MINISTRY OF WATER RESOURCES AND IRRIGATION
ARAB REPUBLIC OF EGYPT

THE PREPARATORY SURVEY FOR THE REHABILITATION AND IMPROVEMENT OF DIROUT GROUP OF REGULATORS IN THE ARAB REPUBLIC OF EGYPT

FAINAL REPORT

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JAPAN INTERNATIONAL COOPERATION AGENCY

SANYU CONSULTANTS INC.

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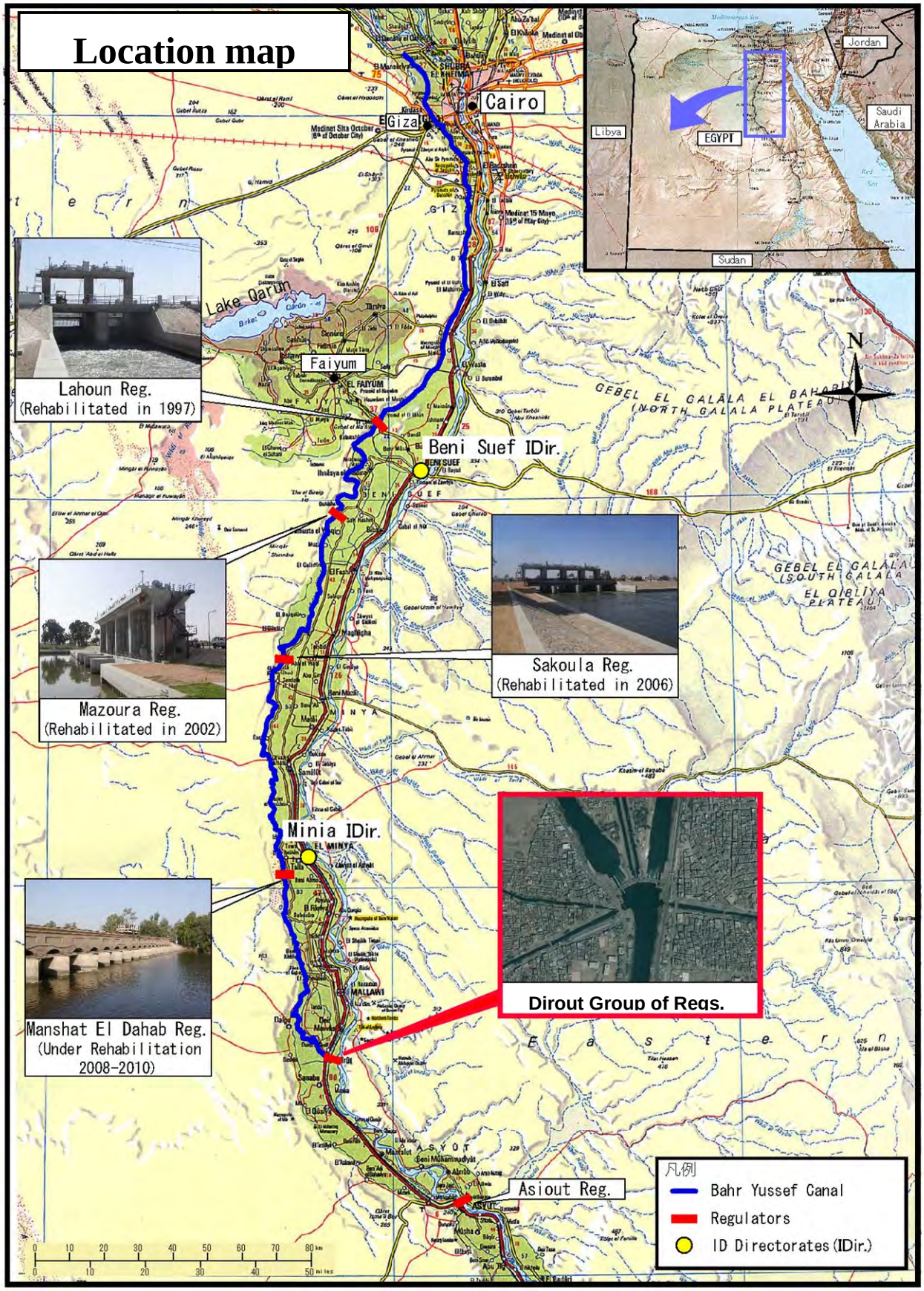
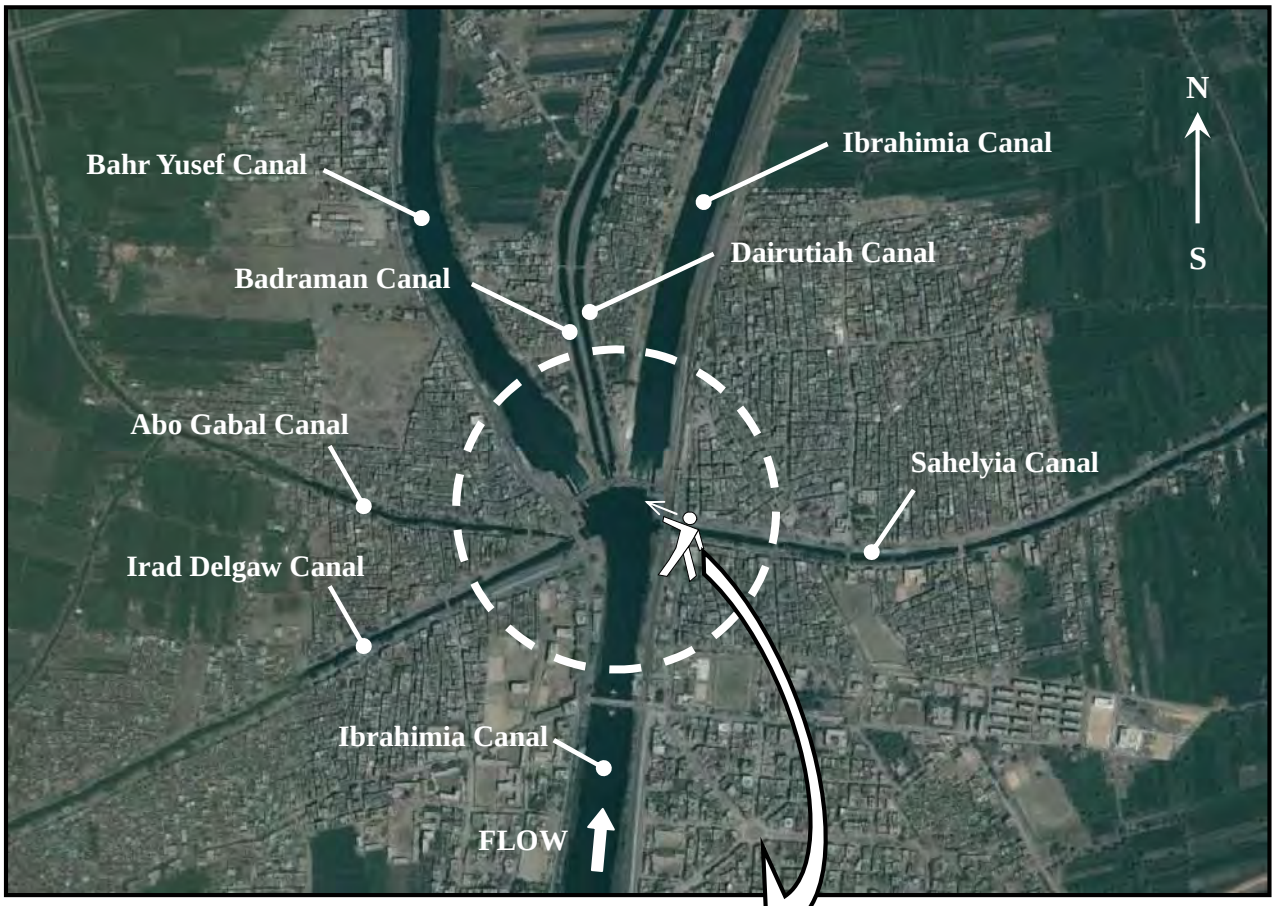
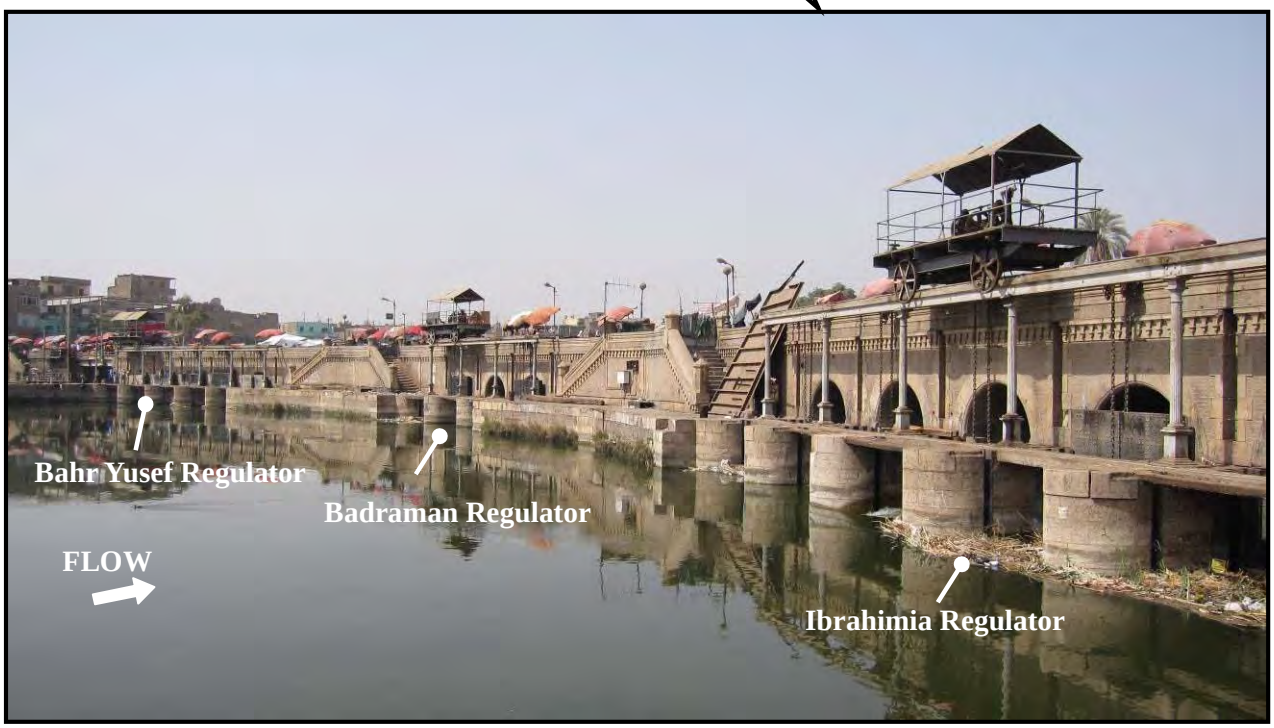
Location map



Panoramatic Landscape of Dirout Group of Regulators





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ABBREVIATIONS

Abbreviations

GOE	Government of Egypt
GOJ	Government of Japan
MWRI	Ministry of Water Resources and Irrigation
MALR	Ministry of Agriculture and Land Reclamation
ID	Irrigation Department
RGBS	Reservoirs and Grand Barrage Sector
UNDP	United Nations Development Program
KfW	Kreditanstalt für Wiederaufbau
USAID	United States Agency for International Development
IIS	Irrigation Improvement Sector
IS	Irrigation Sector
WMIP Ⅱ	Water Management Improvement Project Phase Ⅱ
IIP	Irrigation Improvement Project
IAS	Irrigation Advisory Service
JICA	Japan International Cooperation Agency
O/M or O&M	Operation and Maintenance
WUA	Water User's Association
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GMS	Global System for Mobile Communication
GPRS	General Packet Radio System
HAD	High Aswan Dam
DGR	Dirout Group of Regulators
EIB	European Investment Bank
IMF	International Monetary Fund
ECRI	Environmental and Climate change Research Institute
EEAA	Egyptian Environmental Affairs Agency

Units

cm	centimeter	℃	centigrade
cu.m	cubic meter	cms (m^3/sec)	cubic meter per second
fed.	feddan (= 0.42ha)	ha	hectare (=2.38 fed.)
hr	hour	kg	kilogram (=1,000 gram)
km	kilometer	km^2	square kilometer
lit.	liter	lit/sec	liter per second
m	meter	MCM	million cubic meter
BMC	billion cubic meter		
mg/lit.	milligram per liter	meq/lit.	milliequivalent per liter
m/s	meter per second	ppm	parts per million
t	ton (1,000 kg)	%	percent
Ardab	Weight unit for agricultural products (differing by products) 1 ardab = wheat(150kg), beans(155kg), maize(140kg), sesame(120kg)		
Qertar	1 Qertarr=Cotton(100kg)		

Currency

LE	Egyptian Pond (1 LE = 16.6 YEN)
Pt	Egyptian Piaster (1 LE = 100 Pt)
Yen or J¥	Japanese Yen
US$	US Dollar (1US$ =91.7 YEN)

Glossaries

Sakia	Water wheel to lift water by animal to field ditch from lateral canal
Mesqa	Small irrigation field canal constructed by the farmers themselves

EXECUTIVE SUMMARY

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1. INTRODUCTION

As Egypt depends on her water resources almost entirely from the River Nile and its river-bed water, Egypt's quota from the river water, which is 55.5 billion cubic meter (BCM) per annum, is literally the lifeline of the country. Meanwhile, the recent population growth accompanied with pressure for enhancement of food production and land reclamation and prevailing economic growth of the country have resulted in a steep increase of water demand for agriculture, industry and domestic use.

To meet the increasing demand, the Government of Egypt (GOE) formulated the National Water Resources Plan 2017 under the Ministry of Water Resources and Irrigation (MWRI) in 2005, which defines "Integrated Water Resources Management" to realize the appropriate water resources management. Above all, the realization of efficient and rational water use has been urgent especially in the agriculture sector, which occupies more than 80% of the total water demand of the country.

Also, economic disparity among the regions of the country has become obvious as the country's economy grows. Especially, poverty incidence in the Upper Egypt region is high. Therefore, the Sixth Five-Year Socio-Economic Development Plan (The Sixth Five-Year Plan) stated that 42% of the budget for regional public investment shall be distributed into the Upper Egypt region.

Because most of the poor in this region are small-scale farmers, increasing and stabilizing agricultural production is considered as an important measure for poverty alleviation. Accordingly, outcome of this measure depends on securing a sustainable water supply. To meet the national policy of correcting the economic disparity, realization of the Integrated Water Resources Management in the Upper Egypt region is essential.

The Dirout Group of Regulators (DGR) subject to this study was constructed in 1872, the oldest active regulator in the country and plays a vital role of distributing irrigation water to all the beneficiary area located in the middle Nile basin region. DGR delivers 9.6 BCM/year of irrigation water or 20% of gross water resources of the River Nile taken from the Assiut Barrage into the beneficiary area of 0.6 million ha through the Ibrahimia main canal. DGR branches the Ibrahimia main canal into seven (7) main canals, and irrigation water is provided to the beneficiary area through these main canals.

DGR is, however, facing declining capability due to the decrepit facilities as DGR has been used for 137 years. DGR consumes a considerably high cost for operation and maintenance, and the operation is no longer effective with the manual operation of its gates. Therefore, the facilities cannot distribute sufficient and sustainable irrigation water to the beneficiary area.

For effective use of the limited water resources, rehabilitation of DGR is quite urgent. Based on such an understanding, the Government of Egypt (GOE) requested informally to the Government of Japan (GOJ) for the Japanese Official Development Assistance by Yen-Loan. Accordingly, the JICA dispatched the Study Team for the Preparatory Survey for the Rehabilitation and Improvement of the Dirout Group of Regulators (the Study). The main objectives of the Study are defined as the following four (4) subjects in order to increase agricultural production and to keep sustainability of agricultural industry in the Upper Egypt region.

1. To formulate the rehabilitation plan of the Dirout Group of Regulators;
2. To formulate the Improving Water Distribution Plan for the entire operation and maintenance of the Dirout Group of Regulators and other regulators, which are located along the main

canals;

3. To evaluate the present situation and the rehabilitation plan of the existing minor structures based on the result of the inventory survey carried out by the MWRI; and
4. To carry out technology transfer to the implementation agency through the study period on the above mentioned subjects.

2. RATIONALE OF THE STUDY

2.1 The Country and the National Economy

The main industry in the Upper Egypt Region is agriculture. Because of the industrial structure and regional characteristics, an increase of regional disparity between the Upper Egypt Region and Lower Egypt Region can be pointed out as the main issue to be solved for the GOE.

According to Poverty Maps in the Human Development Report (UNDP, 2008), poverty regions are concentrated in rural regions of the entire country. The people who are living in rural areas are 56% of the total population in the country, but the 78% of poor and 80% of extreme poor live in rural areas. The report specifically mentions that 95% of the poorest villages are located in the Upper Egypt Region, pointing out clearly the heavy subject to be solved in the Upper Egypt Region.

GOE wrote clearly in the Sixth Five-Year Plan that the budget of the public investment of 1,295LE billion or 42% of the total budget during the five years shall be invested to commodity activities consisting of agriculture and natural resource and secondary sectors consisting of manufacturing, electricity, water, building and construction.

Investment to the Agricultural and Irrigation Sector is mentioned as 9.7 LE billion for the last year of the Fifth Five-Year Plan (2006/07) to an annual 12.32 LE billion through the Sixth Five-Year Plan with an incremental ratio of 27%. The policy of the Government stresses strongly on the Agriculture and Irrigation sector. Specifically, the policy mentions that the budget of public works shall be invested in the Upper Egypt Region and in the Desert Region intensively.

The working population is mainly engaged in the manufacturing industry, petroleum industry, social industry and trading industry, and it flows into the urban area to gain employment opportunities. This in turn increases employment anxiety and creates more unemployed people. To prevent employment anxiety, the agriculture industry should be situated as the chief industry in the rural area as a source for establishing a foundation for living.

The Agriculture sector shares 27% of the national labor structure (2006/07), and it should be kept as a stable industry for a better living standard by investment of the public budget for the improvement of agricultural infrastructures. To keep the economic increase of Egypt stable, all the industrial infrastructures including agriculture sector should be improved strongly. An outcome through the improvement of industries in the Upper Egypt Region where a high poverty ratio exists contributes to increasing stable economic development in the country.

2.2 Positioning of the Project in the National Plans

“The National Water Resources Plan” was prepared by MWRI. The main subject of this policy is defined as follows: that it is to make a solution against population increase and the limited available water resources. If available water resources will be developed in the future, it is essential to answer the following questions:

(1) How to accelerate the ratio of utilization efficiency of various kinds of water resources.

(2) How to support the Governmental Policy of agricultural expansion and what sector will be set as first priority, in spite of the present situation that the Government is concentrating on saving water resources with an optimization of efficiency and prioritization of domestic use and industrial use.

(3) How to manage the water resources management system, in spite of various water supply systems having been spread.

"The Sustainable Agricultural Development Strategy 2030" prepared by MALR clearly defines that sustainable usage of natural agricultural resources is one of the pillars for agriculture development in Egypt and its strategy of "raising the efficiency of water usages in cultivation" is shared with the strategy of MWRI. But the emphasis in the Strategy 2030 is put on the improvement of on-farm irrigation efficiency as the nature of MALR whose mandate does not include the management of irrigation structures. Hence the role of improving irrigation efficiency at conveyance level, namely improving irrigation structures, is left to MWRI. Nevertheless, it is confirmed that the Project is consistent with the policy and strategy of the agriculture sector led by MALR.

In "The Sixth Five-Year Plan", the Long-Term Agricultural Development Strategy (2017) was defined as follows:

- Increasing agricultural production by 3.9% annually, through achieving economic efficiency in allocation and use of resources to sustain development and protect the environment.
- Achieving food security and develop agriculture exports by exploiting comparative and competitive advantages.
- Contributing in increasing employment opportunities and improving living standards in rural areas.

Then the main pillars and strategic mechanisms of the Agricultural Sector were mentioned as follows:

- Reclaiming 3.4 million feddans, including Toshka, east of Oynat, El-Salam canal, and other areas, with an annual average of 150 thousand feddan.
- Vertical Development by increasing agricultural production through expanded cultivation of highly productive crops that are characterized by efficiency in using inputs, resisting pests and with a limited growth period.
- Encouraging agricultural products' exports, as it is targeted to increase the value of annual exports from L.E. 2 billion to L.E. 5 billion.
- Stimulating domestic and foreign investments in all agricultural areas.

2.3 Activities of Other Donors

Foreign assistance by other donors for the Irrigation Sector has a long history in the country. Concerning the result of the foreign assistance for the rehabilitation of major barrages located along the River Nile, new construction of the Ethna Barrage had been started, which was located in the River Nile downstream of Lake Nasser. It has been completed in 1994, funded by the Government of France, the Government of Italy, the Government of Romania and the Government of Australia. It consists of a regulator of 820 m with a power generation station and a navigation lock.

The Nagaa Hammady Barrage has been completed in 2008 funded by the Government of Germany after the Feasibility Study done by European Investment Bank (EIB). The Feasibility Study for Assiut Barrage has also been completed and as of now the implementation process is on-gong.

2.4 Priority and Relevance of the Project

The Project consists of the following three (3) main subjects:

- Rehabilitation and improvement of Dirout Group of Regulators
- Establishment of Improving Water Distribution System
- Evaluation of Priority Minor Structures

According to the Project Implementation Plan for Rehabilitation and Improvement on existing barrages along the River Nile and its main irrigation canals, the following seven projects are taken by MWRI with budgets for the year 2009/10: 1) Assiut Barrage, 2) Zefta Barrage, 3) Mattai Regulator, 4) Asfoon Intake Regulator, 5) El Kalabya Intake Regulator, 6) El Bagurea Regulator, 7) Idfena Regulator, 8)**Dirout Group of Regulators.**

According to the annual budget allocation plan in 2009/10 of the MWRI, the Feasibility Study of Dirout Group of Regulators was allocated L.E. 500,000 as a local budget portion. This is evidence of defining this as a priority project over various types of the rehabilitation and improvement projects under the MWRI.

It is confirmed and understood exactly that MWRI has a strong intention and firm resolution for future implementation of the Project to secure the realization of the Integrated Water Resources Management Plan under MWRI. Accordingly, the Project should be taken a step forward as the highest priority project in the sector.

To make a concrete measure to apply the Integrated Water Resources Management on the agricultural sector, rational water management systems should be considered in the Irrigation Sector for effective utilization of limited water resources in the annual gross amount of 55.5 billion m^3, from the aspect of software technology of utilization of the irrigation facilities.

