 feddan (20ha) on the average, and are bounded by irrigation and drainage channels or roads. The cropping plan is prepared every year before summer season according to the following procedure;

- The permitted area of rice is determined for each canal area by MPWWR, based on the availability of water, soils and others. The permitted area is informed to MALR in each Governorate.

- The cropping plan for the coming year is prepared with the permitted rice area, target area of cotton and other crops.

Applying the privatization policy applied in agriculture, it is not necessary for the farmers to follow the cropping plan prepared by MALR. Most of the farmers accept the crop rotation plan especially in case of crop rotation with cotton. However, it is found that there is a significant gap between the actual cropped area and the crop rotation planned area. The Governorate data on the excess of rice area in 1996/97 show that the actual area in Gharbia is about two times of the permitted area, while that in Dakahlia is 1.5 times of the permitted area. It is revealed that this leads to severe water shortage in the downstream areas. (Refer to Appendix E, Table E-1-10)

3.3.3 Agricultural Supporting Services

(1) Research

As a regional agricultural research institutes, the Sakha Agricultural Research Center (SARC) is located in Kafr El Sheikh. SARC belongs to the central ARC which comprises 21 units of multi-disciplinary agricultural research institutes. SARC has regional branches for Soil, Water and Environment Research Institute (SWERI), Field Crops Research Institutes (FCRI) and others. The FCRI involve studies on wheat, rice, maize and legumes. The Rice Research and Training Center (RRTC) is operated as a section for rice for FCRI. The RRTC is one of the largest rice research institute in Egypt and has played important role on breeding and research on rice cultivation. (Refer to Figure 2.4.4)

According to RRTC, it is prohibited to grow long duration rice varieties like Giza 171 in Egypt. This is part of the policy on reduction of high water consumption crops of sugarcane and rice in the Fourth Five-Year Plan for Economic and Social Development. The promising rice varieties of medium (about 140 days of growth period) and short duration rice (about 120 days of

the period) are bred by RRTC recently. As for horticulture, there is no research facility except for Kafr El Sheikh Branch for Protected Agriculture Research Institute. Therefore, there is a need to establish research institution on horticulture as there are many farmers who needs to learn production technology on vegetables.

(2) Agricultural Extension

MALR is going to establish an agricultural extension center to strengthen the agricultural extension at the Local Unit level. At the village level, there is an agricultural cooperative that has about 15 technical staffs who assist farmers in various aspects including preparation of crop rotation plan, arrangement of farm input supply and others. The expertise of the agricultural extension staff and agricultural cooperative staff has been limited to crop management and production techniques, with limited knowledge on irrigation and on-farm irrigation management techniques.

(3) Subsurface Drainage and Land Improvement

The Egyptian Public Authority for Drainage Projects (EPADP) has implemented subsurface drainage projects in the whole upstream area as well as in most part of the midstream area. The installation of subsurface drainage facilities will be expanded throughout almost all areas excluding the new reclamation area during the Forth Five-Year Plan for Economic and Social Development.

The Executive Authority for Land Improvement Projects (EALIP) under MALR has an organization in each Governorate, which is implementing land improvement works of gypsum application, subsoiling, and cleaning of irrigation and drainage watercourses at on-farm level. Also, EALIP conduct soil survey on soil salinity and ground water table. The land leveling by laser beam has been implemented in 14,000 feddan (5,900 ha) a year by EALIP throughout Egypt in 1996/97. The leveling works have increased rapidly since 1994/1995. In the Study Area, some private companies started the business of land leveling by laser beam. (Refer to Appendix D TableD.1.2)

(4) Agricultural Extension on Irrigation Improvement

The MPWWR has the following four training facilities within the vicinity of the Study Area;

- Branch Training Center of MPWWR, Kafr El Sheikh for Irrigation
- Branch Training Center of MPWWR, Tanta for Drainage
- IAS Training Center, Bahr El Saidi area
- IAS Training Center, Kahwagy area

The Branch Training Center of MPWWR, Kafr El Sheikh for Irrigation was established in 1978. It provides training services to professionals and technicians of MPWWR and MALR. The center has nine staff consisting of three engineers, two agronomists, an agro-economist, a sociologist, a laboratory staff and a coordinator. The center started training on water management at on-farm level in the IIP implementation areas two years ago. The IAS Training Center in the Bahr El Saidi area started its activity on irrigation advisory services with five field agents since 1989. The field agents have background in agronomy. The Training Center was built in 1994. The IAS Training Center, Kahwagy has similar activity with only one field agent.