First of all, to consolidate the Integrated Water Resources Management, modernization of the main irrigation infrastructures should be an essential activity; in addition, the Improving Water Distribution System should be installed by covering entire facilities rehabilitated by the latest engineering and technology as irrigation facilities.

Accordingly, the Project for the rehabilitation and improvement of Dirout Group of Regulators meets the basic concept, above-mentioned, by collaboration of rehabilitation and modernization for existing regulators and establishment of improving water distribution systems on seven main canal systems. It has enough rationality to be adopted as the Feasibility Study for future implementation by Japanese Yen Loan.

In addition to the above-mentioned reasons, rehabilitation and improvement of the Minor Structures, located under secondary canals, contribute to improvement of irrigation efficiency on the farm situated under terminal irrigation facilities.

Finally, the Project for the Rehabilitation and Improvement of Dirout Group of Regulators and the establishment of Improving Water Distribution System and Rehabilitation of Priority Minor Structures can contribute to the Policy of the MWRI by increasing the agricultural productivity with an increase of agricultural production.

3. THE STUDY AREA

3.1 Location and General Features

Entire beneficiary area is located in Giza Governorate, Fayum Governorate, Beni Suef Governorate, Minya Governorate and Assiut Governorate. These five Governorates are belonged to the Upper Egypt, and situated to Middle Basin Region of the River Nile. Total area of these five Governorates is 146,507 km^2 which is 14% of whole area of the country, and population is 18,696,796, which is 26% of whole population of the country.

Dirout Group of Regulators is situated at Dirout City located at 310 km south from Cairo City. Dirout Group of Regulators was constructed at 60 km downstream from Ibrahimia Intake which was situated beside of the Assiut Barrage. The Assiut Barrage is third main barrage in the downstream reaches from the High Aswan Dam (HAD), which is located at 545.25 km downstream from the HAD.

The beneficiary areas are distributed in the left bank of the River Nile. Geological conditions of the areas are divided to alluvium plain-lowland and basin. Basin area is located in Fayum Governorate only, the land level of its area is almost minus 45 m (-45 m above mean sea level) and it goes to the Lake Qaron with steep slope of 1 to 500.

The beneficiary area is located in the Upper Egypt Region, in which main economical activity is agriculture. The utilization ratio of the arable land for agricultural activity is almost 90% in average. The total beneficiary area can be said as about 600,000 ha. The Project area is located from 27° north latitude to 30°, and center of longitude is located in 31° east longitude. The climate zone of the Project area is classified into desert climate zone.

Maximum temperature in summer season (Jun to September) is 35℃(±) in monthly mean among four (4) Governorates excluding Assiut, and in winter season (December to March) is 21℃(±) in monthly mean. Minimum temperature in summer season is 20℃(±) and in winter season is 6℃(±). It is the characteristics of climate condition that daily difference of the temperature is big.

Annual discharge volume from the High Aswan Dam (HAD) is 55.5 Billion m^3 which is limited by International Agreement between Sudan, as mentioned before. Annual average discharge volume through the Bahar Yusef regulator is 4.820 billion m^3, and through the Ibrahimia regulator 4.069 billion m^3 for the past 10 years individually. Its ratio between Bahar Yusef and Ibrahimia are 47% and 40% out of seven main canals at Dirout Group of Regulators.

3.2 Socio-economic Conditions

The beneficiary area of the Project lies on five governorates, namely the Giza, Beni Suef, Fayum, Minya, and Assiut governorates. Among them, the beneficiary area in the Assiut governorate is so small that the statistical data at the governorate level for the remaining four (4) governorates will be used for featuring the beneficiary area.

According to the Population Census of 2006, the rural population in the beneficiary governorates is 9.2 million, occupying 63% of the total population in the governorates. The number of rural households in the beneficiary governorates is two (2) million, and the average family size in the governorates ranges from 4.2 to 4.7 with the average size being calculated at 4.5, slightly higher than the national average of 4.4.

The average share of poor persons in the beneficiary governorates numbers 23% in 2002 and 25.4% in 2006. The average of the four (4) governorates is worse than the national averages of 16.4% in 2002

and 19.6% in 2006, as well as other regions. Beni Suef marks the second highest poverty incidence with 45.4% in 2006 among all the governorates in Egypt. Poor persons in Minya and Giza numbered 39.4% and 12.0% in 2006 respectively. The share of poor persons in Minya was drastically worse compared to 2002, while the data in Fayum decreased by more than half from 2002 to 2006.

The Agriculture Sector in the beneficiary area is important, especially in providing job opportunity. The share of employment in agriculture & hunting in the beneficiary area is considerably high, except for the Giza governorate. The shares of employment in agriculture and hunting in Giza, Beni Suef, Fayum and Minya are estimated at 10%, 59%, 43% and 61% respectively, while the national average is estimated at 32%. It is also significant that employment of women in agriculture and hunting is high, especially in Beni Suef and Minya, in which the shares of employed women in the Agriculture Sector number 84% and 79% respectively.

Average sizes of farmland per farm household as of 2005 is estimated at 1.07 feddan (0.45ha), 1.55 feddan (0.65ha), 2,77 feddan (1.16ha) and 1.43 feddan (0.60ha) in Giza, Beni Suef, Fayum, and Minya respectively. Farm households with a land holding of less than 1 feddan (0.42ha) occupy more than 50% in all the four (4) governorates as well as for the national total. Farm households with a land holding of less than 3 feddan (1.26ha) in the four (4) governorates occupy 86%, which is 10 points higher than the national total. According to the Seventh Agriculture Census in 1999, the number of landless farmers numbers 0.82 million households or 18% of the national total.

3.3 Present Situation of Dirout Group of Regulators and its Vicinity

The vicinity of DGR is a built-up area and a point of traffic system. There are also some Mosques beside the canals situated downstream from the Bahr Yusef regulator and the Sahelyia regulator. Thus these surrounding conditions should be carefully taken into consideration for planning.

There is an alternative to rehabilitate and improve the existing DGR. However that is hardly expected to improve the function of suitable distribution. The gate facilities can be improved from the manual type to the electric type, but the function of distribution and maximum distribution water on each regulator can not be improved because of the same vents and same number of the gates. That means this alternative would not be able to solve the issue on water management of Bahr Yusef canal and Ibrahimia canal together with following reasons;

- In Bahr Yusef and Ibrahimia canal on term of maximum discharge (June ~ August), it is impossible to regulate the discharge even with the gates fully opened.
- There are 5 vents on Bahr Yusef Reg. and 7 vents on Ibrahimia Reg. According to the protocol of the distribution of MWRI on 2002, the ratios of distribution for Bahr Yusef and Ibrahimia are 50% and 40% respectively. That is against the relationship of the size of the facility.
- The gate facilities of existing DGR would be improved to electric type. However it is difficult to operate the gates consisting of triple gates for a gate, therefore it would be complicated operation and require the visual operation by each local winch. Additionally, it would be impossible to install the advanced operation by the control house such as remote control.
- From the viewpoint of the horizontal expansion on the Project area, the expansion of farmland would be to the west for the desert. Bahr Yusef canal supplying the water toward the west would be forecasted well to larger discharge in the near future. Therefore it would be required to suitable and rapid gate operation in order for efficient water management.

Accordingly, the rehabilitation and improvement of the existing DGR would not extend the life for 50 years or 100 years and it can not adjust the supply of the water at the present and for the future, because of not to improve the function and performance of the DGR. Furthermore, to keep use the existing DGR would be considered to be loss the opportunity of the improvement of the water management and the horizontal expansion for the future. Therefore the existing DGR should be newly constructed as regulators with suitable facilities of the distribution.

3.4 Present Situation of Operation and Management along Main Canal

The water distribution of the MWRI is managing the water distribution of the irrigation ranging from the Nile River to the branch canal. In general, the staff of the water distribution in Cairo and Assiut determines the amount of water supply to the lower stream which is based on the existing water distribution plan. This volume of water is converted into the water level, and the instruction is given twice a day by wire telephone from the staff of Assiut to the gate operator through the directorate irrigation office.

In the Survey area, there are about 30 water level observation and recording points managed by the water distribution for Upper Egypt and the H-Q rating curve is updated once a year. The existing telemetry system executed by USAID is not scheduled for repair in the future. Instead of the existing Telemetry System, a new Telemetry System project is carrying out a pilot project by MWRI Telemetry Central Directorate at another site. According to the interviewing survey, there is a plan to execute the observation of water level of the large area by using this Global System for Mobile Communications. The Ibrahimia Intake and the Dirout Group of Regulators are included in the future project.

The annual discharge at major regulators and monthly discharge records at the Ibrahimia Intake, Bahr-Yusef canal and Ibrahimia canal are arranged. The present situations of water management are as follows:

(Dirout Group of Regulators) It is only at the Bahr-Yusef canal and the Ibrahimia canal that both the water level and discharge quantities are observed in the Dirout Group of Regulators. As for other canals, only the upstream and downstream water levels are measured. Therefore, whether the water is appropriately distributed to the seven canals in the Dirout Group of Regulators cannot be confirmed by the volume of discharge in the situation of a present water management system.

(Bahr-Yusef canal) After recording the smallest annual discharge (4,608 MCM) in 2003 within ten years in the past, the annual discharge is in an uptrend. However, the annual discharge in 2009 was about 2% less than the previous year. The water level difference between upstream and downstream is about 1.0 m except for the period from June to August. From June to August, it can be presumed that during this period the gates are almost completely opened because this is the period when the irrigation water is most needed. The annual discharge of the Sakoula regulator in 2009 was less than that of the average for ten years until 2008. This result will show an increase in the amount of water supply to Minya in 2009 compared with the ten past years.

(Ibrahimia canal) After recording the smallest annual discharge (3,804 MCM) in 2005 within the past ten years, the annual discharge is in an uptrend. However, the annual discharge in 2009 was about 12% less than the previous year. The annual discharge of the Ibrahimia canal has decreased greatly while the annual discharge of the Bahr Yusef canal was only 2% less than that of 2008. It is important that each regulator highly controls the water level in the canal when the discharge volume is smaller than that of an ordinary year. The water level difference between upstream and downstream is approximately less than 2.0 m. From June to August, it can be presumed that during this period the

gates are almost completely opened because this is the period when the irrigation water is most necessary. It can be guessed that the discharge volume downstream is adjusted by using the gate compared with the Bahr-Yusef canal during this period.

(The other five canals) In these five canals, the only observation criterion is the water level, and the discharge is unidentified because there is no H-Q rating curve. The water level downstream of the regulator is not steady in all regulators. Therefore, it can be guessed that these water supplies to the canal are not stable.

The problems of water management are as follows:

(Dirout Group of Regulators) Recently, the upstream water level of the DGR has not been steady. It can be guessed that the deterioration of the gate makes it difficult to maintain the upstream water level of the DGR. The actual distribution ratio to the Bahr Yusef canal is smaller than the distribution ratio of the agreements.

(Bahr-Yusef canal) The distribution ratio to the Minya governorate, Beni Suef governorate, the Fayoum governorate, and the Giza governorate that supplies irrigation water from the Bahr Yusef canal is 26%, 9%, 48%, and 17% respectively, according to the quota in 2002. However, the distribution ratio to Minya is smaller than the distribution ratio of the quota according to the evaluation result of each regulator. The tendency to stabilize the upstream water level can be analyzed according to the actual data of the water level in the upstream and the downstream of each regulator. However, the upstream water level is unstable throughout the year.

(Ibrahimia canal) In the regulators, except the New Hafez regulator, the function to keep constant the upstream water level is not achieved at all. It can be guessed that the gate is not appropriately operated because the water-level difference of upstream and downstream is not observed in the regulator along the Ibrahimia canal.

(Branch canal intake) The discharge distributed from the branch canal intake to the branch canal is not observed. Water management reflecting the actual discharge of branch intake is not carried out.

(Water management organization) In the project area, the water management of the wide area, such as the report of water level data, transmission, decision, instructions, gate operation, and monitoring has been performed. However, the water distribution instruction system has weakness in real-time evaluation, which is to promptly evaluate the water level after the gate operation and reflect it to the following gate operation.

(Water level of Quarun Lake) In recent years, there has been a tendency for the water level of the Quarun Lake to rise up, and there is a possibility of affecting the inundation damage and the tourist industry around the lake. It was found that there was a correlation between the quantity of discharge from the Lahoun regulator and the water level of the Quarun Lake. In order to control the inundation damage around the lake, it is necessary to control the discharge that flows into the Bahr Yusef canal and to achieve water management that reduces the invalid discharge.

3.5 Present Situation and Proposed Evaluation Method for Minor Structures

There are many structures concerning the irrigation along the canals. In this Survey, the team will focus on the minor structures to control the distribution of the irrigation water, which are constructed on the branch canal belonging to the main canal of the Dirout Group of Regulators. The target Minor structures are classified into nine (9) types as follows.

1. Intake
2. Regulator
3. Tail escape
4. Culvert and Siphon
5. Aqueduct
6. Bridge
7. Weir
8. Pipe line
9. Pump Station

The field survey for selected minor structures was carried out by the observation and hearing methods for the assessment. The meaning of the assessment is defined as evaluating the data and evaluation of the validity of the necessity works and cost estimation for each structure.

The evaluation was carried out by the sheet which consists of 12 items, such as hydraulic functions, stability of structures and machineries, past maintenance records, social and environmental considerations and operation/maintenance situation, which can be used to evaluate the 9 types of minor structures. The results of the evaluation are expressed as three ranks of A, B and C. Furthermore, mainly in terms of the method of observation and hearing, it is difficult to judge or assume the highly accurate time of implementation of each structure based on the life estimation. Therefore, the evaluation will be shown by the suitable time, including the contingency against the real suitable time. According to the above, the standard of the priority for the minor structures is shown as follows.

Standard of Implementation time judged by the evaluation sheet

Total numbers of A,B and C	Standard of Implementation time
Number of rank A is two (2) to 12, in spite of number rank B and C.	Appropriate work should be implemented within five (5) years. (High priority of urgency)
Number of rank A is one (1), in spite of number of rank B and C, Or number of rank B is six (6) to 12 and number of rank C is zero (0) to six (6).	Appropriate work should be implemented within 10 years, or keep monitoring the present situation and maintenance. (Mid. priority of urgency)
Number of rank A is zero (0), number of rank B is zero (0) to five (5) and number of rank C is seven (7) to 12.	Appropriate work should be implemented within 20 years, or keep monitoring the present situation and maintenance. (Low priority of urgency)

3.6 Present Situation of Agriculture Sector

In general, agriculture in the beneficiary area is characterized by the majority of small-scale farmers growing staple grains such as maize in the summer and wheat in the winter, then berseem and some vegetables. The area is also known as a producing center of ornamental, herbal and medical crops, though their cropped areas are rather small.

The cultivated area in 2004/05 of the beneficiary governorates is estimated at 1.43 million feddan (0.6 million ha), out of which old land and new reclaimed land share 1.35 million feddan (0.57 million ha) and 0.08 million feddan (0.03 million ha) respectively. The cultivated area of the four (4) governorates occupies around 20% of the total cultivated land in 27 governorates (as of 2005) of the country.

Cropping intensities in the winter crop (from November to May), summer crop (from March/April to September), Nile crop (May to October), short clover [berseem] (between summer and winter) and permanent crop in the beneficiary governorates in 2004/05 are estimated at 80%, 66%, 19%, 4%, and 20% respectively. Cropping intensity throughout the year counts 189%, which is higher than the national average of 178%.

Major crops in the beneficiary governorates are wheat and berseem in the winter crop seasons, maize in the summer and Nile crop seasons and sugar cane and cotton as permanent crops. For the winter crop, the wheat crop shares the largest area with 560 thousand feddan (236 thousand ha) or 49% of the

total cropped area in 2005 and the second largest cropped area is long berseem, which occupies 328 thousand feddan (138 thousand ha) or 29% of the total cropped area in 2005. As for summer crop and Nile crop, maize occupies 517 thousand feddan (217 thousand ha) or 55% of the total summer crop in 2005 and 133 thousand feddan (56 thousand ha) or 48% of total Nile crop in 2005.

3.7 Results of the Baseline Survey

The baseline survey was carried out at a total of 17 sites from the 21st of October until the 24th of November, 2009. In total, 360 farmers participated in the group discussion and the Team managed to collect 230 questionnaires. Since the baseline survey was carried out at the sites in which farmers are suffering from water shortage, the result of the survey seems to reflect the situations of the survey sites, namely the average yields of the survey sites are lower than the statistical data at the governorate level.

The average yields of maize in Beni Suef, Fayum and Minya were calculated at 2.434t/fed (5.8t/ha), 2.052t/fed (4.5t/ha), and 2.528t/fed (6.0t/ha) respectively. All of them are lower than the yields shown in the governorate level statistics. As for the Beni Abed site, in which the Irrigation Improvement Project (IIP) by MWRI and the Japanese technical cooperation, Water Management Improvement Project (WMIP) Phase II have been implemented, the average unit yield of maize measured 3.158t/fed (7.5t/ha), much higher than the yield level of the other sites.

The survey result indicates that the yield level and the farmer's report on degree of water shortage have a fairly strong correlation. The average unit yield of maize with the least water shortage situation is 3.449t/fed (8.2t/ha) and the yield level shows a lowering tendency according to the degree of water shortage gets worse. The average unit yield of maize with the most severe water shortage situation is 2.495t/fed (5.9t/ha). The yield level of wheat follows the same tendency, although the tendency is not as clear as maize. The difference of the yields according to the degree of water shortage would be the basis of estimating the effects of the Project, which will contribute to improving the irrigation water distribution into the beneficiary area.

The average annual household incomes of the samples from 2 feddan and less, 2 – 4 feddan, and over 4 feddan are estimated at 5,432LE (average land holding: 1.11fed), 11,341LE (average 3.15fed), and 28,445LE (average 7.37fed) respectively. The share of income from crop production to the total income is estimated at 57% for the samples of 2 feddan and less, 68% for 2 – 4 feddan, and 72% for over 4 feddan.

Average annual income per capita of the sample households is estimated at 839LE/capita for 2 feddan and less, 1,787LE/capita for 2- 4 feddan, and 4,163LE for over 4 feddan. UNDP "Humand Development Report 2008" defines the lower poverty line at the annual expenditure of 1,156LE per capita and the upper poverty line at 1,574LE. Based on the sample household data, the household with less than 1 – 1.5feddan could fall under the poverty line level.

3.8 Environmental and Social Impact Consideration

The Egyptian Environmental Affairs Agency (EEAA) and its Regional Offices (RBO's) are the main environmental bodies responsible for the protection of the environment in Egypt. As for water resources project Ministry of Water Resources and Irrigation (MWRI) is responsible for the environmental and social consideration for the proposed project. In case of study for the rehabilitation and improvement of DGR, RGBS is implementation agency for EIA study.

The rehabilitation project relocating the existing barrages has been judged as a new project. The case of the rehabilitation and improvement of the DGR, in which alignment is planned to be relocated

downstream of the existing barrage, is classified as the black (C) project which required full EIA.

Environmental group (EG) was established in RGBS for managing EIA scoping, EIA work plan, public hearings in the project site, EIA report review and other related work. EG was organized in February 2010 and EIA study is taken charge by Environmental and Climate change Research Institute (ECRI) which is one of sector in MWRI.

Public hearing/consultation was held at the Project site. Participants include stakeholders, representative of local governors and mayors, representative concerned ministry office, engineers of MWRI/RGBS and others.

3.9 Constraints and Opportunities of the Development

Constraint -1: Irrigation Water Shortage

According to the baseline survey, it was confirmed that the farmers in the beneficiary area have been suffering from irrigation water shortage to such a degree of sometimes affecting the crop yields. To examine the situation of water shortage in the beneficiary area, an estimation of irrigation water balance in the beneficiary area was carried out based on the present cropping pattern of the beneficiary governorates and water supply to the main canals of Dirout Group of Regulators.

The examination indicates that there is an overall water shortage with around 1 BCM per year and seasonally, there would be water shortage occurring from December to April and June to August. Most especially, the shortage in the summer season is observed to be more severe than in other seasons. As the examination suggests, improving irrigation efficiency will be the major direction to mitigate the overall water shortage.

Constraint -2: Aged Major Infrastructures for Irrigation

Dirout Group of Regulators which is beginning an entire irrigation system of the Project, has aged facilities, deteriorated structures and has no easy functioning equipment of the gates installed. This means that DGR cannot meet the requirement rationally and accurately from the seven canals which are located downstream from the regulators. Moreover, the control method of distribution of irrigation water through the gates of the regulators is done by the water level controlled method. To improve the traditional method to meet the latest requirements, not only Dirout Group of Regulators but also major infrastructures located along seven main canals are required to be rehabilitated and improved.

Constraint -3: Lack of Integrated Water Management System

Under limited available water resources, to meet the rational utilization of irrigation water, the following efforts will be introduced to the project.

- To grasp the accurate water requirement volume on the basis of a real cropping pattern.
- To grasp the water demand on the basis of actual cultivated areas accurately.
- To supply irrigation water accurately in real time through the canal systems.
- To intake required irrigation water through minor structures.
- To establish the fair water distribution system under the sharing of the basic concept.
- To introduce the sharing of the limited water resources through collaboration.
- To introduce of latest water management system with new technology.

According to the result of hearing from decision-makers and planners, the annual water distribution plan is fixed for more than five years. Farmers are changing crops based on their own judgment sometimes. To meet the water supply with actual water demand on time, a flexible water distribution

method should be developed, which can be reflected by the present cultivated area and present cropping pattern.

The implementation plan of rehabilitation and improvement of major facilities is done steadily year by year. Minor structures are still left in a wide beneficiary area without rehabilitation. To realize the effectiveness of the rehabilitation project entirely through the area, not only rehabilitation of major facilities but also minor structures should be maintained to meet original functions. At the same time, the latest water management system should be developed

Constraint -4: Deterioration of Minor Structures

There are two thousand to three thousand numbers of minor structures in the beneficiary area of the Project, with the actual number of minor structures having never been surveyed. This is one of the constraints for the making of the rehabilitation plan of these structures. To assess the appropriateness of the selected priority minor structures, standardized criteria should be applied for the selection of priority minor structures. At the commencement of the field survey, a summarized table of selected minor structures was not made based on the same criteria for a field survey in the three Governorates. Lack of standardized criteria is also one of constraints.

Moreover, major irrigation facilities such as regulators and main canals are rehabilitated by the annual budget of the MWRI, but minor structures are rehabilitated by the annual budget of the regional directorates individually. Accordingly, the implementation plan of rehabilitation of minor structures is done with the limited budgets. To make clear effectiveness, under the above-mentioned constraints, giving priority on the plan, which will be expected to make contributions for the Project, is proper judgment. For implementation of the fair selection of the priority structures, reaching consensus with the related regional directorate office is based on the same criteria.

Opportunity -1: Positive Policy of the GOE concerning Developing Upper Egypt

According to the Sixth Five-Year Plan, the Government of Egypt expressed to allocate 42% of its local public investments to fostering development in the Upper Egypt governorates as part of the national project for the region’s development. It is a strong intention of the Government of Egypt to assist the activities done by regional governorates.

To realize an increase of the living standard level in the Upper Egypt Region, the agricultural sector and the irrigation sector should be invested by a public fund, which is a major sector of the labor structure of 56% (except the Giza Governorate). Especially, for income creation, agricultural production should be created by an improved irrigation system with the latest water management system. Rehabilitation of existing irrigation facilities should be implemented with an intentional plan using an allocation of the budget. The policy of the Government of Egypt meets the above-mentioned requirement of the agricultural sector and irrigation sector.

Opportunity -2: Steady Improvement of the Major Irrigation Infrastructures

The Major Irrigation Infrastructures, which are located along the seven parts of the main canal, have been rehabilitated based on the implementation plan made by the MWRI. Especially, four numbers of the Regulators located along the Bahr Yusef Irrigation Canal have been rehabilitated by a grant aid scheme of the Government of Japan since 1995. This effort has been continued until now by the Government, just as rehabilitation of regulators along the Ibrahimia irrigation canal, which were done by USAID. To follow the fundamental policy of the MWRI, mentioned in the National Water Resources Plan 2017, before everything else, Major Irrigation Infrastructures like DGR should be rehabilitated for rational utilization and distribution of limited water resources in the country.

4. PLAN FOR THE PROJECT

4.1 Goal of the Project and Basic Policies of Making the Implementation Plan

The goal of the project is defined as follows:

1. Restoration of the required function of irrigation water distribution by the rehabilitation of the DGR.
2. Establishment of the Improving Water Distribution System on the seven (7) main canals and its major intake facilities. The system can be supported as a function of the rational water distribution of the DGR.
3. Making the judgment of appropriateness on implementing the project of the rehabilitation of the selected minor structures, through the analysis and assessment of the selected minor structures of 128, regarding the possibility of the contribution to the project of the rehabilitation and improvement of DGR, with creation of the benefit.

The preparatory survey for the rehabilitation and improvement of the DGR has the following objectives.

- To recover the original function of water distribution of the DGR.
- To realize supplying of stable and sustainable irrigation water to a magnificent beneficiary area of 1,565,100 feddan located along middle Nile Basin in the Upper Egypt Region.
- To make clear the process of creating the benefit through realizing more stability of agricultural activities by farmers can result in greater agricultural production and a raising of income.

4.2 Formulation of Dirout Group Regulators (DGR)

According to the comparative study, the detailed layout of the new DGR is selected at approximately 140m downstream from the existing DGR. Additionally, the policy of the new construction at 140m downstream for the existing DGR was accepted by the fourth (4) steering committee on 29 June 2010. The diversion regulator should enable appropriate distribution of water into each canal. Taking into consideration of the condition of the site, the new DGR will be designed as follows:

Basic Design Conditions of the New DGR

Name of Regulator		Max. W.L. Upstream	Min. W.L. Downstream	Gate type	Number of the vets and width
Bahr Yusef		EL46.30m	EL43.00m	Double-leaf Gate	8m x 4vents
Ibrahimia		EL46.30m	EL43.00m	Double-leaf Gate	8m x 3vents
Badraman	Badraman side	EL46.30m	Same as canal elevation	Single-leaf Gate	4m x 1vent
	Diroutiah side	EL46.30m	Same as canal elevation	Single-leaf Gate	4m x 1vent
Abo Gabal	Abo Gabal side	EL46.30m	Same as canal elevation	Single-leaf Gate	4m x 1vent
	Irad Delgaw side	EL46.30m	Same as canal elevation	Single-leaf Gate	4m x 1vent
Sahelyia		EL46.30m	Same as canal elevation	Single-leaf Gate	4m x 1vent
Other facility ・The maintenance bridge is for the purpose of O&M and the road width of is planned as 6m. ・In the Ibrahimia regulator will be designed the navigation lock.					

The construction periods of the new DGR will be planned for approximately four (4) years (49 months) taking into consideration each of the works and the range of works.

The possibility of the Hydropower generation plan at the DGR has also been studied. The characteristics of the hydraulic data about Bahr Yusef and Ibrahimia main canals are: (a) averages of

the discharges of two main canals have sufficient discharge more than 120m^3/sec. and (b) averages of the water head are 0.9m (1.3m) on Bahr-Yusef and 1.3m (1.7m) on Ibrahimia, and maximum water head is (2.0m). **( ) is the case being raise the maintenance water level

Effective water head for a hydraulic generation will be given in minus certain losses from the water head, and the value of the DGR will be less than two (2) meters, then the empirical case at the Lahoun generation plant in Egypt implemented by the Hydro Power Plant Executive Authority (Ministry of Electricity and Energy), was referenced and the possibility study was carried out. Then evaluation method (development effect) by “Cash flow method” (“Guide book for Hydro-valley planning” (Ministry of Economic and Industrials in Japan, Agency of Natural Resources and Energy)) was applied.

The cash flow estimation by selection of the most effective case (discharge 200m3/s. and raise maintenance water level) as the minimum of (plant cost/annual output) among the several case studies is resulted that the income from electricity for 50 years will never make it reverse the repayment cost the loan by the plant construction cost. The conclusion is not feasible to propose a hydropower generation to the DGR.

4.3 Improving Water Distribution System Plan

As a main characteristic of the water management of the project area, there are the following advantage points.

- In the main facilities in each canal, the water level has been observed and recorded continuously.
- The water management system has been specialized like the gate operator of the regulator, the decision maker of a canal’s discharge, and the inspector of a canal water level.
- The water management system has controlled the downstream water level of the regulator by both experience and custom rules.

Such an existing water management system has supported the water distribution of the Project site with the area of about 1.5 million feddan over the years. Although the existing water management method is respected, the newly planned water management system reduces a water distribution administrator's daily routine work, and introduces the system which can support the policy towards more advanced water supplies. The water management system which supports a policy is technically reliable in Egypt, and it is preferable that operation and maintenance are easy.

In order to improve the existing water management system, the water level and discharge data at a distant place "are supervised", and data "is transmitted" to a central control house using a telecommunications system. In a control center, data "is processed" and it is reflected in the next instructions. An improving water distribution system is introduced, two or more water management institutions are managed at one place, and the following results can be expected.

- Achievement of impartial water management within the range of quantity supplied.
- Achievement of efficient water management that reflects canal arrival time
- Achievement of pre-meditated crop based on irrigation schedule
- Achievement of efficient water management by a decrease in management loss etc.
- Achievement of practical water management matched at crop’s cultivation time.

The following facilities are selected in order to build an improving water distribution system. As for

the equipment composition of the improving water distribution system, the SCADA system is general. In addition, training of the engineer who can manage an improving water distribution system is essential to keep sustained outcome after the introduction of the improving water distribution system. The facilities for introduction of an improving water distribution system are shown as follows;

- Dirout Group of Regulators (Seven sites and one control house)
- Regulators along the main canal (Fourteen sites)
- Major branch canal intake along the main canal (Forty-one sites)
- Water level of Quarun lake (One site)
- Central control house which supervise two or more data at the distant place (One site)
- Training support of the engineer who can operate improving water distribution system.

The organization that manages the amount of the distributed water along the canal in four directorates is newly set up in this project. This new organization performs fair water distribution and evaluation independently of each directorate as the water distribution office in direct control of the water distribution in Assiut. To support this management, a real-time improving water distribution system for the monitor and the evaluation of the distributed water situation is established. The MWRI thinks about the surrounding of Beni Suef as a candidate site in a new central control office.

4.4 The Project plan for the Infrastructures of the Minor Structures

The number of the selected minor structures counted at 128 finally, including original selected minor structure of 125 by the Egyptian side and an additional three (3) as damaged structures by the JICA Study Team during the field survey periods, were assessed. The priority minor structures have been selected in the beneficiary area and should be built depending on the requests and opinions of the users or farmers in the local area, as even the scale of minor structures and the beneficiary area are different. Therefore, priority classification should be decided for the time of suitable implementation works, such as within 5 years, within 10 years, or within in 20 years.

The result of assessment of the priority for the time of implementation work, as to within 5 years, within 10 years and within 20 years, eighty percent (80%) of the minor structures' appropriate implementation works should be required within five (5) years. The total cost for the implementation works is estimated at LE 61,817,000 (¥ 1.1 Billion Yen). The total cost for the implementation works within five (5) years is estimated at LE 59,140,700 (0.97 Billion Yen), sharing 95% of the total cost.

According to the result of the survey, the minor structures have been in place for more than 50 to 100 years since they were constructed, so the bricks were already aged and the gate machinery was deteriorated. The possibility of repairing these structures is low. Therefore the team recommends that almost all the selected minor structures should be reconstructed or replaced as well as the machineries, even considering the past period since it has been constructed. Accordingly, the structures which have been found lacking in their original function or have diminished in their level of performance should be improved or reconstructed as a first priority. Moreover, it is important that the structures with machineries have maintenance carried out regularly. The team recommends that daily maintenance should be made.

4.5 Agriculture Plan

The improvement of productivity is focused on the agriculture plan of this Project and also the plan is preconditioned with no change of water supply currently operated by MWRI. Based on these conditions, the cropping pattern and cropping intensity for the Project is proposed to follow the present cropping pattern and intensity consolidated from the agriculture statistics. Increase of cropping

intensity could be considered with the Project situation, but since the present cropping intensity is already as high as 187%, increase of cropping intensity is not considered in the future plan.

The baseline survey was carried out in the area where farmers are suffering from water shortage, and in the survey the farmers were asked to rate the degree of water shortage by five ranks. The proposed incremental ratio of yield by improving water distribution was examined based on the analysis of correlation between the level of unit yield and the degree of water shortage the farmers reported. Based on this analysis, the incremental ratio of unit yield is proposed at 9% for maize (summer crop) and 4% for wheat (winter crop) as a basis of estimating the benefit of the Project.

5. IPLEMENTATION PLAN OF THE PROJECT

5.1 The Project Plan

(1) Project Description of the Infrastructures

Three (3) components of the Project consist of the following works.

Main Project Component

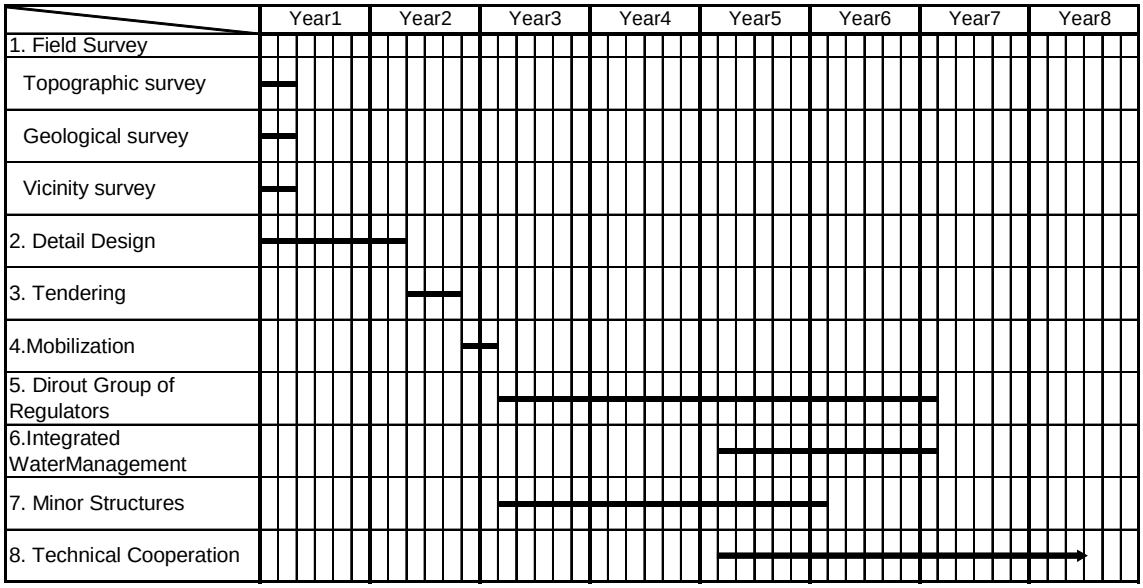
(a) New construction of Dirout Group of Regulators	
(i) New construction of regulators	Construction works of five regulators
(ii) Installation of the gates	W8.0m×H6.3m ; 7vents W4.0m×H2.3 and 2.8m ; 5vents
(iii) Peripherals improvement of facilities	Construction of maintenance bridge Improvement of existing Mosque
(iv) Coffer dam works	Single & Double Coffer dams by Steel Sheet-pile
(b) Improving Water Distribution System	
(i) Monitoring system for improving water distribution sysytem of Regulators along Main canals	Installation of the monitoring equipment
(ii) Monitoring system for improving water distribution sysytem of Intakes along branch canals	Installation of the monitoring equipment
(iii) Construction of the building for IWMS Center	Construction of the building for IWMS Center
(c) Rehabilitation of Priority Minor Structures	
(i) First Priority Structures	Implementation within five (5) years
(ii) Second Priority Structures	Implementation within 10 years
(iii) Third Priority Structures	Implementation within 20 years

(2) The Project Plan of the Technical Cooperation

Items	Contents
Technical Cooperation	Operation/Maintenance (O/M) of the DGR. O/M of the Bahr Yusef Main Canal with O/M for Regulators along main canal and O/M for Intake along branch canal. O/M of the Ibrahimia Main Canal with O/M for Regulators along main canal and O/M for Intake along branch canal. O/M of the Improving Water Distribution Management System
	Short Term Training in Japan of Egyptian engineers for the Improving Water Distribution System.

5.2 Implementation Schedule

Implementation Schedule of the Project



5.3 Project Cost

The project cost consists of the direct cost, the engineering services, the physical contingency and price contingency. The project cost was estimated as bellow.

Project Cost

Items	Project Cost(1,000LE)		Total (000LE)	Exchange to "YEN" (Mil. YEN)
	Foreign Currency	Local Currency		
Dirout Group of Regulators	324,044	139,773	463,817	7,699
Improving Water Distribution System	37,110	4,123	41,233	685
Sub Total	**361,154**	**143,896**	**505,050**	**8,384**
Priority Minor Structures	60,712	26,019	86,731	1,440
Entire total	**421,866**	**169,915**	**591,781**	**9,824**

Disbursement of the project **(1,000LE)**

Items	Consulting Service		Implementation						
	Year 1	Year2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
1.Dirout Group of Regulators			69,573	162,336	162,336	69,572	0	0	463,817
2.Improving Water Distribution System			0	0	20,617	20,616	0	0	41,233
3.Priority Minor Structures			18,177	18,177	18,177	17,620	10,824	3,756	86,731
TOTAL			87,750	180,513	201,130	107,809	10,824	3,756	591,781

6. ENVIRONMENTAL AND SOCIAL CONSIDERATION

6.1 EIA study

Environmental Climate change Research Institute (ECRI), who is one of the institutes in MWRI, has commenced the EIA study on March 3, 2010 after agreement between RGBS and ECRI for the EIA works. The ECRI has completed the EIA study by the end of MAY, 2010. After review and discussion by RGBS and JICA study team, final report of EIA has submitted to RGBS. After receipt of EIA report RGBS sent it to EEAA on June 29, 2010 for getting approval and/or comments. RGBS received

EEAA's comments in August 2010 and replied it. After replying for some comments by RGBS EEAA approved EIA report on 27th September 2010.

6.2 Public Hearing/Consultation

Public hearing/consultations for DGR were conducted twice on April 21 and May 27, 2010 at project site. RGBS has invited representatives of government agencies, representatives of local government offices, mayor's offices and project stakeholders. RGBS explained to participants the background of the proposed project of DGR. In the consultations participants joined the discussions and question on the meeting.

6.3 Involuntary Resettlement

It was found that no resettlement area exists except of replacement of two mosques. Abutment of new located regulators belongs to RGBS owned lands. RGBS explained to stakeholders in the public hearing that any compensation of new construction of the mosques will be shouldered by RGBS. No objections of the replacement were made from the stakeholders including representatives of local government and municipality.

6.4 Information disclosure

In principal project proponent disclose information about the environmental and social considerations of the project. As for this project RGBS has disclosed the information of DGR project in the public consultations. And also RGBS will disclose the information in future time by time as for the environmental and social considerations.

6.5 Potential Impact Assessment, mitigation measures and monitoring plan

The potential impacts assessment of the proposed project is evaluated in construction stage and operation stage. And then mitigation measures that would counteract the negative impacts during construction phase and operation phase are shown in the EIA report. Environmental monitoring plans are made separately in three (3) steps which are the pre-construction monitoring plan, the construction monitoring plan and the operation monitoring plan.

6.6 Proposed alternatives

Three (3) alternatives plans for the location of proposed structures of regulators are prepared and evaluated considering with structural design, operation and maintenance, working life and others including environmental matter. In a comprehensive consideration, a plan-c, which the regulators locate at 140m downstream of the existing one, was selected.

6.7 JICA checklist

According to the minutes of meeting on the mission for the preparatory survey for the rehabilitation and improvement of DGR, which was signed by RGBS and JICA dated on May 19, 2009 at Cairo, the review of JICA's environmental checklist based on EIA study would be required. JICA study team has introduced the JICA guidelines for environmental and social considerations and the checklist to RGBS for reference. The JICA checklist was attached in the final EIA report after confirmation with RGBS, ECRI and JICA consultant.

7. PROJECT EVALUATION

The direct effect of the Project is to realize the improved and appropriate water distribution into the command area of DGR. Furthermore, the renewal of the facility and improving water distribution system will enable more rational water management, so that the water shortage for irrigation will be alleviated. Increase of agriculture productivity is expected through this effect. The increase of

agriculture production is applied for the benefit of the Project in monetary value to perform the economic evaluation.

Without the Project situation, it is expected that the function of DGR will be lost in the near future due to age. That would cause the destruction of appropriate water distribution, especially in the Bahr Yusef canal, and severe water shortage along the Bahr Yusef canal would occur, leading to a decrease of agricultural production. Implementation of the Project can avoid such expected loss in the future. The value of the expected loss of agricultural production without the Project in the future will also be counted as the benefit of the Project in monetary value. Realization of these Project benefits would contribute to the long-term process of correcting regional economic disparity in Egypt through increasing farm income.

The Economic Internal Rate of Return (EIRR) based on the economic cost and benefit is calculated, and also B/C and Net Present Value (NPV) are calculated using the opportunity cost of capital in Egypt, namely 12% as a discount rate. These economic indicators are calculated as the cases excluding and including the benefit to avoid future loss without the Project. In addition, the economic indicators including the minor structure component is examined.

Result of Calculating Economic Indicators (Base Case)

Project Component		EIRR	B/C	NPV (000LE)	(FIRR)
(1) DGR + Improving Water Distribution sysytem	Exclude the benefit avoiding future loss without project	20%	1.76	281,577	(22%)
	Include future loss without project	26%	2.98	736,278	(28%)
(1) ＋ Priority Minor Structures	Exclude the benefit avoiding future loss without project	21%	1.91	388,101	(24%)
	Include future loss without project	27%	2.98	842,802	(29%)

EIRR for the renewal of DGR and the establishment of the Improving Water Distribution System is calculated at 20% in case of excluding the benefit of avoiding future loss without the Project and 26% in case of including said benefit. These EIRR figures exceed the opportunity cost of capital in Egypt, i.e. 12%. Though the portion of the Priority Minor Structures is small compared to the whole scale of the project, combining the three components altogether will give a higher economic return, as the EIRR for the aggregated three components is estimated at 21% and 27% in cases of excluding and including the benefit of avoiding future loss without the Project.

With the Project, an annual increase of 4,4000 tons (food for 252,000 people), or the equivalent of 8.6 million US$ (49 million LE) for wheat and 92,000 tons (food for 0.8 million people), or 15 million US$ (84 million LE) for maize would be expected. These amounts of value would be substituted from importing these grains contributing to saving foreign currency reserves as well as increasing the food security for the nation. Also, if the project was not implemented, 18,000 tons of wheat (food for 103,000 people) and 52,000 tons of maize (food for 448,000 people) would be annually lost after the function of DGR was lost. These amounts are equivalent to 3.5 million US$ (19.5 million LE) and 8.5 million US$ (47.6 million LE).

With the Project, crop production is expected to increase, and proportionally, the labor demand for harvesting would increase. It is estimated that 6 million man days of labor demand would be created with the Project. This is equivalent to 25 thousand labor days with the annual working days per person

of 240 days.

The Project will contribute to increasing farm income by improving irrigation water distribution and agricultural productivity. This would contribute to improving the income status of the rural population in Upper Egypt, where the poor population has been mostly concentrated among the country, as well as contributing to correcting the regional disparity in Egypt for the long term.

8 CONCLUSION AND RECOMENDATION

8.1 Conclusion

1. It is projected that the population of Egypt will reach 150 million in 2050. That would be a big issue to be solved from the national security point of view, especially the national food security. For instance, the production of wheat, the staple food of the country, has to be doubled to meet the demand in 2050 from the current seven (7) million tons per year, provided that the current wheat self-sufficient ratio of 54.4% were maintained. The horizontal expansion (expansion of the arable land) and vertical expansion (increase of agricultural productivity) is therefore an urgent pursuing measure of the Government. The success of the measure heavily depends on securing the water resources and stable water supply.

2. The Dirout Group of Regulators (DGR) has a function to deliver the irrigation water of 9.6 billion m^3 (BCM), which is equivalent to 17% of Egypt's annual quota of 55.5 BCM, into the seven (7) main canals through the five (5) regulators commanding 1,565,100 feddan, which occupies 17% of the total arable land in Egypt. As the existing DGR has deteriorated, since it was constructed in 1873, its original function has seriously declined. That is a major cause of the drop of crop productivity in the Project area, which is a food supply center in the Upper Egypt region.

3. The Project aims at realizing the appropriate water distribution and resolving the decreasing agriculture productivity due to water shortage in the Project area through the rehabilitation and improvement of the existing DGR. It is expected that the Project would contribute to increasing crop production, which would lead to increase of farm income and creation of job opportunity during harvest season, and eventually contribute to alleviating poverty and improving the living standard of the people in the Project area in Upper Egypt, situated in an area of high poverty incidence.