The world Bank/ KfW assisted IIP project has started to operate On-Farm Irrigation Pilot Program, involving the Agricultural Extension Department and Soil, Water and Environment Research Institute , MALR for the training activity to the farmers on the IIP area.

3.3.4 Marketing and Agro-processing

1) Marketing

With the prevailing privatization policy and the introduction of the free market since 1991, the farmers are given the opportunity to make their own decisions as to what products to grow and where to sell their agricultural products. The market for major products are as follows;

a) Grain (rice)

Rice, wheat, and maize is supplied to small-scale and large-scale milling factories in the villages and cities such as Kafr El Sheikh. About 30 to 50% of these grains are consumed by farmers. The price of grains is based on free market. However the amount of export and import as well as stock by middlemen affects prices of produce. Large-scale rice mills are still under the administration of the Ministry of Trade and Supply (MTS), particularly the quality control by the governmental inspectors.

b) Cotton

The price of cotton is determined by the Ministry of Economy (ME) with reference to the world market price. On the process of physical distribution, raw cotton is collected to a stock yard of the village bank by farmers. Then the product is graded by the inspectors of ME and brought to the cotton ginning factories, some of which have been privatized. A group of companies (five (5) companies) under the administration of MTS is in charge of purchasing cotton from farmers and marketing of cotton fiber and seeds after ginning at the factory.

c) Sugar beet

Sugar beet is grown under contract between farmers and sugar company. The product is delivered from fields to the sugar factory by the company's trucks. The planting area and the price of contract are supervised by MTS. The minimum planting area of the contract is 0.5 feddan without maximum rate. Elaborate quality control for sugar beet is carried out by providing guidance to growers. Pest control is undertaken in the field by agricultural engineers who are staff of the company. Sample check of the product are done upon arrival at the factory.

d) Vegetables and fruits

The prices for vegetables and fruits are determined by auction at a wholesale market. In the Study Area, there are three (3) wholesale markets, namely Tanta, El Mahalla El Kubra, and Mansura. The routes of vegetables and fruits are of three (3) types as, follows: 1) Farmers bring directly their products to the small market in a village. 2) Middle men purchase products from farmers and bring them to wholesale markets in the local city or urban centers such as Cairo or to export traders. 3) Large-scale farmers bring directly their own products and also the products of small-scale farmers to the local or central market directly. Majority of the routes are 2), and 3).

e) Livestock

The livestock market is held once a week in the major city of each district. The auction is done by farmers and middlemen at the market. The livestock commonly sold are the buffaloes and cows with a share of more than 90 % of the market. The middlemen for livestock are small-scale sellers. Most of the livestock exchanged at the market are distributed for local consumption.

2) Agro-processing

There are large-scale agro-processing facilities such as rice mill, wheat flour mill, cotton

ginning factory, sugar factory, feed mill and cold storage for seeds and products of fruits and vegetables, some of which have already been privatized. However, the other processing facilities are still managed by the ME or MTS. There are also small-scale private factories for rice milling, wheat and maize milling, fodder processing, oil extracting and daily products. There are 29 large-scale rice mills in the Study Area with average rice milling capacity of 50 to 155 ton per day. Also the government is targeting the increase of cold storage facilities for potato seeds to expand potato production.

3.3.5 Agricultural Credit

The Principal Bank for Development and Agricultural Credit (PBDAC) is the core of agricultural credit in Egypt. Their activities are varied from deposit service, loan for agricultural modernization, banking and investment for Islamic traditional community such as Mosharaka, managing stock yard, etc. The major type of loans are agricultural loan (70 % of production cost by crops within 12 months), short term loan (within 12 months) and medium term loan (more than 12 months and up to five (5) years) for green-house production, livestock production activities, agricultural mechanization irrigation system development etc., and long term loan (more than five (5) years and up to 15 years) for large projects such as land reclamation project. The interest is from 11 to 13 % and the collateral is about 30 % of land price for each farmer or a project. PBDAC also assist farmers by providing flexible rates. In case a farmer fail to return the debt, the bank will consult the debtor for any rearrangement of redemption plan. Because of this, the PBDAC recovery of debt has been 97 %.