4. The Project consists of (1) New construction of the existing DGR, (2) Establishment of the Improved Water Distribution System, and (3) Rehabilitation of the Priority Minor Structures. The total project cost is 0.59 Billion LE. The Project performs high economic efficiency as the Economic Internal Rate of Return (EIRR) is estimated at as high as 27%.

5. It is expected that the production of wheat and maize would increase by 44,000 tons per annum (equivalent to annual consumption of 252,000 people) and 92 thousand tons per annum (equivalent to annual consumption of 800,000 people) respectively. These increases would contribute to saving foreign currency reserves as the values of the increase of wheat and maize production at the international market price are 8.6 million US$ and 15 million US$ respectively. The Project would therefore contribute to the fiscal status of the Government as well as the National Food Security. Furthermore, the Project would create job opportunities of about six (6) million man days, or about 25,000 people in the agriculture sector.

6. Under the pressure of population growth, people have been moving from rural areas to urban areas

to seek job opportunities. The rehabilitation and improvement of the major structures alleviates the irrigation water shortage and contributes to stabilizing and increasing farm income. That would promote the motivation of the farmers to succeed on the land, engage in farming, and develop agriculture technologies. Such a qualitative impact is also expected from the Project.

7. In conclusion, it is judged that the Project is feasible based on the high economic efficiency and values. It is also judged that the Project is socially viable as a public investment since the Project follows and contributes to the policies of the Sixth Five-Year Plan, which are (1) Raising income and living standards, (2) Achieving food security, and (3) Contributing to increasing employment opportunities.

8-2 Recommendation

1. It is recommended to apply the Japanese ODA Loan for the Ministry of Water Resources and Irrigation (MWRI) to secure the fund for the implementation in order to realize the Project benefits as early as possible.

2. It is proposed to establish the new Dirout Group of Regulators Construction Project Office under MWRI for earlier realization of the Project benefits accrued from the operation of the new structure. It is also proposed to procure foreign consultants as the core of implementation organization for smooth execution in case of applying the Japanese ODA Loan for the Project.

3. In order to realize the Project benefits as early as possible and for the Project objective to take root, it is essential to develop a system of decision process for water distribution based on the water level and water discharge volume, which are observed at the intake facilities and weirs located along the seven (7) main canals and measured as a function of the water distribution of the new DGR, as well as the improvement of the engineering of operation and maintenance of the facilities and equipment. It is proposed that MWRI would apply for the technical cooperation scheme by the Government of Japan as the best way of developing the system.

4. The governmental policy on the National Security, especially the policy on Food Security, is defined in the Sixth Five-Year Plan as the long term plan towards the Year 2017 (Refer to NWRP Reoprt). The Project is to increase the agricultural productivity and production through improving irrigation efficiency by recovering the appropriate function of the water distribution of 9.6 BCM (equivalent to 17% of 55.5 BCM agreed in the Nile River Agreements) to irrigate the beneficiary area of 1.5 million feddan by the Ibrahimia Main Canal. Realizing an appropriate water distribution system is an essential factor to meet the increasing demand of food accompanied with the population growth. However, the appropriate irrigation system without a water shortage can be realized in accompaniment with the rehabilitation of the irrigation canal network, rehabilitation of more than 3,000 minor structures, and on-farm irrigation improvement. It is therefore recommended that MWRI should implement the improvement of the total irrigation system of the Ibrahimia Main Canal as a long-term plan and the Project of the new DGR construction as its initiation.

5. At the beginning of the Detailed Design stage, it is recommended to carry out a geological survey with the necessary number and depth of the borehole drilling at the location of the new DGR in order to obtain basic data for the safety design with enough capacity of strength and stability for the long term use of the facility.

6. Since the important buildings for religion are located at the proposed site of the new DGR, it is requested that MWRI should discuss and agree with the involved parties for the issue including the

possibilities of removing the buildings at the detailed design stage.

7. The navigation lock is one of the successive functions from the existing DGR to the new DGR. It is recommended for MWRI to make a final decision on the succession of the navigation lock at the detailed design stage from the viewpoint of the future effective transportation system.

8. It is recommended that MWRI should accelerate consensus-making regarding the future regional transportation system and designed infrastructures of the new DGR.

9. Upon the recommendation made by the Steering Committee, it is recommended to preserve the existing DGR as historical structure in the world with careful study to identify the required rehabilitation works based on the foundation survey and strength survey of the regulator body.

CHAPTER 1

INTRODUCTION

CHAPTER 1: INTRODUCTION

1.1 History of Dirout Group of Regulators[1]

From ancient times to the second half of the 19th century, the basin irrigation system remained as the prevalent form of irrigation in Egypt. In the flood cycle, the level of the Nile began to rise in late June and reached its high water mark in September. Thereafter, the water level began to drop till early December, after which the whole process started again. Annual flood water on the land was somehow controlled by the system of basins, dykes, canals and outlets to retain water in the basins for forty to fifty days. When the land was still wet after the flood had receded, farmers planted crops. Following the natural flood cycle, one harvest per year was possible as the noxious salts were washed out of the soils and a fresh layer of Nile silt containing numerous nutrients was received annually.

A rapid shift from basin irrigation to year-round irrigation began after the construction of the Delta barrage in 1861 (the construction started in 1843 during the reign of Mohammed Ali). It was one of the largest barrages in the world at that time. The barrage was constructed with the intention of developing an agriculture sector, especially extending the area for cotton cultivation, which had a great demand in the world market at that time. Year-round irrigation was decisively introduced when the Aswan dam was constructed in 1902. The dam was heightened in 1912 and 1933 to reach the storage capacity of 5.3 BCM.

During these periods, major barrages were constructed in order to raise the level of water to be led into corresponding irrigation canals. Ibrahimia canal was built in 1873. The canal was designed primarily to provide year-round irrigation to the Khedivial sugar estates in Middle Egypt. It supplied year-round irrigation to 230,000 ha and basin irrigation to another 170,000 ha. The canal runs northward from its head in Assuit for 60 km and then divides in Dirout Group of Regulators into seven canals, two main branches of which are the Bahr Yousef canal and Ibrahimia canal proper. Dirout Group of Regulators was constructed in 1872 during the time of the canal construction.

Plate attached on the Dirout Regulators:
"Dirout Group of Regulators was constructed by the order of Ismael Pasha from 1869 to 1872 under the supervision of Eng. Salama Ibrahim and Eng. Ismael Pasha and some remodeling work was conducted from 1900 to 1907 under the supervision of Eng. Ismael Pasha Serri and this name plate was written in 1934."

Ibrahimia canal with a length of 350 km, one of the largest artificial canals in the world, used to take off from the Nile without any barrages or inlet works on the river. Sir William Willcocks, the British civil engineer who designed Aswan dam, constructed the Assuit barrage later in 1902 to provide a means for better controlling its discharge. Later, barrages on the Nile, namely Zefta, Ethna, and Naga Hammady were constructed in 1902, 1906 and 1930 respectively. Through these barrages constructed, year-round irrigation had covered 85.2% of arable land in Egypt by the 1960s before the construction of the High Aswan Dam.

Those great barrages, Delta, Ethna and Naga Hammady were renewed in 1935, 1994 and 2008, and new barrages were constructed just downstream of the old barrages. The old ones have remained simply as bridges to cross the river. The feasibility studies for rehabilitation of the Assuit and Zefta barrages have been completed and the rehabilitation work of these barrages is awaiting implementation. As reviewed from the chronicle, Dirout Group of Regulators stands as the oldest working barrage without major rehabilitation in Egypt as of today. The following summarizes the

[1] Referred to "Egypt An Economic Geography", Fouad N. Ibrahim and Barbara Ibrahim (2003) and Wikipedia

studies and major repairs made for Dirout Group of Regulators.

Table 1.1.1 Studies and Repairs undertaken for Dirout Group of Regulators

Year	Topics
1872	Construction of the Regulators was completed.
1900-07	Remodeling work was carried out.
1935	Abo Gabal Intake regulator was constructed.
1962	Improvement work was carried out (extension of apron of Ibrahimia canal, driven sheet pile [wooden], protection of the canal bed due to rise of water level upstream reaches of the Dirout Group.
1993-94	Study for major repair by Nile Research Institute (NRI)
1996	Underwater inspection
2001	Maintenance of regulator gates, chains, cranes, and replacement of road of lifting bridges over locks
2006	Over and underwater inspection: survey on sedimentation and scouring of apron by NRI
2008	Stability Study for Dirot group & improvement Study of the operation mechanism of the group gates to work electrically and manually

Table 1.1.2 History of Great Barrages and Dams Construction and Rehabilitation

Year / Topic	1861	1872	1902	1906	1930	1935	1959	1971	1994	2008
Construction (Rehabilitation)	Delta Barrage	**Dirout Group of Regulators**	Aswan Dam, Asyut Barrage, Zefta Barrage	Esna Barrage	Naga Hammady Barrage	(Delta Barrage)		High Aswan Dam	(Esna Barrage)	(Naga Hammady Barrage)
Feasibility Study for Rehabilitation									Asyut Barrage Zefta Barrage	
Incidents in Egypt	great demand of cotton in the world market	Fiscal crisis and bankrupcy due to Suez canal project	Resuming irrigation development by British administration		1st Nile Agreement (1929)		Egypt-Sudan Nile Agreement (1959)			

1.2 Background of the Study

As Egypt depends on her water resources almost entirely from the Nile and its river-bed water, Egypt's quota from the river water, which is 55.5 billion cubic meter (BCM)[2] per annum, is literally the lifeline of the country. Meanwhile, the recent population growth accompanied with pressure for enhancement of food production and land reclamation and prevailing economic growth of the country have resulted in a steep increase of water demand for agriculture, industry and domestic use, and it is projected that the water demand of the country would reach 82.0 BCM in 2027. To meet the demand, the Government of Egypt (GOE) has targeted to develop an additional 16.2 BCM by use of groundwater and recycling water albeit the supply would still remain short (refer to Table 1.2.1 below).

Based on the above background, GOE formulated the National Water Resources Plan 2017 under the Ministry of Water Resources and Irrigation (MWRI) in 2005. In the strategy, Integrated Water

[2] Refer to "2.2.1 National Water Resources Plan"

Resources Management was defined to realize the appropriate water resources management. Above all, the realization of efficient and rational water use has been urgent especially in the agriculture sector, which occupies more than 80% of the total water demand of the country.

Table 1.2.1 Water Supply and Demand in Egypt in 1994 and 2017 Projection

Description		BCM per Year	
		Year 1994	Year 2027
Demand	1)Agriculture	54.5	69.1
	2)Domestic/Industry/Shipping	8.6	12.9
	Total	63.1	82.0
Supply	1)River Nile	55.5	55.5
	2)Ground Water	4.1	7.5
	3)Recycling	4.3	17.1
	Total	63.9	80.1
Balance of Water Resources		0.8	▲1.9

Source: International Commission on Irrigation and Drainage, Annual Meeting 1996

The Dirout Group of Regulators, which is subject to this study, is the core irrigation structure to supply irrigation water to all the beneficiary area located in the middle Nile basin region. The Dirout Group delivers 9.6 BCM/year of irrigation water or 20% of gross water resources of the Nile taken from the Assuit Barrage into the beneficiary area of 0.6 million ha through the Ibrahimia main canal. The Dirout Group branches the Ibrahimia main canal into seven (7) main canals, and irrigation water is provided to the beneficiary area through these main canals.

The Bahr-Yousef canal is the largest canal in capacity among the seven canals. Its length extends as long as 312 km and there are four regulators along the canal, namely the Rahoun Regulator, the Mazoura Regulator, the Sakoula Regulator and the Dahab Regulator. Those regulators have been rehabilitated by Japan's Grant Aid since 1995.

The Dirout Group, which was constructed in 1872, is the oldest active regulator in the country, and the weirs cannot function well due to their age. The rehabilitation of the Dirout Group should, therefore, be urgently implemented. It is expected that the impacts of the rehabilitation of the Dirout Group should be significant considering the vast beneficiary area and very long canal networks.

Moreover, economic disparity among the Upper Egypt region, the Metropolitan region and the Nile Delta region has become obvious as the country's economy grows. Especially, poverty incidence in the Minya and Assuit Governates out of the five beneficiary Governates is indicated high (UNDP, 2008 EGYPT HUMAN DEVELOPMENT REPORT). Therefore, the Sixth Five-Year Socio-Economic Development Plan (the Sixth Five-Year Plan) stated that 42% of the budget for regional public investment shall be distributed into the Upper Egypt region.

Because most of the poor in this region are small-scale farmers, increasing and stabilizing agricultural production is considered as an important measure for poverty alleviation. Accordingly, outcome of this measure depends on securing a sustainable water supply. To meet the national policy of correcting the economic disparity, realization of the Integrated Water Resources Management Plan in the Upper Egypt region is essential. The rehabilitation and improvement of the Dirout Group can be the core project for the realization of this plan.

1.3 Objectives of the Study

The public investments in the Upper Egypt region have been emphasized to correct regional disparity which has appeared according to the economic growth in Egypt. Dirout Group, which plays a vital role of distributing water in the region, is facing declining capability due to the decrepit facilities as the group has been used for 138 years. Dirout Group consumes at a considerably high cost for operation and maintenance, and the operation is no longer effective with the manual operation of its gates. Therefore, the facilities cannot distribute sufficient and sustainable irrigation water to the beneficiary area.

For effective use of the limited water resources, rehabilitation of Dirout Group is quite urgent. Based on such an understanding, the Government of Egypt (GOE) requested informally to the Government of Japan (GOJ) for the Japanese Official Development Assistance by Yen-Loan. Accordingly, the JICA dispatched the Study Team for the Preparatory Survey for the Rehabilitation and Improvement of Dirout Group of Regulators (the Study).

The main objectives of the Study are defined as the following four (4) subjects in order to increase agricultural production and to keep sustainability of agricultural industry in the Upper Egypt region.

1. To formulate the rehabilitation plan of the Dirout Group;
2. To formulate the Integrated Water Management Plan for the entire operation and maintenance of the Dirout Group and other regulators which are located along the main canals;
3. To evaluate the present situation and the rehabilitation plan of the existing minor structures based on the result of the inventory survey carried out by the MWRI; and
4. To carry out technology transfer to the implementation agency through the study period on the above mentioned subjects.

The Preparatory Survey Team was dispatched by JICA at the beginning of October 2009. The study consists of Phase I and Phase II, which take 2.7 months and 5.5 months individually. Phase I was defined as confirmation of priority and relevance of the Project, and implementation of required field survey for formulation of the Project. Phase II was defined as implementation of required field survey for formulation of the Project, formulation of the Project, social and environmental consideration and evaluation of benefit of the Project.

CHAPTER 2

RATIONALE OF THE STUDY

CHAPTER 2: RATIONALE OF THE STUDY

2.1 The Country and the National Economy

2.1.1 General Condition of the Country

For five thousand years, the River Nile has been bringing the blessings of water to Egypt, where one of the four high civilizations in the world has been born, and it is still contributing to the development of the civilization by shaping a rich delta. Consequently, Egypt is the gift of the River Nile, as said by the ancient Greece historian Herodotus. .

Egypt is located in an arid region, with the greater part of the country having a minimum rainfall of only 5 mm, in spite of its wide area of 1,002 million km^2 (which is 2.7 times the size of Japan) except in the delta region where the Rive Nile is flowing into the Mediterranean Sea. Therefore, utilization of the surface water sourced from rainfall cannot be expected except in the coastal region. For the same reason, utilization of the ground water cannot be expected due to a lack of stable cultivated water resources. Consequently, water resources in Egypt have been completely dependant on the Rive Nile for all of Egypt's history.

The Rive Nile originates from Lake Tana in northeast Ethiopia where it is named the Blue Nile and Lake Victoria in Kenya, Uganda, and Tanzania where it is called the White Nile. Both the Blue Nile and White Nile are joined at Khartoum in the Sudan, making the complete River Nile 6,200 km running through ten countries. It flows into Lake Nasser, which was made by the High Aswan Dam built in 1968, and is located 350 km downstream from the border of Sudan.

Before the construction of the High Aswan Dam, the River Nile flooded because of heavy rainfall in upper basins located in other countries, bringing rich soil continuously. Currently, the High Aswan Dam controls the flooding throughout the year, relieving the people of the country from such a menace. The Integrated Water Resources Management Plan was defined as a stable water resources supply to the entire country, making it a true sharing of the water resources. The plan was defined on the base of understanding that the life-line of the country will be realized by the effective use of water resources which are a motive power for agriculture and industry.

Under the above-mentioned historical and natural environmental condition, the Egyptian economy in recent years has remained stable with a GDP of +4.3% in the previous period between January and March in 2009 compared with the year before. (Announcement of Government of Egypt, 13th May 2009) Income from the transportation toll of the Suez Canal and tourism has decreased due to the worldwide economic crisis. Conversely, the domestic demand is still making progress in the construction industry and the communication industry. Therefore, the expected GDP from October to November 2009 will be increased more than +4.1% from 2008.

The IMF is forecasting an average value of +1.6% in under-developed countries for 2009. The pace of the growth rate of the Egyptian economy is still high as the IMF is forecasting +3.6% for 2009 and +3.0% for 2010. The Agricultural and Fishery sector in the Labor Structure had a share of 27.0% in 2006/07 (Sixth Five-Year Plan) and 13.4% of the GDP. It can be said that the sector is contributing to economic development in the country. The Horizontal Expansion and Vertical Expansion in the agricultural sector, which are government policies, can contribute to stable economic development as these policies are one of the primary factors for stable development.

2.1.2 Positioning of Upper Egypt

(1) Geographic definition and Population composition

The Upper Egypt Region is defined as the area from Giza, located south of Cairo to Aswan in the Nile River Basin. The Lower Egypt Region is defined to be distributed from the southern part of Cairo to Alexandria and the Mediterranean Sea, namely the Nile Delta.

Egypt consists of twenty-nine (29) governorates (muhafazah), with eleven (11) governorates located in the Upper Egypt Region. These governorates cover 730,829 km^2 which is equivalent to 69.5% of the 1,052,184 km^2 of gross territory. Population of the Upper Egypt Region has 27,556 thousand which is equivalent to 37.9% of the 72,669 thousand gross population.

The project area is located in the Giza, Beni Suef, Fayum, Minya and Asuit Governorates. The total area of the five governorates is 146,507 km^2 (13.9%), and the total population is $18,697 \times 10^3$ (25.7%). Therefore, the project area can be defined as a priority region where the subjects to be solved are faced in the Upper Egypt Region.

(2) Industrial Structure and Living Conditions

The communication industry, cement industry and petroleum industry, which are leading industries of the country, are situated around the Metropolitan Region and the Delta Region which are in the Lower Egypt Region. The main industry in the Upper Egypt Region is agriculture. Because of the industrial structure and regional characteristic, an increase of regional disparity between the Upper Egypt Region and Lower Egypt Region can be pointed out as the main issue to be solved for the Government of Egypt.

According to Poverty Maps in the Human Development Report (UNDP, 2008), poverty regions are concentrated in rural regions of the entire country. The people who are living in rural areas are 56% of the total population in the country, but the 78% of poor and 80% of extreme poor live in rural areas. The report specifically mentions that 95% of the poorest villages are located in the Upper Egypt Region, pointing out clearly the heavy subject to be solved in the Upper Egypt Region.

(3) Direction of the Regional Development Plan and the Industrial Public Investment

The Egyptian Government wrote clearly in the Sixth Five-Year Plan that the budget of the public investment of 1,295LE billion or 45% of the total budget during the five years shall be invested to commodity activities consisting of agriculture and natural resource and secondary sectors consisting of manufacturing, electricity, water, building and construction.

Investment to the Agricultural and Irrigation Sector is mentioned as 9.7 LE billion for the last year of the Fifth Five-Year Plan (2006/07) to an annual 12.32 LE billion through the Sixth Five-Year Plan with an incremental ratio of 27%. The policy of the Government stresses strongly on the Agriculture and Irrigation sector. Specifically, the policy mentions that the budget of public works shall be invested in the Upper Egypt Region and in the Desert Region intensively.

(4) Necessity of Development in the Upper Egypt Region

The working population is mainly engaged in the manufacturing industry, petroleum industry, social industry and trading industry, and it flows into the urban area to gain employment opportunities. This in turn increases employment anxiety and creates more unemployed people. To prevent employment anxiety, the agriculture industry should be situated as the chief industry in the rural area as a source for

establishing a foundation for living.

The Agriculture sector shares 27% of the national labor structure (2006/07), and it should be kept as a stable industry for a better living standard by investment of the public budget for the improvement of agricultural infrastructures. To keep the economic increase of Egypt stable, all the industrial infrastructures including agriculture sector should be improved strongly. An outcome through the improvement of industries in the Upper Egypt Region where a high poverty ratio exists contributes to increasing stable economic development in the country.

2.2 Positioning of the Project in the National Plan

2.2.1 National Water Resources Plan

Egypt has constraints under the agreement between Sudan according to the International Water Agreement of 1959 concerning annual available water resources with a volume of 55.5 billion cubic meters (BCM) through the High Aswan Dam to the River Nile. The utilization of the surface water resources cannot exceed the amount of this volume. Under this situation, the available water resources volume is cause for concern as the countries will be faced with a more severe situation by an agreement among ten (10) countries which are members of the Nile Basin Initiative.

Consequently, receiving cooperation from the Netherlands, the Ministry of Water Resources and Irrigation (MWRI) established the “National Water Resources Plan 2017 (NWRP2017)” in May 2005, which was subtitled ”Water for the Future” based on the understanding that without proper water resources management, water will constrain socio-economic development. This policy of the National Water Resources Plan by MWRI has been targeted to be reached by 2017.

The main subject of this policy is defined as follows: that it is to make a solution against population increase and the limited available water resources. If available water resources will be developed in the future, it is essential to answer the following questions:

(1) How to accelerate the ratio of utilization efficiency of various kinds of water resources.
(2) How to support the Governmental Policy of agricultural expansion and what sector will be set as first priority, in spite of the present situation that the Government is concentrating on saving water resources with an optimization of efficiency and prioritization of domestic use and industrial use.
(3) How to manage the water resources management system, in spite of various water supply systems having been spread.

The population of Egypt is forecasted to be 83,000,000 in 2017 (Source: National Water Resources Plan 2017), though it was 63,000,000 in 2000. Furthermore, it is forecasted to be 150,000,000 in 2050. The Agriculture Sector and Water Resources Sector are major subjects to be solved from the aspect of food securities. Since agricultural activities depend on the irrigation systems 100%, the Agricultural Sector shares 95% of the total consumptive use, while municipal and industrial use shares 4% and fishponds share 1%, from the aspect of water resources demand.

For example, for wheat, the staple food in Egypt, the gross requirement is predicted to be 26 million tons in 2050 based on the unit consumption volume of 174.5 kg/year per head. This will prove to be rather inadequate for the future food security of Egypt considering the present situation of the gross arable land of 370 million ha and crop intensity of 30% in the winter crop of the wheat. For proposing a solution to this dilemma, tackling positively the horizontal expansion and the vertical expansion of the national development policies by the Government are priority issues. To meet these policies,

development of the water resources and arable land are the supreme proposition.

The Mega Project of the Toshka Development and the Sinai Development are expected to expand 35% of agricultural land, and based on the Policy of Horizontal Expansion, it can be possible to apply an increase of population of 20% in the NWRP2017. On the other hand, the available water resources volume per unit area and cultivated area are decreased gradually.

To achieve a breakthrough concerning the present situation of food securities in Egypt, Vertical Expansion shall be accelerated under development of the water resources management systems.

For realization of the rational water resources management, existing barrages situated along the River Nile, which are distributing irrigation water to an entire beneficiary area located in the country, have been rehabilitated intentionally by the Government beginning with the Ethna Barrage in 1994 till now.

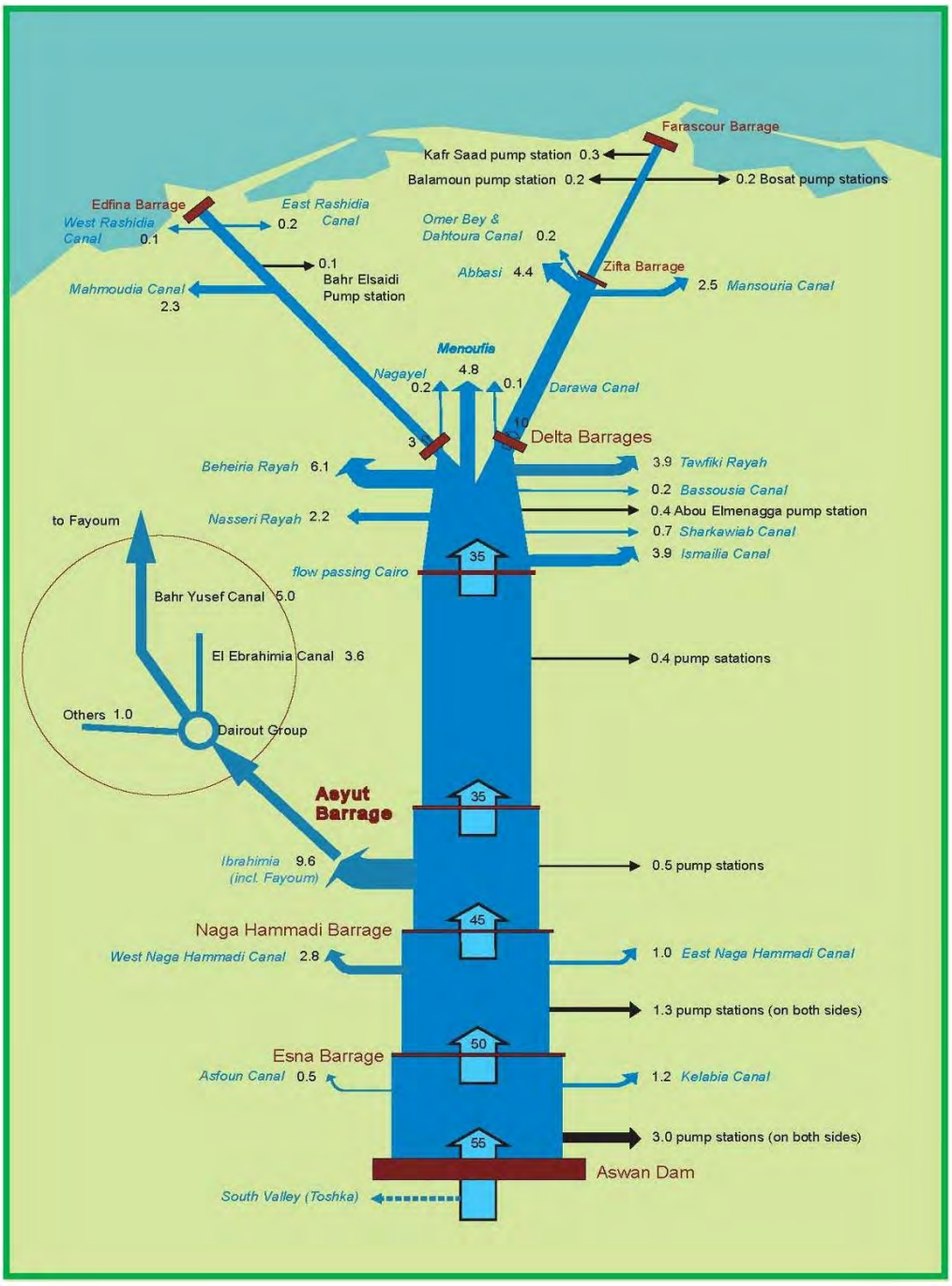


Figure 2.2.1 Water distribution Nile System (source; NAWQAM project)

2.2.2 National Agriculture Development Plan

In the Agriculture Sector of Egypt, the Ministry of Agriculture and Land Reclamation (MALR) takes a leading role to administrate the relevant stakeholders for developing their interests in agriculture as well as contributing to the national welfare such as food security. MALR has formulated a series of strategies of agricultural development since the early 1980s in order to set frameworks to be adopted by the State in realizing developmental goals of the Agriculture Sector. Following the 1980s and 1990s strategies, MALR prepared a long term strategy, "The Strategy of Agriculture Development in Egypt until the Year 2017" in 2003. These strategies focused on the following issues:

Table 2.2.1 Agriculture Development Strategies and their Focuses

Strategy	Focus of the Strategy
1980s Strategy	Developing the agricultural pricing policies as a mechanism for reallocating resources and providing motivation for farmers to raise production and freeing the agricultural sector from centralization of decision making.
1990s Strategy	Full deregulation of the cotton production, marketing and export, subsidizing agricultural research, increasing agricultural exports, and reviewing policies and criteria of allotting new lands.
The Strategy until 2017	Switching to decentralization in water management, creating a mechanism for recovering part of the expenses of irrigation and maintenance, combating trespassing agricultural land and achieving self-reliance in producing strategic crops.

In the course of implementing the Agriculture Development Strategy until 2017, MALR stated the pressed need to reformulate the on-going strategy due to the rapid changes of the regional and international environments such as the international food crisis experienced in 2008, etc. Hence, before the target year of the on-going strategy, MALR has established the new strategy, "Sustainable Agricultural Development Strategy 2030." The Strategy 2030 has set the following vision, mission and strategic goals:

Vision: "Seeking to accomplish a comprehensive social and economic rise based on a dynamic agricultural sector capable of sustainable fast growth, which is particularly interested in aiding the needy and limiting the rural poverty."

Mission: "Updating agriculture to achieve food security for citizens and improving the standard of living for the rural population by promoting the efficiency of using the resources and investing Egypt's political geographical vitals and the environmental differentiations among the Egyptian agricultural provinces."

Strategic Goals:

1. Improving the standard of living for rural populations and decreasing the rural poverty rates
2. Sustainable usage of natural agricultural resources
3. Increasing the agricultural productivity for the land and water
4. Accomplishing a high level of food security for strategic food goods
5. Supporting the competitive ability of the agricultural products in the international and local markets
6. Improving the agricultural investment climate

Among the goals above, "Sustainable usage of natural agricultural resources" and "Increasing the agricultural productivity for the land and water" are relative to the water resources management. Then

the Strategy until 2030 sets the approach of "raising the efficiency of water usages in cultivation." Based on the understanding that the irrigation efficiency does not exceed 70% in the present situation, but being possible to increase the efficiency at conveyance and on-farm levels, the Strategy 2030 sets the ambitious target to increase the efficiency from 50% in 2007 to 75% in 2017 and 80% in 2030.

To achieve the target, the Strategy 2030 mentions the measures as gradual improvement of the field irrigation system efficiency and a limiting of the rice cultivation area. With these measures, it is expected that nearly 5.3 BCM and 12.4 BCM will be saved in 2017 and 2030 respectively. The corresponding target areas for improving the field irrigation system are assumed as 2.25 million feddan (0.95 million ha) and 5 million feddan (2.1 million ha) in 2017 and 2030 respectively.

Targeting land reclamation with 1.25 million feddan (0.5 million ha) and 3.1 million feddan (1.3 million ha) in 2017 and 2030 respectively, total irrigated area will be from 8.4 million feddan (3.5 million ha) in 2007 to 9.65 million feddan (4 million ha) in 2017 and 11.5 million feddan (4.8 million ha) in 2030. Accordingly, the share of water per feddan will decrease from the current 6,900 m^3/feddan to 6,320 m^3/feddn/year in 2017 and 5,565 m^3/feddan/year in 2030. Hence, the Strategy 2030 also sets the goal of increasing the unit productivity of water as well as land with measures including agronomical ones such as introducing dryness and salinity-resistant varieties, short matured varieties, etc.

The Sustainable Agricultural Development Strategy 2030 prepared by MALR clearly defines that sustainable usage of natural agricultural resources is one of the pillars for agriculture development in Egypt and its strategy of "raising the efficiency of water usages in cultivation" is shared with the strategy of MWRI. But the emphasis in the Strategy 2030 is put on the improvement of on-farm irrigation efficiency as the nature of MALR whose mandate does not include the management of irrigation structures. Hence the role of improving irrigation efficiency at conveyance level, namely improving irrigation structures, is left to MWRI. Nevertheless, it is confirmed that the Project is consistent with the policy and strategy of the agriculture sector led by MALR.

2.2.3 National Sixth Five-Year Plan

(1) Main issues and target of the Sixth Five-Year Plan

The Plan stated the future development vision as the first axis as follows:

> Raising income and living standard
> Improving the quality of life

And the third axis was defined as follows:

> Developing the natural resources base, such as land resources, water resources and mineral resources.
> Developing the competitiveness of domestic production
> Securing the necessary minimum food requirements, such as including self sufficiency ratio of wheat.
> Expanding and developing the infrastructure
> Preserving the environment and realizing sustained development

According to the Sixth Five-Year Plan, although the relative GDP share of the agriculture sector has receded from 18.8% (1981/82) to 13.4% (2006/07), production and productivity increased. The agricultural areas gained about 2.4 million feddan during the period (1981/82-2006/07) with an

average increase rate of 96 thousand feddan per year based on the Policy of Horizontal Expansion. Meanwhile, the cropped area increased by 3.7 million feddan, approximately at a rate of 148 thousand feddan per year. Moreover, infrastructure works ware carried out during that period, covering about 3.1 million feddan in addition to internal reclamation works for an area of approximately 2.9 million feddan. Furthermore, the quantities produced of various agricultural crops increased continuously, as listed below based on the Policy of Vertical Expansion.

Table 2.2.2 Crop Production Egypt (Million Ton)

Crops	1981/82	2005/06
Grain Crops	8.0	23.0
Vegetables and Onion	8.8	21.3
Fruits	2.6	8.9
Meat	0.26	0.77
Poultry	0.144	1.0
Eggs (billion eggs)	3.2	9.0
Fish	0.21	0.89

Source: The National Sixth Five-Year Plan

The increase in agricultural production entitled a raise in the self-sufficiency rates of some of the main essential products, such as wheat (from 39% to 58%), and the realization of full self-sufficiency from corn, vegetables, fruits, dairy products, egg and fish.

Agricultural exports escalated from around $200 million to approximately $1 billion. The number of new agricultural job opportunities reached about 1.4 million, so that the number of agricultural workers rose from 4.1 million to about 5.5 million.

Based on the above-mentioned real result of former Five-Year Plan periods, the Cabinet has expressed the main objectives and aspect of that vision on January 2007, which are highly compatible with suggested targets of the Development Plan. The main objectives and targets related to agricultural development and rural development are defined as follows:

- Realizing higher rate of sustained economic growth until the contemplated future horizon (year 2030).
- Reducing social disparities between various social groups and securing fair development opportunities between different regions of the country, especially in the governorates of Upper-Egypt, Sinai and other marginalized regions.
- Increasing income levels for Egyptians and improving the quality of life within a sound environmental framework.
- Increasing the Egyptian inhabited area by directing development projects towards desert regions.

(2) The situation of Agriculture and Irrigation Sector in the Five-Year Plan

In a state of commencement of the sectoral aspects of the economic development plan, agriculture and irrigation were given first priority to be written in the policy and objectives of the target. Moreover, it mentioned that the Agriculture and Irrigation Sector's plan rests on the main pillars of the long-term agricultural and water resources development strategies.

The Long-Term Agricultural Development Strategy (2017) was defined as follows:

- Increasing agricultural production by 3.9% annually, through achieving economic efficiency in allocation and use of resources to sustain development and protect the environment.
- Achieving food security and develop agriculture exports by exploiting comparative and competitive advantages.
- Contributing in increasing employment opportunities and improving living standards in rural areas.

Similarly, the Water Resources Development Strategy was defined to aim at provision of water requirements, both quantitatively and qualitatively, to face long term various needs, and in harmony with the agricultural development strategy.

The main pillars and strategic mechanisms of the Agricultural Sector were mentioned as follows:

- Reclaiming 3.4 million feddans, including Toshka, east of Oynat, El-Salam canal, and other areas, with an annual average of 150 thousand feddan.
- Vertical Development by increasing agricultural production through expanded cultivation of highly productive crops that are characterized by efficiency in using inputs, resisting pests and with a limited growth period.
- Encouraging agricultural products' exports, as it is targeted to increase the value of annual exports from L.E. 2 billion to L.E. 5 biliion.
- Stimulating domestic and foreign investments in all agricultural areas.

To support the agricultural development strategy, the water resources development strategy is essential for realization of sustainable Irrigation Development. The main pillar of the Water Resources Development Strategy (2017) was defined as follows:

Development of new water resources

- Developing the use of deep ground water in the western desert and controlling reservoirs to prevent deterioration.

New water resources can be found by effective use of existing water resources because of the constraint of the international agreement of 55.5 billion m^3. In order to follow this line, existing irrigation facilities, located along the main canals under the Head Intake of the River Nile should be rehabilitated or improved to meet the above-mentioned policy.

The Five-Year Plan made clear that Rationalizing Irrigation Water use is to be done through changing the crop mix to reduce areas cultivated with water-intensive crops, such as rice and sugar cane, and reducing the use of the traditional surface irrigation systems in new lands, while improving such systems in both new and old lands, with the gradual shift from the surface "traditional" system to developed irrigation systems in areas cultivated with fruit trees on old land as well as expanding water rationalization programs and the re-use of agricultural drainage water in cultivation.

2.3 Activities of Other Donors

Foreign assistance by other donors for the Irrigation Sector has a long history in the country. Concerning the result of the foreign assistance for the rehabilitation of major barrages located along the River Nile, new construction of the Ethna Barrage had been started, which was located in the River

Nile downstream of Lake Nasser. It has been completed in 1994, funded by the Government of France, the Government of Italy, the Government of Romania and the Government of Australia. It consists of a regulator of 820 m with a power generation station and a navigation lock.

The Nagaa Hammady Barrage has been completed in 2008 funded by the Government of Germany after the Feasibility Study done by the Government of Germany in 1996. The latest information of the foreign assistance for the irrigation sector is summarized below.

Table 2.3.1 Foreign Assistance for Irrigation Sector

Name	Donor	Budget	Remarks
Integrated Irrigation Improvement and Management Project (IIIMP)	World Bank, Netherlands	300 M. US$	
El Mahmoudia Canal Project	KfW	30 M. US$	
El Bohia Canal Project	OPEC	10 M. US$	
West Delta Irrigation Project	World Bank	120 M. US$	Pumping
Integrated Water Resources Management Project (LIFE)	USAID	10 M. US$	Technical Cooperation
Ethna Barrage	Italy, Romania, Australia	325 M. Eur	Loan &Local
Nagaa Hammadi Barrage	EIB, KfW	320 M. Eur	Loan &Local
Assuit Barrage	KfW	430 M. Eur	Loan &Local

2.4 Priority and Relevance of the Project

2.4.1 Outline of the Project

The Project consists of the following three (3) main subjects:

- Rehabilitation and improvement of Dirout Group of Regulators
- Establishment of Integrated Water Management System
- Evaluation of Priority Minor Structures

Dirout Group of Regulators were constructed in 1872, thus it has past 137 years since being constructed. It is facing the following problems to be solved to meet required functions on entire beneficiary areas and beneficiaries based on the Agricultural Development Plan defined by the Government of Egypt and Ministry of Water Resources and Irrigation.

- Existing Regulators bodies are decrepit, due to aged facilities. The regulators are in an unstable condition from the aspect of stability of bodies and foundation.
- Operation of nineteen (19) gates is controlled by manually, so it is difficult to meet required water distribution on the basis of quantity and accuracy.
- Water distribution through seven main canals is difficult due to lack of proper water management systems including hardware and software on the basis of integrated water management systems for main canals.
- To gain benefit through the project, minor structures located in entire beneficiary areas should be rehabilitated or improved, to convey required irrigation water from secondary canals until end of farm.

Dirout Group of Regulators consists of five regulators and seven main canals. The group of regulators is distributing required irrigation water to seven main canals, through each regulator individually. The irrigation water, which counted a total annual discharge volume of 9.6 billion m^3, conveyed to Dirout Group of Regulators from the Assuit Barrage through the Ibrahimiya Intake and the Ibrahimiya Main Canal. It is equivalent to 17.3% of 55.5 billion m^3 which is the annual gross available water resources of Egypt through the River Nile.

Dirout Group of Regulators is a real root of irrigation systems to control and manage on the middle basin of the River Nile in the Upper Egypt Region. It holds beneficiary areas of approximately 600,000 ha under its group of regulators and its entire irrigation systems.

2.4.2 Priority and Relevance of the Project

(1) Priority of the Project

According to the Project Implementation Plan for Rehabilitation and Improvement on existing barrages along the River Nile and its main irrigation canals, the following seven projects are taken by MWRI with budgets for the year 2009/10.

- Assuit Barrage
- Zefta Barrage
- Mattai Regulator
- Asfoon Intake Regulator
- El Kalabya Intake Regulator
- El Bagurea Regulator
- Idfena Regulator
- **Dirout Group of Regulators**

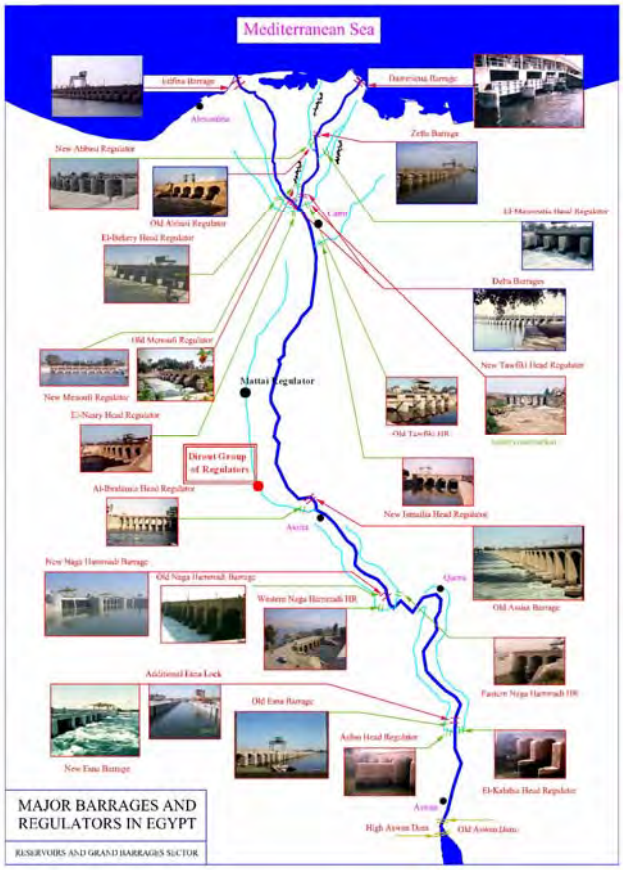


Figure 2.4.1 Location ,map of main regulator and barrage (source;RGBS)

The stages of each project are in various situations. The Assuit Barrage, which is one of the main barrages constructed along the River Nile, is under preparation of Pre-Qualification (P/Q) for International Tender of Construction Work of a new barrage. The MWRI allocated the budget in 2009/10 for implementation of studies and construction works individually, taking precedence over other domestic projects (Refer to Table 2.4.1). Among all the rehabilitation and improvement plans, except big barrages like the Assuit Barrage and the Zefta Barrage, the Dirout Group of Regulators was given a position out of five priority projects.

The Assuit Barrage takes the annual water resources of 9.6 billion m^3 through an intake facility from the River Nile, and then it reaches to the Dirout Group of Regulators through the Ibrahimia main canal. The annual discharge volume of 9.6 billion m^3 is equivalent to 17% of the available annual gross water resource volume of Egypt of 55.5 billion m^3. It irrigates the beneficiary area of 600,000 ha under the Dirout Group of Regulators, which is equivalent to 17% of the gross arable land of 3,700,000 ha in Egypt.

According to the annual budget allocation plan in 2009/10 of the MWRI, the Feasibility Study of Dirout Group of Regulators was allocated L.E. 500,000 as a local budget portion. This is evidence of defining this as a priority project over various types of the rehabilitation and improvement projects under the MWRI. It is possible to confirm and understand exactly the strong intention and firm resolution of the MWRI for future implementation of the Project to secure the realization of the Integrated Water Resources Management Plan under MWRI. Accordingly, the Project should be taken a step forward as the highest priority project in the sector.