The sources of funds of PBDAC are from deposits, overdraft and the funds from international institutions such as World Bank, KfW etc. After introduction of the privatization policy, the bank has shifted from government-oriented management to market-oriented management. It is now facing the problems of self-supporting accounting system and manpower cut. Nevertheless, PBDAC keeps a strong demand from clients and the amount of each loan shows steady increase. As a strategy to expand financial activity, the Bank aims to mitigate financial condition to small scale farmers, graduated youth and women who have less ability to provide pledges. (refer to Appendix E.6, Table E.6.1)

3.3.6 Animal Husbandry

The majority of farmers raise cattle and water buffaloes not only for draft but also for meat

and milk purposes. On the average, one each of cattle, water buffalo, sheep and donkey are raised by a farmer. The raising of these animals provide significant share in the farm income than those in crop production. It also supply nutrition to the family. The main source of feed for them is berseem and corn which occupy about 40 % of total cropped area both in the winter and summer seasons. Besides these crops, the straw of wheat and rice are another important feeding source. (Refer to Appendix E Table E.4.1 and E.4.2)

3.3.7 Farm Mechanization

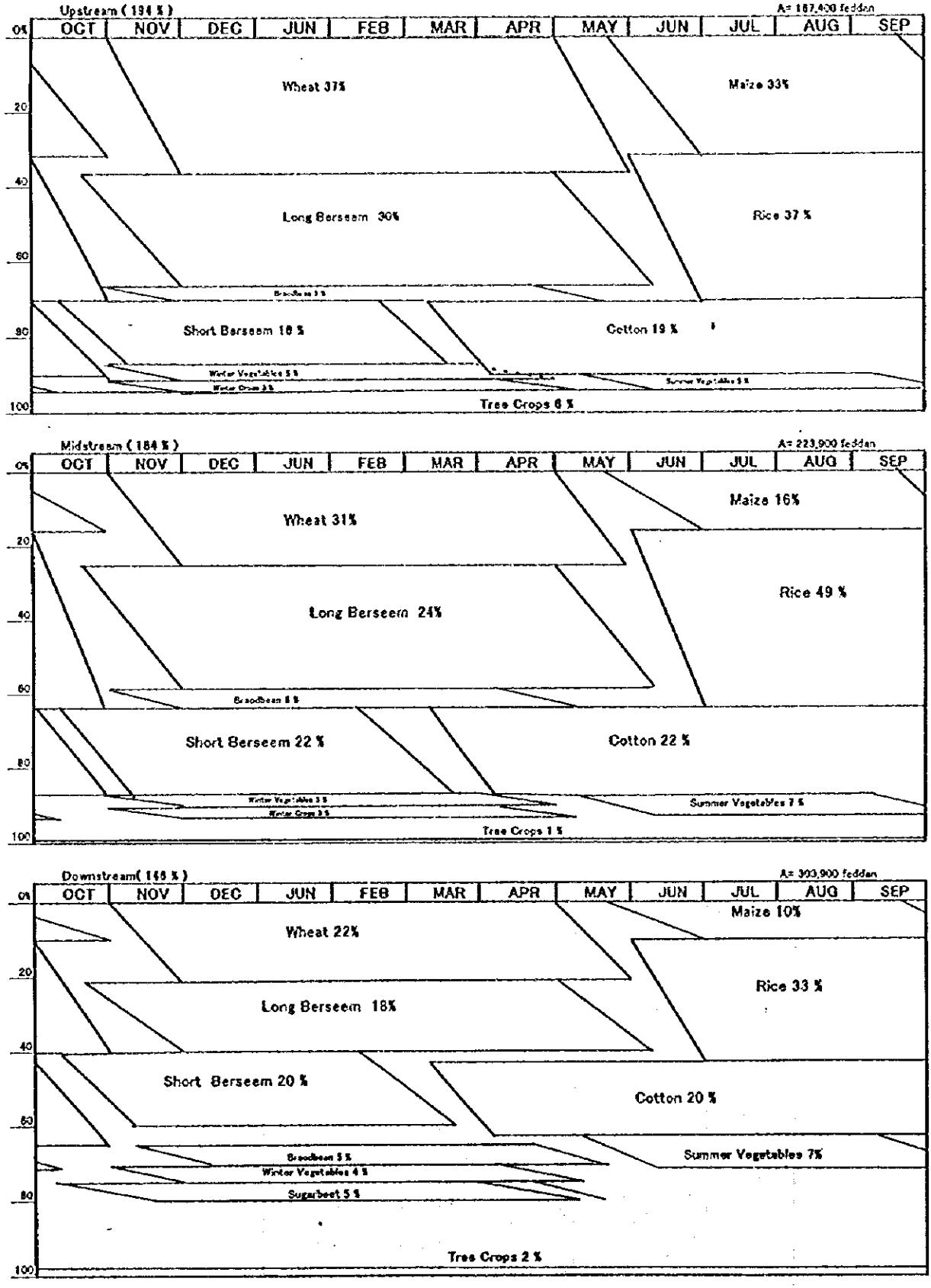
The land preparation works are almost operated by group of farmers or through custom services with large tractors with more than 70 HP. Usually, draft animals like cattle and donkey are utilized for supplementary works like puddling, harrowing and transportation. As described, previously, the precision land leveling by laser beam became popular among farmers , which is mainly operated by EALIP. The technology on the precision land leveling by laser beam which is employed in Egypt is not efficient due to trailing type of leveler under the prevalent small scale land holding.