Table 2.4.1 The Sixth Five Year Plane 2007/2008 to 2011/2012, The First Year of it

Ministry of Water Resourses and Irrigation (MWRI)

Resvoirs and Grand Barrage Sector (RGBS) [On Going Contracts]

Project No.	Project Name	ammout		expense to finish 2006/07	fifth planned schedule	first year of schedule
		1,000$	1,000LE	1,000 LE		
1	Assiut Barrage The first stage works of hydraulic model	----	3,000	3,000	0	3,000
2	Assiut Barrage The second stage works of hydraulic model	----	4,000	0	4,000	0
3	Feasibility study of Mattai Regulator	----	600	600	0	600
4	Feasibility study of El Bagurea Regulator	----	600	600	0	600
5	Study of Cracks in Idfena regulators	----	500	100	400	100
6	Feasibility study of construction weir d . S Idfenas regulators	----	300	75	225	75
7	Feasibility study of Dirout Groups of Regulators	800	500	300	200	300

General Directorate for Studies and Specifications [Investments for Financing Year 2009/10]

no	project	governerate	total cost	start date	expected to finish till 30/6/2009	finence amout 2009/10
1	New Assiut Barrage, Hydraulic Model Phase Ⅰ & Ⅱ	1,620	24/2/2008	23/8/2009	1010	----
2	Consultant Services for Assiut New Barrage	106,006.4	24/2/2008	2016	816,686LE +415,158EUR	----
3	EIA Stydies for Hydro Power Plants of New Assiut Barrage	----	----	----	----	----
4	pesomtrats maintinance	85.56	29/2/2008	28/11/2008	43.78	----
5	Feasibility Study of Zefta Barrage	9,400	18months		100	----
6	Feasibility Study of Asfoon Intake Regulator	----	9 months		----	----
	Feasibility Study of EL Kalabya Intake Regulator	----	9 months		----	----
	Feasibility Study of Idfena Barrage	0	18months		----	----
	TOTAL	117,111.96			1341.28	2,000

New Works

1	Feasibility Study of Construction weir d . S Idfenas Regulators	300	----	----	----	----
2	Feasibility Study of DiroutGgroups of Regulators	500LE + 800 $	----	----	0	300
	TOTAL	800LE+800 $	----	----	----	----

TOTAL	118,161.96LE+	----	----	1341.28	2,300
	800$	----	----	----	----

(2) Relevance of the Project

Reducing of the social disparities between various social groups and different regions of the country by the Sixth Five-Year Plan is defined as one of the most important and urgent subjects to be solved. The Upper Egypt Region is specified as the most emphasized region in the country concerning the above-mentioned issue.

Additionally, for the resolution of uneasiness against the food security of the country because of the population increase, planning and practice of policy for increase of agricultural production is an urgent issue. The Sixth Five-Year Plan defined agricultural activities as the most important to meet above-mentioned issue.

To strengthen activities of the Agricultural Sector, before everything, securing of the available water resources is an essential measure to realize sustainable agricultural production in the country. However, annual gross available water resources in the country are actually limited to 55.5 billion m^3. Development of the ground water resources is an urgent issue, but it is hard to extend it nation-wide because of the hydro-geological condition.

Accordingly, the Integrated Water Resources Management, which was defined by MWRI in "National Water Resources Plan 2017," should be placed as a basic concept from the aspect of the rational water utilization to obtain available water resources to create agricultural production in the country.

To make a concrete measure to apply the Integrated Water Resources Management on the agricultural sector, rational water management systems should be considered in the Irrigation Sector for effective utilization of limited water resources in the annual gross amount of 55.5 billion m^3, from the aspect of software technology of utilization of the irrigation facilities.

First of all, to consolidate the Integrated Water Resources Management, modernization of the main irrigation infrastructures should be an essential activity; in addition, the Integrated Water Management System should be installed by covering entire facilities rehabilitated by the latest engineering and technology as irrigation facilities.

Accordingly, the Project for the rehabilitation and improvement of Dirout Group of Regulators meets the basic concept, above-mentioned, by collaboration of rehabilitation and modernization for existing regulators and establishment of integrated water management systems on seven main canal systems. It has enough rationality to be adopted as the Feasibility Study for future implementation by Japanese Yen Loan.

In addition to the above-mentioned reasons, rehabilitation and improvement of the Minor Structures, located under secondary canals, contribute to improvement of irrigation efficiency on the farm situated under terminal irrigation facilities.

Finally, the Project for the Rehabilitation and Improvement of Dirout Group of Regulators and the establishment of Integrated Water Management System and Rehabilitation of Priority Minor Structures can contribute to the Policy of the MWRI by increasing the agricultural productivity with an increase of agricultural production and an increase of farming technology.

The project for the rehabilitation and improvement of the Dirout Group of Regulators has a great national significance from the viewpoint of the national food security in order to escape from the potentially severe situation predicted for 2050 in the Upper Egypt regions located in the middle Nile River Basin, the food supply base.

CHAPTER 3

THE STUDY AREA

CHAPTER 3: THE STUDY AREA

3.1 Location and General Features

3.1.1 Location

The Study Area is defined as follows:

- Dirout Group of Regulators and Vicinity
- Beneficiary area belonged from main canals and secondary canals until Meska.

The entire beneficiary area is located in Giza Governorate (plus 6th October Governorate)[1], Fayum Governorate, Beni Suef Governorate, Minya Governorate and Assuit Governorate. These five Governorates belong to Upper Egypt and are situated in the Middle Basin Region of the River Nile. The total area of these five Governorates is 84,048 km^2 which is 8.3% of the whole area of the country, and the population is 18,050,682, which is 25% of the whole population of the country. (Refer to Table 3.1.1)

Table 3.1.1 Demography in Egypt by Governorate

No.	Name	Area (km2)	Population (2006)
1	Giza	80	3,115,139
2	6th of October	8,741	2,575,358
3	Beni Suef	10,954	2,286,368
4	Fayum	6,068	2,505,725
5	Minya	32,279	4,150,397
6	Assuit	25,926	3,417,695
Project Area	sub-total (a)	84,048	18,050,682
	(a) / Total	8.33%	24.95%
7	Suhag	11,022	3,737,171
8	Quena	10,798	2,992,392
9	Luxor	2,410	449,790
10	Aswan	62,726	1,176,217
Upper Egypt	sub-total (b)	171,004	26,406,252
	(b) / Total	16.94%	36.50%
11	Cairo	366	6,687,961
12	Alexandria	2,300	4,099,348
13	Port Said	1,351	559,581
14	Suez	9,002	508,306
15	Helwan	7,082	1,700,867
16	Damietta	910	1,094,305
17	Dakhalia	3,716	4,974,545
18	Sharkia	4,911	5,343,086
19	Kalyoubia	1,124	4,242,956
20	Kafr El Sheikh	3,748	2,613,739
21	Gharbia	1,948	4,001,199
22	Menoufia	2,499	3,260,097
23	Behera	9,826	4,743,845
24	Ismailia	5,067	949,048
25	Red Sea	119,099	233,438
26	El-Wadi El Gidid	440,098	183,493
27	Matrouh	166,563	319,897
28	North Sinai	27,564	340,737
29	South Sinai	31,272	86,419
	sub-total (c)	838,446	45,942,867
	Total	1,009,450	72,349,119

Source: Statistical Year Book (CAPMAS) Sep. 2009

Dirout Group of Regulators are situated at Dirout City which is located 310 km south of the city of Cairo. Dirout Group of Regulators was constructed 60 km downstream from the Ibrahimia Intake which was situated beside the Assuit Barrage. The Assuit Barrage is the third main barrage in the downstream reaches from the High Aswan Dam (HAD), which is located 480 km downstream from the HAD.

Dirout Group of Regulators branches into seven (7) main canals through gates from the Ibrahimia main canal. Seven main canals are conveying irrigation water to the entire beneficiary area of 600,000 ha (refer to following section 3.1.2). The greatest capacity of the canal is the Bahar Yusef Irrigation Canal out of seven main canals, which has the maximum capacity of 234 m^3/sec during the summer season. Its canal length is measured to be 313 km from Dirout until the termination of the canal system in the city of Fayum.

3. 1.2 Geographic Conditions

The beneficiary area is distributed on the left bank of the River Nile with the geological condition of the areas being divided into an alluvium plain-lowland and a basin. The basin area is located in the Fayum Governorate only, the land level of its area is almost minus 45 m (-45 m above mean sea level)

[1] Giza Governorate has been divided in to three (3) governorates since 2008. Among the three, new Giza and 6th October Governorates consist of the part of the beneficiary area.

and it continues to Lake Qaron with a steep slope of 1 to 500.

The beneficiary area is located in the Upper Egypt Region, with its main economical activity being agriculture. The utilization ratio of the arable land for agricultural activity is almost 90% on average. According to the Statistical Year Book 2006, total cultivated area of the four beneficiary governorates (Giza, Beni Suef, Fayum and Minya) is 1,429,454 feddan or 600,371 ha (refer to Table 3.6.1 in the Section 3.6.1 Agriculture Production). Therefore the total beneficiary area can be said to be about 600,000 ha. According to the Statistical Year Book 2009, the substantial land-use is summarized as follows, individually.

Table 3.1.2 Land Use of the Beneficiary Area

Items	Area by Governorate (km^2)				
	Giza	Fayum	Beni Suef	Minya	Total
Gross area	8,821.0	6,068.0	10,954.0	32,279.0	58,122.0
Arable land	757.0	1,856.0	1,369.4	2,411.7	6,394.1
Farmland (Old land)	585.7		1,091.3	1,978.0	
(Reclaimed land)	150.5		132.6	250.4	
Farmland Total	736.2		1,223.9	2,228.4	
% of Farmland	97%		89%	92%	

Source: Statistical Year Book (CAPMAS) Sep 2009
Note: Arable land = Farmland + Residential area + Others (Roads, Public land, etc.)
Area of Giza = Giza + 6th October governorate

Since the Assuit Governorate covers little part of the beneficiary area, it is excluded in the table. The geographical condition of the Fayum area is situated at low land level, and the irrigation system in the area was established by the gravity method from old times, traditionally.

3.1.3 Climate

Egyptian climate is affected by several geographical factors such as location, topography, and solar and water stretches. The Project area is located from 27° north latitude to 30° , and the center of the longitude is located in 31° east longitude. The climate zone of the Project area is classified as a desert climate zone, with the climate condition of each Governorate being shown in Table-1. Data was collected from the STATISTICAL YEAR BOOK 2005, 2007, 2009. (CAPMAS)

(1) Temperature

The Project area covers the Giza, Beni Suef, Fayoum and Minya Governorates, and the temperature data listed in the Statistical Year Book is summarized as following figure:

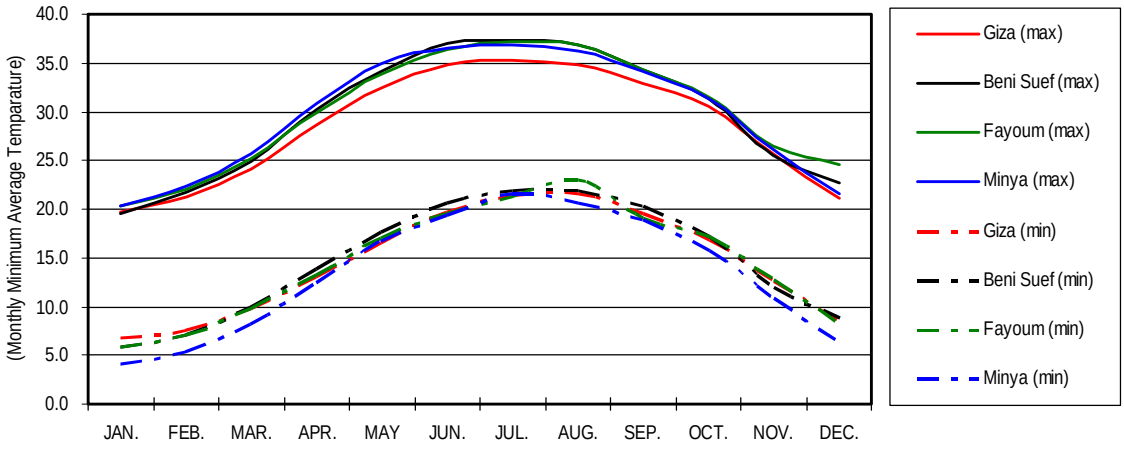


Figure 3.1.1 Max. and Min. Temperature in the Beneficiary Governorates

According to the above-mentioned figure, the maximum temperature in the summer season (June to September) is 35℃(±) as the monthly mean among the four (4) Governorates, and in the winter season (December to March) it is 21℃(±) as the monthly mean. Minimum temperature in the summer season is 20℃(±), and in the winter season it is 6℃(±). It is characteristic of the climate condition that daily differences of the temperature are large.

(2) Rainfall

The rainfall amount in the project area is very small. It is measured as an annual rainfall of 20.8 mm/year in the Giza Governorate and 3.2mm/year in the Minya Governorate for the past three years. The effective rainfall for agriculture cannot be expected through the year in the Project area. Figure below shows the rainfall with monthly average for the past 3 years in the four (4) governorates.

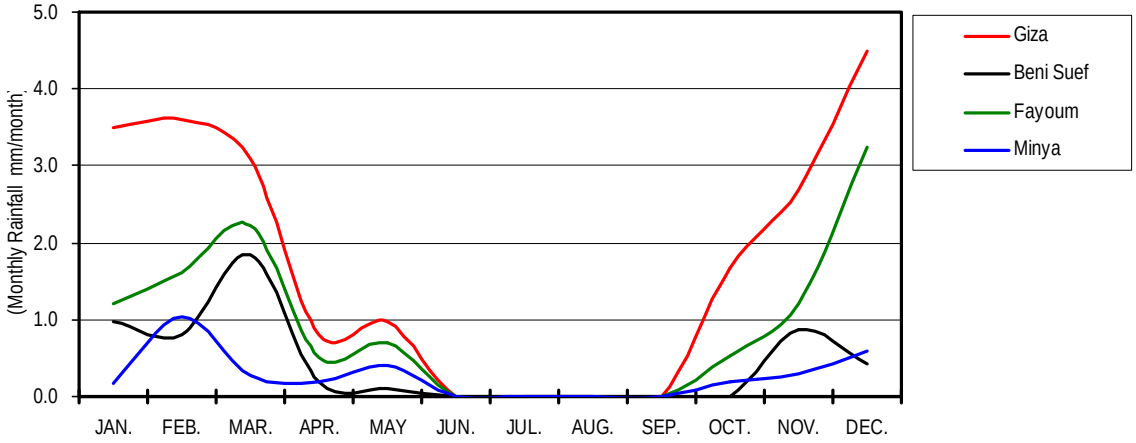


Figure 3.1.2 Annual Rainfall with Monthly Average of the Past 3 years

(3) Sunshine hours

Since rainfall is unexpected because of the small amounts, sunshine hours are plenty through the year. It is a suitable condition for agricultural activities with much sunshine energy, if irrigation water will flow into farmlands without interruption.

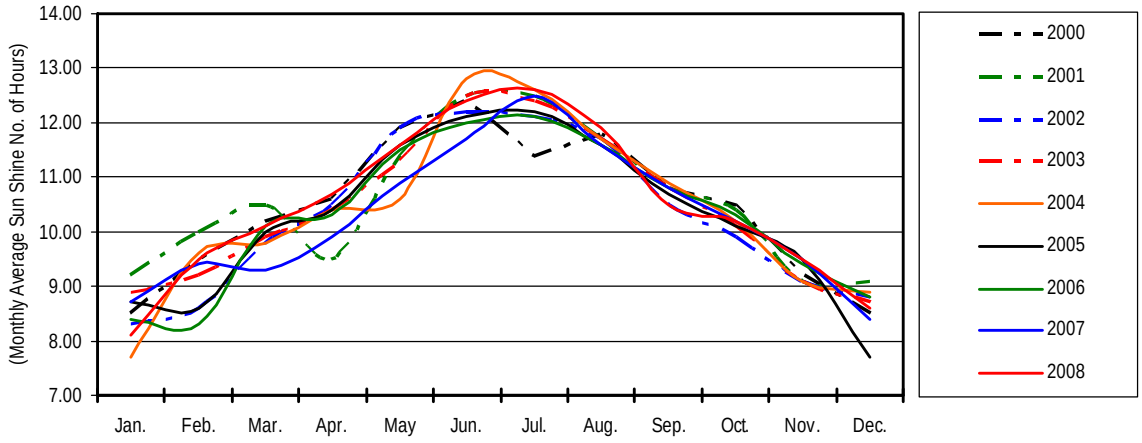


Figure 3.1.3 Monthly Sunshine hours Average of the per a day

3.1.4 Hydrology

(1) Inflow volume into the High Aswan Dam Reservoir

The River Nile supplies 87% of the available water resources in Egypt, the resources is stored in the High Aswan Dam (HAD). (International Commission on Irrigation and Drainage, General Meeting, 1996)

According to the data, annual average inflow discharge volume into the HAD is 63,476 MCM in the past 10 years. It shows that average inflow volume is larger than 55.5 BMC which is limited by the international agreement between Sudan, as mentioned before.

Table 3.1.3 Monthly Inflow Volume Record at High Aswan Dam Reservoir

YEAR	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
1999	1,922	1,621	1,377	1,665	2,678	2,199	6,225	20,151	22,105	12,433	7,731	3,119	83,226
2001	1,513	1,608	1,441	2,750	2,052	2,027	4,523	17,985	17,103	9,018	6,520	3,247	69,787
2002	1,950	1,656	1,268	1,524	2,439	1,848	4,977	25,801	20,112	5,388	4,468	2,320	73,751
2003	1,507	1,513	1,561	1,642	2,378	1,494	2,702	14,310	10,106	5,050	1,247	1,335	44,845
2004	1,292	474	686	1,616	1,852	846	2,980	19,548	17,960	8,006	1,965	1,432	58,657
2005	1,062	651	899	1,184	734	349	2,738	16,025	9,190	8,246	2,223	1,737	45,038
2006	1,420	555	369	422	1,098	1,246	4,746	15,503	16,356	7,399	2,775	1,798	53,687
2007	1,277	1,080	422	803	686	1,931	3,483	20,925	23,600	8,932	3,267	2,223	68,629
2008	1,515	1,634	1,397	1,263	1,784	2,200	11,680	22,567	23,647	11,404	2,780	1,630	83,501
2009	1,701	813	851	1,166	1,647	2,252	5,462	19,059	16,314	2,277	990	1,102	53,634
Average	1,516	1,161	1,027	1,404	1,735	1,639	4,952	19,187	17,649	7,815	3,397	1,994	63,476

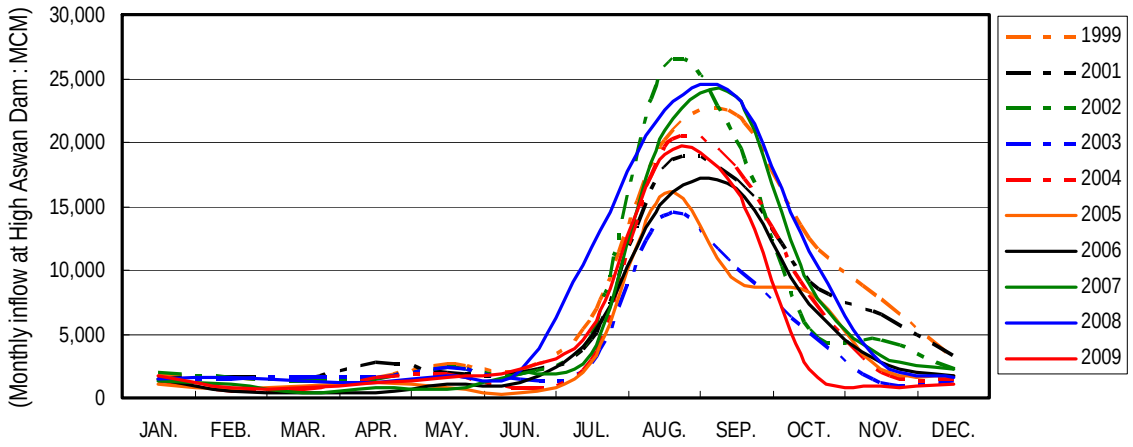


Figure 3.1.4 Monthly Inflow Volume in at High Aswan Dam Reservoir

(2) Intake volue at the Ibrahimia Intake

The Ibrahimia Intake which is located beside the Assuit Barrage, the third barrage from the High Aswan Dam (HAD). The Ibrahimia main canal conveys irrigation water to Dirout Group of Regulators. The monthly intake volume at the Ibrahimia Intake is shown below and the monthly discharge volume through the Bahar Yusef regulator and the Ibrahimia regulator are shown below.

According to the data, annual average intake volume at the Ibrahimia Intake is 10.215 BMC in the past 10 years. It reaches up to 9.6 BMC which is defined as the annual intake volume in the National Water Resources Plan 2017. (P 2-8)

Table 3.1.4 Monthly Discharge Records at Ibrahimia Intake

Unit:MCM

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1,999	498	597	875	836	951	1,117	1,194	1,207	908	851	727	620	10,381
2,000	175	765	833	847	922	1,159	1,235	1,207	908	808	711	562	10,132
2,001	284	700	845	846	901	1,149	1,227	1,199	918	875	707	555	10,206
2,002	305	617	839	816	902	1,144	1,208	1,203	879	747	668	549	9,877
2,003	187	650	738	778	860	1,133	1,209	1,207	886	781	716	550	9,695
2,004	269	668	761	808	899	1,127	1,199	1,206	911	761	727	556	9,892
2,005	219	657	786	831	877	1,145	1,216	1,210	918	788	723	537	9,907
2,006	258	633	855	848	894	1,185	1,217	1,181	935	785	741	595	10,127
2,007	358	728	849	897	916	1,158	1,197	1,223	991	933	894	640	10,784
2,008	260	749	929	986	1,025	1,161	1,234	1,250	1,019	942	792	718	11,065
Average	281	676	831	849	915	1,148	1,214	1,209	927	827	741	588	10,207

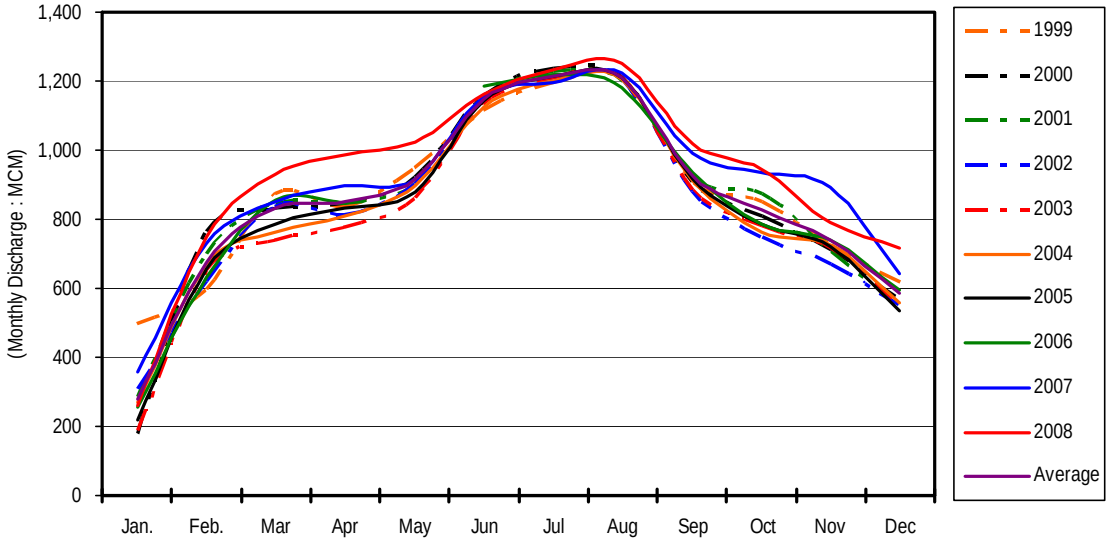


Figure 3.1.5 Monthly Discharge Records at Ibrahimia Intake

Annual average discharge volume through the Bahar Yusef regulator is 4.820 BMC and through the Ibrahimia regulator 4.069 BMC for the past 10 years individually. Its ratio between Bahar Yusef and Ibrahimia are 47% and 40% out of seven main canals at Dirout Group of Regulators.

Table 3.1.5 Annual Discharge Volume at Major Point

unit : MCM

Year	Ibrahimia Intake	Bahar Yousef	Ibrahimia at Dirout
1999	10,381	4,759	***
2000	10,132	4,690	4,182
2001	10,206	4,752	4,084
2002	9,877	4,640	3,965
2003	9,695	4,608	3,821
2004	9,892	4,722	3,907
2005	9,907	4,735	3,804
2006	10,127	4,967	3,903
2007	10,784	5,050	4,454
2008	11,065	5,281	4,500
Average	10,207	4,820	4,069
(Ratio)	(100%)	(47%)	(40%)

3.2 Socio-economic Conditions

3.2.1 Area and Population

The beneficiary area of the Project lies on five governorates, namely the Giza, Beni Suef, Fayum, Minya, and Asuit governorates. Among them, the beneficiary area in the Asuit governorate is so small that the statistical data at the governorate level for the remaining four (4) governorates will be used for featuring the beneficiary area.

Total Population of the beneficiary governorates were 14.74 million in 2006 when the population census was carried out, and the population in 2009 is estimated at 15.45 million. The share of the population to the nation is 20% both in 2006 and 2009. The total area of the beneficiary governorates extend to 62,485 km^2, but for the inhabited area within the four (4) governorates it is only 6,828 km^2 or 9% of the total land. The population in Giza is the highest among the beneficiary governorates since the governorate includes a part of the Greater Cairo area. As for the inhabited area, i.e. arable land, Minya has the largest share among the four (4) governorates. Population density of arable land in the beneficiary governorates is estimated at 2,159 in 2006 and 2,263 in 2009, which is around 2.3 times of the national density.

Table 3.2.1 Demographic Data on the Beneficiary Governorates

Governorate	1996	2001	2006	2009 *	Total area (km2) *	Inhabited Area (km2) *	Share Inhabited	Pop.Density(person/km2)	
								2006	2009
Giza *	4,739,667	5,253,685	5,800,382	6,031,052	13,184.0	1,191.0	9.0%	4,870	5,064
Beni Suef	1,838,157	2,086,001	2,286,368	2,407,301	10,954.0	1,369.4	12.5%	1,670	1,758
Fayum	1,968,137	2,241,770	2,505,725	2,646,461	6,068.0	1,856.0	30.6%	1,350	1,426
Minya	3,270,599	3,725,454	4,150,397	4,369,104	32,279.0	2,411.7	7.5%	1,721	1,812
Total	11,816,560	13,306,910	14,742,872	15,453,918	62,485.0	6,828.1	10.9%	2,159	2,263
National	58,755,211	65,298,293	72,349,119	76,054,112	1,009,449.8	78,990.2	7.8%	916	963
% of the 4 gov't	20.1%	20.4%	20.4%	20.3%	6%	9%	140%	236%	235%

Source: Statistical Year Book (CAPMAS)

(*) Giza Governoate was divided into Giza, 6 October and Helwan governorates in 2008. The area of Giza is beofore the division of the governorat Helwan governorate consists of the former jurisdictions of Giza and Cairo. To compare the population of Giza with the past, the population of Giza in 2009 is estimated adding the ones of Giza, 6 october and 4% of Helwan in 2009 (it is estimated from 2006 census that 4% of Helwan population used to belong to Giza).

Population increase in the beneficiary governorates between the census years of 1996 and 2006 is around three (3) million. Hence the average annual growth rate between 1996 and 2006 is calculated at 2.2%, which is slightly higher than the national average of 2.1% during the same period. Among the four (4) governorates, Minya and Fayum marked the highest growth rate of 2.4% followed by 2.2% for Beni Suef and 2.0% for Giza. During the period from 2006 to 2009, the growth rates of the beneficiary governorates are estimated in a lower range from the period above, as the average annual growth rate of the 4 (four) governorates is 1.6%, which is a little lower than the national estimate of 1.7%. According to the Population Census of 2006, the rural population in the beneficiary governorates is 9.2 million, occupying 63% of the total population in the governorates. The share of the rural population in the beneficiary governorates is higher than that of the national level of 57%. Among the beneficiary governorates, the share of rural population in Minya

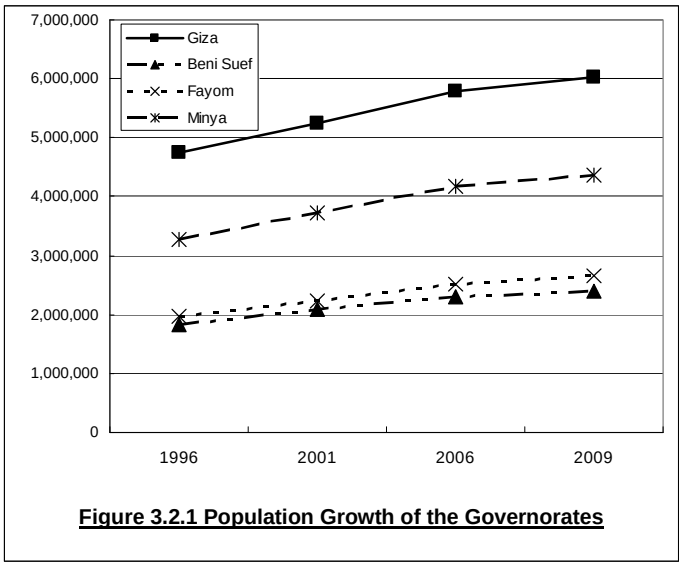


Figure 3.2.1 Population Growth of the Governorates

is the highest with 81% followed by 78% in Fayum and 77% in Beni Suef. The share of rural population in Giza is only 37% since the governorate covers a part of the Greater Cairo area. The number of rural households in the beneficiary governorates number two (2) million, and the average family size in the governorates ranges from 4.2 to 4.7 with the average size being calculated at 4.5, slightly higher than the national average of 4.4 (refer to Table 3.2.2).

Table 3.2.2 Population in the Rural Area and Number of Household (2006 Population Census)

Governorate	Population					No. of Household			Average Family Size	
	Urban	Rural	Total	Urban	Rural	Urban	Rural	Total	Urban	Rural
Giza	3,659,764	2,140,618	5,800,382	63%	37%	936,278	504,029	1,440,307	3.9	4.2
Beni Suef	527,669	1,758,699	2,286,368	23%	77%	124,394	371,293	495,687	4.2	4.7
Fayum	560,163	1,945,562	2,505,725	22%	78%	135,861	426,986	562,847	4.1	4.6
Menia	772,758	3,377,639	4,150,397	19%	81%	182,999	727,530	910,529	4.2	4.6
Total	5,520,354	9,222,518	14,742,872	37%	63%	1,379,532	2,029,838	3,409,370	4.0	4.5
National	30,974,151	41,374,968	72,349,119	43%	57%	7,844,852	9,444,447	17,289,299	3.9	4.4

Source: Statisitcal Year Book (CAPMAS) (Population Census 2006)

3.2.2 Living Conditions

Based on the Egypt Human Development Reports in 2004 and 2008 published by UNDP, we will describe the living conditions of the beneficiary governorates. Table 3.2.3 below shows the poverty incidence and income level of the beneficiary governorates. The average share of poor persons[2] in the beneficiary governorates numbers 23% in 2002 and 25.4% in 2006. The average of the four (4) governorates is worse than the national average, as well as other regions.

As for the average poor persons of Upper Egypt, it is worse than the four (4) governorates because of the highest poverty incidence in Asuit (60.6%) and the third highest in Suhag (40.7%). Beni Suef marks the second highest poverty incidence with 45.4% in 2006 among all the governorates in Egypt. Poor persons in Minya numbered 39.4% in 2006, which was drastically worse compared to 2002, while the share of poor persons in Fayum decreased by more than half from 2002 to 2006.

According to the UNDP data, GDP per capita of the beneficiary governorates in 2006 is estimated at LE 6,171 or $5,714, which is lower than the national average. GDP per capita has grown from 2002 to 2006, except in the Giza governorate. Also, GDP per capita in urban governorates showed a decrease from 2002 to 2006. Although the poverty incidence of Fayum in 2006 is the lowest among the four (4) governorates, GDP per capita in Fayum is the lowest among the four (4) governorates as well. Households with televisions in the beneficiary governorates number between 76% and 93.1%, fairly lower than the other regions and the national level.

Table 3.2.3 Poverty Incidence and Income Level in the Study Governorates

Governorate	Poor Persons (%)		Poor Persons (%) (2002)		GDP per Capita (LE)		GDP per Capita (PPP$)		Households with Television (%)
	2002	2006	Urban	Rural	2002	2006	2002	2006	2004
Giza	12.6	13.1	-	-	6,381	5,552	4,215	5,141	93.1
Beni Suef	45.7	45.4	-	-	3,454	7,043	2,282	6,521	78.8
Fayoum	30.1	12.0	-	-	3,746	5,706	2,475	5,283	76.0
Miniya	20.6	39.4	-	-	4,061	6,823	2,682	6,318	78.6
Total (Ave.)	23.0	25.4	-	-	4,821	6,171	3,185	5,714	83.9
Urban Gov't	5.7	5.7	5.7	-	10,457	6,093	6,908	5,642	95.3
Lower Egypt	10.0	14.5	6.3	11.3	5,246	6,911	3,465	6,399	90.6
Upper Egypt	28.8	32.5	19.3	32.8	5,197	5,867	3,433	5,432	84.2
Frontier Gov't	9.9	14.5	4.0	18.0	7,770	6,376	5,133	5,903	81.2
National	16.4	19.6	9.6	21.2	5,742	6,372	3,793	5,900	89.4

Source: Egypt Human Development Reports 2004 and 2008 (UNDP)

[2] Poverty line is defined in the Egypt Human Development Reports considering the value of required calorie (food poverty line) plus non-food expenditure. Poverty line in Egypt in 2008 is defined as LE1,116 for the lower poverty line and LE1,574 for the upper poverty line.

Table 3.2.4 shows the unemployment status in the beneficiary governorates. The average unemployment ratio has slightly worsened from 6.5% in 2002 to 6.9% in 2006, but the unemployment ratios in Fayum and Minya halved from 2002 to 2006. The unemployment ratio in the beneficiary governorates is lower than the national level. This would be attributed to the significance of the Agriculture Sector in these governorates. As described in the following section, the Agriculture Sector has a significant role in providing job opportunities in Egypt. This can be proved from the unemployment ratios between urban areas and rural areas as shown in the right side columns of Table 3.2.4. The unemployment ratios in rural areas are much lower than those of urban areas in all the regions as well as the beneficiary governorates (In 2002 unemployment ratio in the urban areas of the four governorates was 10.4% while the ratio for rural area was 5.2%. Unemployment ratios of urban and rural areas in 2006 were 9.6% and 5.2% respectively. However, it should be noted that there are potential unemployment in the rural area as labor for farming could used more than marginal labor demand).

Table 3.2.4 Unemployment in the Study Governorates

Governorate	Unemployment (%)		Female Unemployment (%)		Unemployment (%) (2002)		Unemployment (%) (2006)	
	2002	2006	2002	2006	Urban	Rural	Urban	Rural
Giza	5.3	9.6	18.4	23.6	5.6	4.9	10.8	7.9
Beni Suef	6.0	9.7	12.6	8.7	12.2	3.9	8.0	2.4
Fayoum	7.3	3.7	30.0	33.2	11.9	5.6	6.2	2.6
Miniya	7.9	3.4	25.0	20.7	15.1	6.0	10.8	4.5
Total (Ave.)	6.5	6.9	21.3	22.0	10.4	5.2	9.6	5.2
Urban Gov't	7.8	10.8	19.6	26.6	7.8	-	10.8	-
Lower Egypt	11.7	9.3	25.2	24.4	14.3	10.6	10.9	8.8
Upper Egypt	9.4	19.4	24.3	25.7	12.4	7.8	12.4	8.5
Frontier Gov't	8.8	6.3	20.3	18.8	9.6	2.0	7.0	5.3
National	10.2	9.3	23.9	25.1	11.0	9.5	10.9	8.0

Source: Egypt Human Development Reports 2004 and 2008 (UNDP)

Table 3.2.5 summarizes some indicators relative to health and education status. The average life expectancy and infant mortality in the beneficiary governorates in 2006 were 69.4 years and 20.4 per 1,000 infants respectively. Although both data sets of the four (4) governorates are worse than the national average, the gap between the governorates and the national level is narrowing as compared to the past. Combined basic and secondary enrollment and adult literacy rates in the beneficiary governorates in 2006 were 82.3% and 63.4% respectively. Both are lower than the national average. Furthermore, the gap between the urban area and the rural area is more significant as the table shows the literacy rate in the urban area of the beneficiary governorates in 2006 was 75.5% while that of the rural area was only 56.8%.

Table 3.2.5 Health and Education Status in the Study Governorates

Governorate	Life Expectancy at Birth (years)			Infant Mortarity (per 1000 live births)			Combined basic and Secondary Enrollement (%)			Adult literacy rate (+15)			Literacy (+15) (%) (2006)	
	1976	2002	2006	1961	2002	2005	1961	2002	2006	1960	2002	2006	Urban	Rural
Giza	55.2	68.5	69.1	126.0	17.7	13.5	45.8	87.4	82.6	27.9	75.2	72.7	79.4	62.6
Beni Suef	50.1	70.6	71.2	106.0	31.5	27.1	43.6	78.7	81.5	18.6	54.3	58.1	72.1	53.6
Fayoum	49.3	68.5	69.1	151.0	26.9	20.9	40.9	76.2	79.1	16.3	50.5	57.3	69.3	53.6
Miniya	52.1	68.3	68.9	108.0	33.4	25.9	35.2	84.5	84.4	18.1	52.2	57.0	75.7	52.4
Total (Ave.)	52.5	68.8	69.4	122.0	25.9	20.4	41.6	83.3	82.3	21.7	61.2	63.4	75.5	56.8
Urban Gov't	57.6	71.1	71.8	147.0	29.9	29.6	59.1	98.2	79.8	46.9	85.4	80.5	80.5	-
Lower Egypt	55.6	70.5	71.1	93.0	18.1	14.3	38.9	91.4	79.9	23.1	68.6	69.4	78.8	65.8
Upper Egypt	53.0	69.2	69.8	102.0	29.2	24.0	36.5	86.1	83.8	17.8	59.7	63.6	76.9	57.1
Frontier Gov't	-	70.1	70.7	124.0	21.2	16.5	-	77.8	90.6	22.5	74.3	76.2	82.2	62.5
National	55.0	70.1	71.3	108.0	24.5	20.5	42.0	90.1	89.4	25.8	69.4	69.5	79.1	62.0

Source: Egypt Human Development Reports 2004 and 2008 (UNDP)

Table 3.2.6 summarizes the status of basic infrastructures for indicating the standard of living in the region. Installment of piped water has been progressing and the average share of the households with piped water in the beneficiary governorates reached 94.2% in 2006, though the shares in Beni Suef and Minya are still below 90%. The installation of sanitation facility has continued to be slow, as the average share of the households with sanitation in the beneficiary governorates is 39% in 2006, much

lower than the national average of 50.5%. Beni Suef and Minya are also delayed in sanitation as the shares of both governorates in 2006 were only 15.2% and 12.7% respectively. The gap of the sanitation installation between urban and rural areas is also significant. As the table shows, the share of households with sanitation in the rural areas of the beneficiary governorates in 2006 is merely 19.5%, less than one-third of the urban share in the four (4) governorates. It should be clear that the beneficiary area of the Project, namely the rural areas of the four (4) governorates would be rather left behind in the development in Egypt.

Table 3.2.6 Basic Infrastructure in the Study Governorates

Governorate	% of Households with Access to							
	Piped water			Sanitation	Piped Water (2006)		Sanitation (2006)	
	1976	2001	2006	2006	Urban	Rural	Urban	Rural
Giza	61.1	94.2	98.4	69.3	99.4	97.0	91.8	35.1
Beni Suef	67.7	72.1	88.6	15.2	97.2	85.8	49.6	3.7
Fayoum	83.0	79.6	97.2	35.4	99.4	96.5	75.5	22.7
Miniya	58.9	82.3	89.7	12.7	98.7	87.5	44.3	4.8
Total (Ave.)	65.2	84.9	94.2	39.1	98.9	92.4	69.0	19.5
Urban Gov't	92.3	99.8	99.1	90.8	99.1	-	90.8	-
Lower Egypt	69.2	89.6	95.0	48.5	98.7	93.5	86.0	33.7
Upper Egypt	60.4	85.9	94.7	30.5	99.0	92.5	67.2	11.7
Frontier Gov't	47.8	90.0	84.5	49.5	92.5	66.2	62.1	21.1
National	70.9	91.3	95.5	50.5	98.8	92.9	82.5	24.3

Source: Egypt Human Development Reports 2004 and 2008 (UNDP)

3.2.3 Agricultural Demography

The Agriculture Sector in the Study area is important, especially in providing job opportunity. As Figure 3.2.2 and Table 3.2.7 show, the share of employment in agriculture & hunting is considerably high, except for the Giza governorate. The shares of employment in agriculture and hunting in Giza, Beni Suef, Fayum and Minya are estimated at 10%, 59%, 43% and 61% respectively, while the national average is estimated at 32%. It is also significant that employment of women in agriculture and hunting is high, especially in Beni Suef and Minya, in which the shares of employed women in the Agriculture Sector number 84% and 79% respectively. It is considered that the Agriculture Sector is also important from the gender aspects in Egypt.

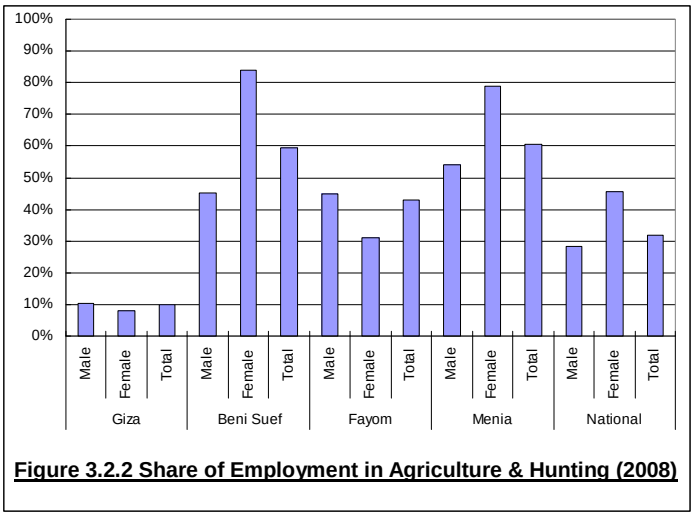


Figure 3.2.2 Share of Employment in Agriculture & Hunting (2008)

Table 3.2.7 Share of Employed Persons by Economic Activity (Estimated in 2008)

Governorate	Sex	**Agriculture & Hunting**	Mining, Quarrying & Manufacturin	Construction & Building	Retail & Wholesale trade &	Hotel & Restaurant	Transportation, storage & Comm.	Education	Health & Social activity	Services	Others	Total
Giza	Male	**10%**	22%	15%	16%	4%	12%	5%	1%	15%	0%	100%
	Female	**8%**	14%	2%	8%	0%	2%	26%	12%	28%	1%	100%
	Total	**10%**	21%	13%	15%	3%	11%	7%	3%	17%	0%	100%
Beni Suef	Male	**45%**	6%	15%	7%	2%	5%	5%	1%	13%	0%	100%
	Female	**84%**	1%	0%	4%	0%	0%	5%	2%	3%	0%	100%
	Total	**59%**	4%	10%	6%	1%	3%	5%	2%	9%	0%	100%
Fayom	Male	**45%**	8%	11%	9%	3%	6%	6%	1%	12%	0%	100%
	Female	**31%**	10%	0%	11%	0%	1%	26%	8%	12%	0%	100%
	Total	**43%**	8%	10%	9%	2%	5%	8%	2%	12%	0%	100%
Menia	Male	**54%**	6%	13%	7%	1%	4%	5%	1%	10%	0%	100%
	Female	**79%**	1%	0%	5%	0%	0%	8%	2%	4%	0%	100%
	Total	**61%**	4%	9%	7%	1%	3%	6%	1%	8%	0%	100%
National	Male	**28%**	15%	12%	12%	3%	8%	6%	1%	14%	0%	100%
	Female	**46%**	5%	1%	6%	0%	1%	21%	7%	14%	0%	100%
	Total	**32%**	13%	10%	11%	2%	7%	9%	3%	14%	0%	100%

Source: Statistical Year Book (CAPMAS)

Average sizes of farmland per farm household as of 2005 is estimated at 1.07 feddan (0.45ha), 1.55 feddan (0.65ha), 2,77 feddan (1.16ha) and 1.43 feddan (0.60ha) in Giza, Beni Suef, Fayum, and Minya respectively. However, as Table 3.2.8 and Figure 3.2.3 below show, most of the farm households are small-scale farmers with the land holding of less than 3 feddan (1.26ha).