Table 3.3.1 Present Crop Yield (M/P Area ,1994/95-1996/97)

Area	Wheat (ardab) (150kg)	Broad-bean (ardab) (155kg)	Sugar-beet (ton)	Flax (ton)	Vegetables (Onion) (ton)	Berseem (Long) (ton)	Berseem (Short) (ton)	Cotton (kantar) (157.5kg)	Maize (ardab) (140kg)	Rice (ton)	Vegetables (Tomato) (ton)	Orange (ton)
1. Upstream												
- Zifta	17.38	9.79	-	2.90	8.70	25.36	9.56	5.68	18.50	3.58	13.12	9.45
- Samanoud	18.27	10.30	-	2.63	13.32	23.41	7.18	6.18	19.98	3.42	10.03	9.05
- El Mahalla Kubra	17.20	10.26	26.06	2.63	12.13	26.47	7.18	6.28	19.84	3.36	9.70	8.30
Average	17.62	10.12	26.06	2.72	11.38	25.08	7.97	6.05	19.44	3.45	10.95	8.93
(ton/ha)	6.29	3.73	62.05	1.91	27.10	59.71	18.98	2.27	6.48	8.22	26.07	21.27
2. Midstream												
- Sherbin	16.63	9.17	21.26	1.06	7.06	21.83	8.26	5.53	17.34	3.15	10.14	8.04
- Talkha	17.36	8.46	20.84	1.11	8.99	23.18	7.02	5.33	17.64	3.08	9.20	8.39
- Biyala	16.75	10.62	17.70	0.87	7.32	18.38	12.24	6.02	20.14	3.07	10.54	11.00
Average	16.91	9.42	19.93	1.01	7.79	21.13	9.17	5.63	18.37	3.10	9.96	9.14
(ton/ha)	6.04	3.36	47.46	2.32	18.55	50.31	21.84	2.11	6.12	7.38	23.71	21.77
3. Downstream												
- Bilqas	16.35	8.80	20.27	1.05	6.48	22.23	7.19	5.39	19.87	3.61	7.33	7.49
- El Hamoul	16.00	8.99	16.54	0.70	5.78	22.95	10.13	4.89	15.00	3.17	12.33	10.11
- El Burullus	15.21	7.23	16.33	-	-	16.17	7.49	4.51	14.49	2.52	9.17	10.34
- Kafr Saad	14.13	7.86	19.22	0.98	6.25	19.94	7.02	5.80	16.14	3.16	7.77	5.39
- Damietta	11.81	7.26	10.00	0.99	8.00	22.77	-	-	19.17	2.85	6.13	4.65
Average	14.70	8.03	16.47	0.93	6.63	20.81	7.96	5.15	16.93	3.06	8.55	7.60
(ton/ha)	5.25	2.87	39.22	2.21	15.78	49.55	18.95	1.93	5.64	7.29	20.35	18.09

Note: MALR,DOS

Figure 3.3.1 Present Cropping Pattern(M/P Area)



Source: Study Team