Table 3.2.8 Farm Household by Land Holding Size as of 2005

Class	Giza		Beni Suef		Fayoum		Minya		Total		National	
	Area (fed)	No.	Area (fed)	No.	Area (fed)	No.	Area (fed)	No.	Area (fed)	No.	Area (fed)	No.
Less than 1 fed	38,416	96,789	52,236	98,011	56,154	66,947	62,544	175,644	209,350	437,391	986,010	2,364,809
1 fed <	24,753	21,618	37,136	28,326	27,775	16,160	60,525	49,769	150,189	115,873	746,160	652,116
2 fed <	22,178	12,227	27,853	15,552	37,983	11,929	54,819	24,927	142,833	64,635	707,534	389,641
3 fed <	15,578	4,506	26,752	9,624	29,340	7,526	42,984	13,505	114,654	35,161	612,021	246,899
4 fed <	10,421	1,878	20,798	6,494	28,869	7,760	38,727	8,281	98,815	24,413	551,430	175,297
5 fed <	15,671	2,089	25,625	5,140	25,706	4,216	37,827	11,416	104,829	22,861	688,888	335,547
10 fed <	9,066	869	28,544	2,465	29,538	2,401	36,663	3,165	103,811	8,900	682,992	130,007
20 fed <	7,263	370	20,564	1,040	39,271	1,289	39,485	1,654	106,583	4,353	650,763	87,038
50 fed <	3,354	147	18,345	383	35,623	470	30,958	703	88,280	1,703	417,530	46,459
100 fed <	3,095	87	1,114	16	22,039	1,144	8,764	109	35,012	1,356	763,515	27,793
Total	149,795	140,580	258,967	167,051	332,298	119,842	413,296	289,173	1,154,356	716,646	6,806,843	4,455,606
Average (fed/HH)	1.07		1.55		2.77		1.43		1.61		1.53	

Source: Statistical Year Book (CAPMAS)

As Figure 3.2.3 on the right shows, farm households with a land holding of less than 1 feddan (0.42ha) occupy more than 50% in all the four (4) governorates as well as for the national total. The average landholding size of the farm households with less than 1 feddan is calculated at 0.4 feddan (0.17ha) in Giza, 0.53 feddan (0.22ha) in Beni Suef, 0.84 feddan (0.35ha) in Fayum, 0.36 feddan (0.15ha) in Minya and 0.42 feddan (0.18ha) for the national total. Farmers in Minya seem to be the least of the landholders among the beneficiary governorates.

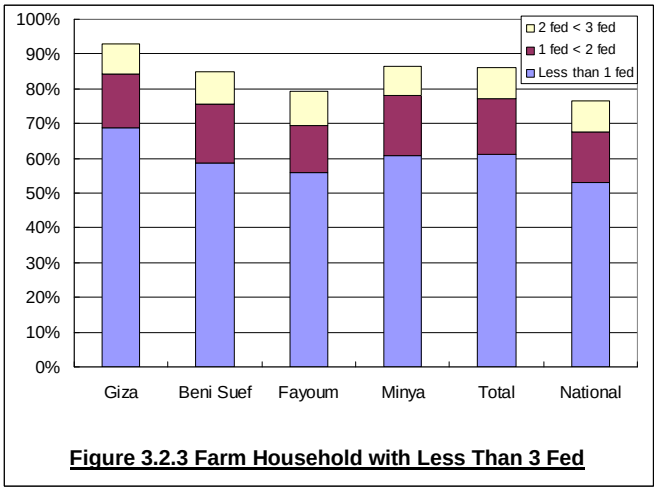


Figure 3.2.3 Farm Household with Less Than 3 Fed

Farm households with a land holding of less than 3 feddan (1.26ha) in the four (4) governorates occupy 86%, which is 10 points higher than the national total. The farm households with less than 3 feddan in Giza, Beni Suef, Fayum and Minya occupy 93%, 85%, 79%, and 87% respectively. Statistics show that most of the farm households contain small-scale farmers. However, existence of landless farmers in the rural area should also be given attention. According to the Seventh Agriculture Census in 1999, the number of landless farmers numbers 0.82 million households or 18% of the national total (breakdown by governorate is not available).

3.3 Present Situation of Dirout Group of Regulators and its Vicinity

Dirout Group of Regulators (DGR) is located toward the south approximately 380 km from Cairo. The DGR was constructed in 1872 (more than 137 years ago, as of now), and is one of the major historical regulators in Egypt which has five (5) regulators and seven (7) canals. The beneficiary area of the DGR covers the Assuit, Minya, Beni Suef, Fayum and Giza Governorates. According to the National Water Resources Plan 2017, the irrigation water from the Assuit barrage is located 60 km upstream from DGR on the river Nile, distributing 9.6 billion m^3/year of water into the DGR. Especially at the Ibrahimia canal and the Bahr-Yusef canal, which are main canals, the irrigation water distributes 3.6 billion m^3/year and 5.0 billion m^3/year into each canal. (Refer to the follow figure) Incidentally, the Ibrahimia canal and the Bahr-Yusef canal are different types of canals. The former is a man-made canal constructed in 1873, and the latter is a natural canal. The current formations of DGR are shown as follows.

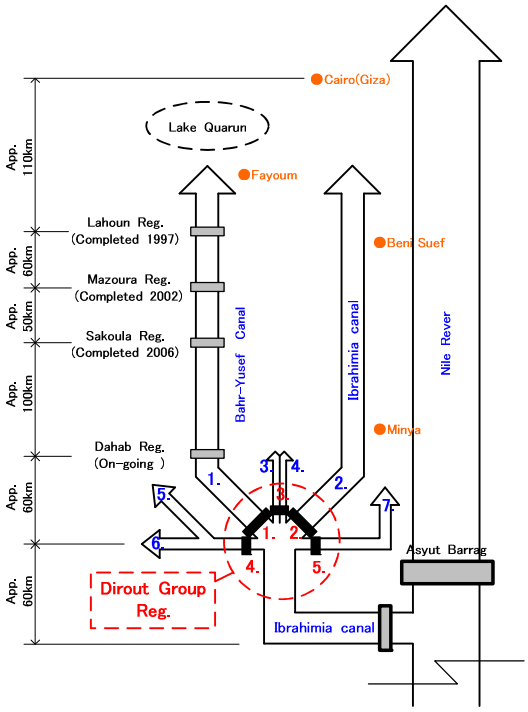


Figure 3.3.1 Illustration of DGR

Table 3.3.1 Current Formation of Dirout Group of Regulators

Name of canal at DGR		Structural dimensions		Gate dimensions
Downstream side of DGR	Bahr Yusef	No. of gate Pier Mid. apron Foundation Lock	5 vents 4 units & width 1.80~2.25m L=43.25m, thickness 3m limestone partially concrete width 8.5m	3m width x 5 vents Total height 7.5m 3 leaves of gate Bottom elevation 39.50m Operational high water level 46.00m
	Ibrahimia	No. of gate Pier Mid. apron Foundation Lock	7 vents 6 units & width 1.80~2.25m L=39.70m, thickness 3m limestone partially concrete width 8.5m	3m wide x 7 vents Total height 7.5m 3 leaves of gate Bottom elevation 39.81m Operational high water level 46.00m
	Badraman & Dirotiah	No. of gate Pier Mid. apron Foundation	2 vents (1 vent closed) 2 units & width 1.80~2.25m L=38.65m, limestone, t=unknown	3m wide x 2 vents total height 7.5m 3 leaves of gate Bottom elevation 39.30 m Operational high water level 46.00m
Upstream side of DGR	Abo Gabal & Irad Delgaw (left bank)	No. of gate Pier Mid. apron Foundation	3 vents 2 units & width 1.80~2.25m L=28.60m limestone, t=unknown	3m wide x 3 vents Total height 5.5m 1 leaves of gate Bottom elevation 42.00 m Operational high water level 46.00m
	Sahelyia (right bank)	No. of gate Pier Mid. apron Foundation	2 vents 1 unit & width 1.80~2.25m L=18.90m, Limestone, t=unknown	3m wide x 2 vents Total height 5.5m 1 leaves of gate Bottom elevation 41.80 m Operational high water level 46.00m

Figure 3.3.2 Location of the Dirout Group of Regulators

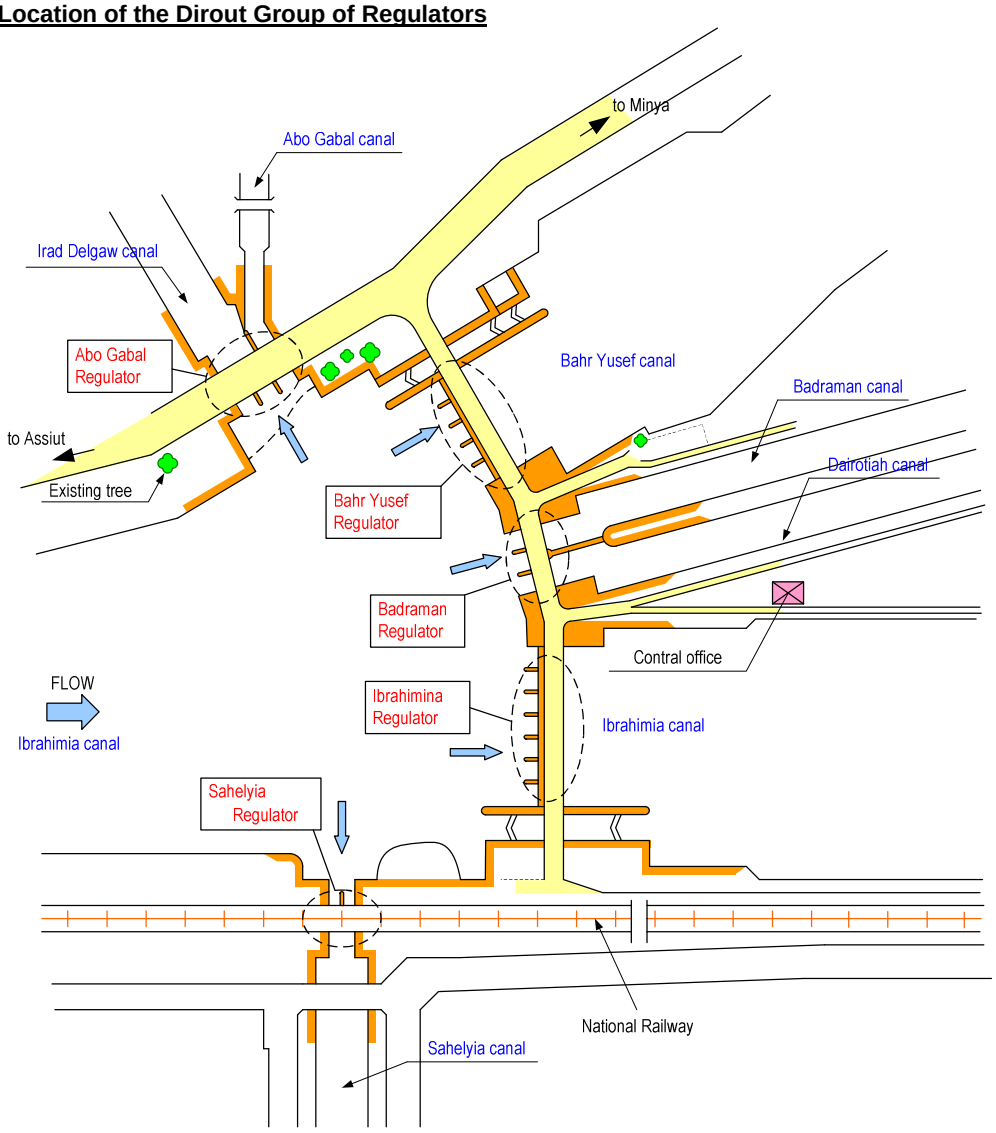
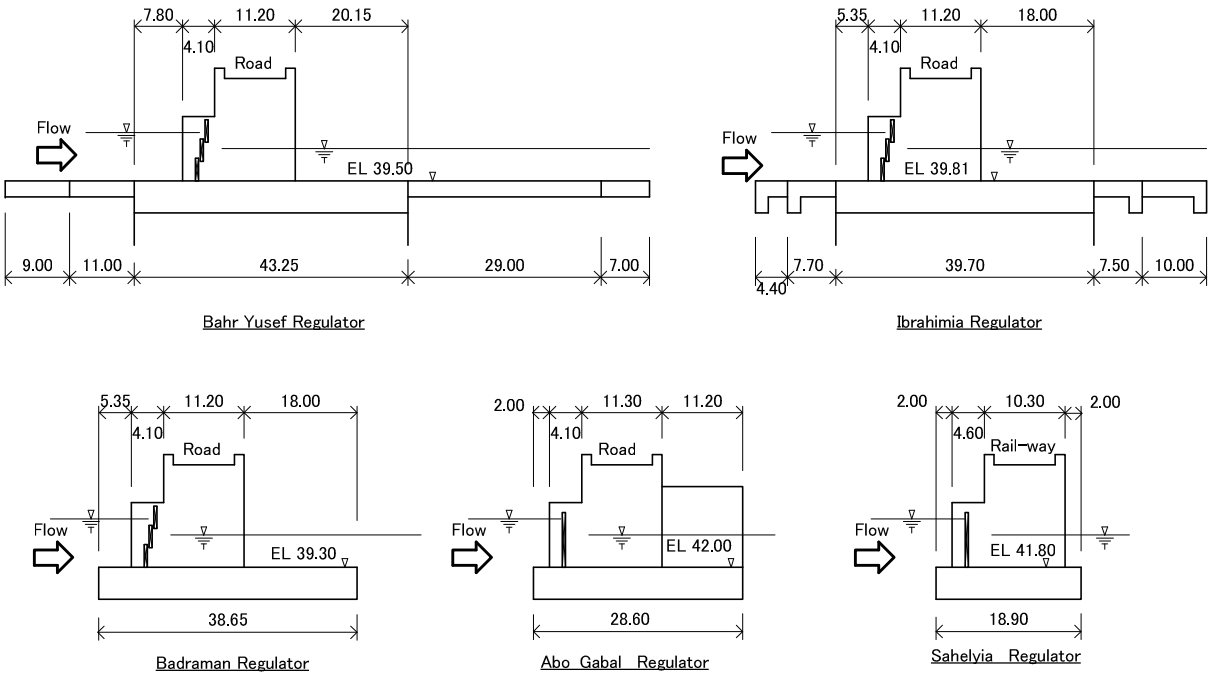


Figure 3.3.3 General section



3.3.1 Present Situation of Vicinity of Dirout Group of Regulators

(1) Dirout city

As of 2009 the Dirout city with a population of 77,000, where seems to be developed around DGR after the construction of DGR in the 19th century. It is assumed that the location is due to the proximity of the railway station, road, bridge with market, mosque, and bus terminal stations to the other area. Additionally, there are many cities and villages along the canal radiating from DGR, and we can see that the irrigation water is used not only for irrigation but also for living.

Figure 3.3.4 Situation of Dirout City

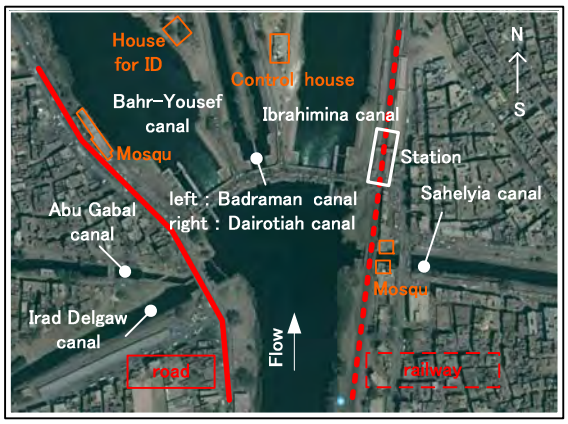


Figure 3.3.5 Situation of DGR

As one of the features of DGR, we can see the national railway on the right bank of the Ibrahimia canal, which connects Alexandria to Cairo and Aswan. That station of Dirout is located near DGR (on the right) and is used by many people. Besides the main road located on the left bank, reaching the other main road are both banks of river Nile. Therefore, the active transportation by trailer through this area is seen.

The bridge of DGR has two functions. One is for the maintenance road for DGR and the other is used as a general road for persons, horses, small vehicles and cars. Moreover, on the bridge, the many markets are opened almost every day and the bridge is crowded with many customers and car traffic. The markets deal with foods mainly, such as fruits, vegetables, fish, and others. Therefore here is a place for living of the people inside and outside of the town.

Picture : View on the bride of DGR from the left

According to the site survey from view point of logistics and transportation systems, it is difficult for the middle class and heavy vehicle of more than 2 tons to cross the bridge, which assumes that it is available for the normal and small car only. The reason for that, the team considers as follows.

- Width of the bridge of DGR is seven (7) meters approximatly, besides there being many markets on both sides of the bridge occupying the bridge. Therefore, the bridge is not wide enough to allow large trucks and the like to pass.
- Due to the narrow width of the road on the right bank (railway side) and close proximity to the

houses near the road, large trucks and such would not be able to pass. Moreover, the cross point of the railway prevents the comfortable passage of such oversized vehicles.

- Since there are two bridges which have enough width on the upstream and downstream, it is not necessary to pass over the bridge of DGR.

There are five mosques located at the upstream and downstream areas, and especially there is a relatively large scale mosque situated at the downstream and left bank of the Bahr Yusef canal, and a mosque is situated just downstream at the Saheilyia canal located upstream of DGR (refer to photo above). These mosques have the possibilities to be obstacles for making the implementation plans in the future. Since a mosque holds strong religious symbolism, making alternative plans of new barrages requires the public announcement to residents an essential procedure.

(2) Present Dirout Group of Regulators

DGR consists of 19 numbers of continuous arch structural vents made by bricks. This is one of the typical models of river structures, and it was the most advanced technology for construction of a long span barrage against the tension stress by arch structures at the time when reinforced concrete was not popular yet.

Picture : View form upstream of DGR

DGR consists of 19 gates, the width of each measuring three (3) meters. Three regulators out of five (5), named as the Ibrahimia, Badraman and Bahr Yusef regulators, have three gates with the upper, middle and lower gates each measuring 7.5 m high. The gates are made of a steel material coated with a black thick paint of asphalt. The gutter of a gate is made by cast metal and is divided into three (3) rows. On the other side, the Sahelyia regulator and the Abo Gabal regulator each consist of one life gate with heights of 5.5 m. The material is the same as the other gates, but the lifting system is different from the others.

The gate operating system is manual with a sliding operating system. To operate the Bahr Yusef regulator, the Ibrahimia regulator and the Badraman regulator, on each regulator they are driven by one (1) movable manual hoist, despite the gates number on these regulatora are fourteen (14) which consists of three leaf at one (1) vents.

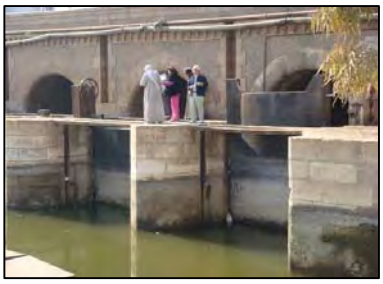
The Abo Gabal and Sahelyia regulator are driven by a fixed manual hoists at every gates. To operate these gates are needed only one technician, by contrast movable manual hoist on Bahr Yusef, Ibrahimia and Badraman regulator are needed three or four technicians.

According to the site survey of the operation of the gate, in order to open and close the gate fully, since the gates were stuck at the guide on moving the gate, the technician hit on the top of the gate with the wood as a hammer to fall in down the gate. After all, total cycle time for closing the gate was approximately 30 minutes. Additionally, accumulation of the garbage at upstream of gates has caused to obstruction of the smooth gate operation.

Picture: A hoist at downstream Regs. on DGR

Picture: A view from below the hoist at downstream Regs. on DGR

Picture: A situation of the closing gate (hit on the gate with wood)



Picture: A hoist at upstream Regs on DGR

Picture : A hoist by close up

The three leaf gates at vent located at downstream are operated as follows:

- In case of ordinary times, discharge is controlled by using upper gate and middle gate.
- In case of maintenance work, flood sedimentation is flushed and discharged

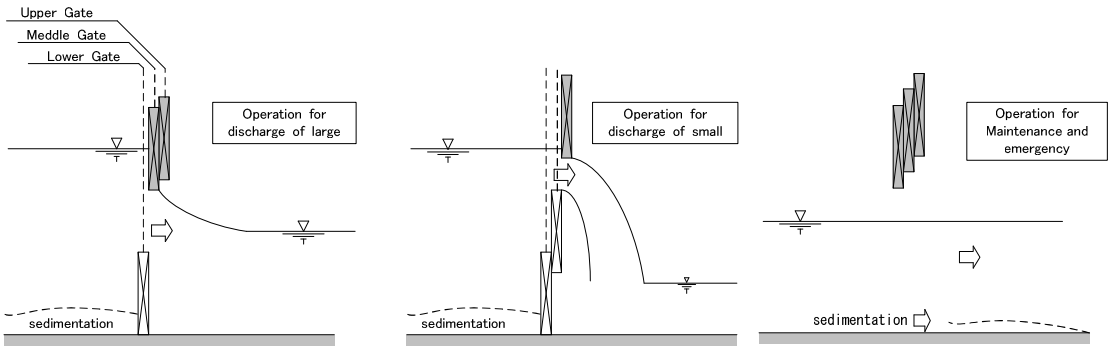


Figure 3.3.6 operation of the three leaf gate

(3) Background of the remodeling, rehabilitation and investigations of Dirout Group of regulators

As already mentioned in Chapter 1, the existing DGR has experienced a main remodeling, rehabilitation and investigation four (4) times as indicated below.

1907 : Remodeling Dirout group (Works of remodeling unknown)

1939 : Remarks of the crakes on the regulator group (Investigation)

1962 : Rehabilitation for Dirout group (Rehabilitation)

2001 : Maintenance of regulator gates, chains, etc. (Maintenance for mechanical facility)

The contents of improvement works in 1907 is not clear, the information of the works will be collected continuously. The improvement works in 1939 was carried out to survey for cracks in the bodies of barrages and other repair works. A plate was put on the wall of the barrage where the date of repair work was registered. The root cause of cracks found on the side wall of the bridge can be assumed to be from repeated shock load. When DGR was constructed originally, the design condition of the load was grasped by both man and horse loads only. Accordingly, the cause of cracks is assumed due to the increase of the load by heavy loads such as vehicles.

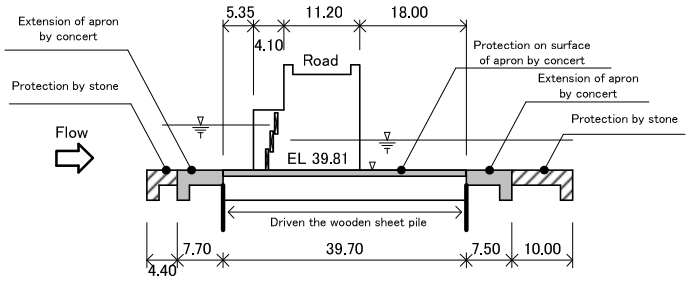


Figure 3.3.7 Rehabilitation of Ibrahimia Regulator in 1962

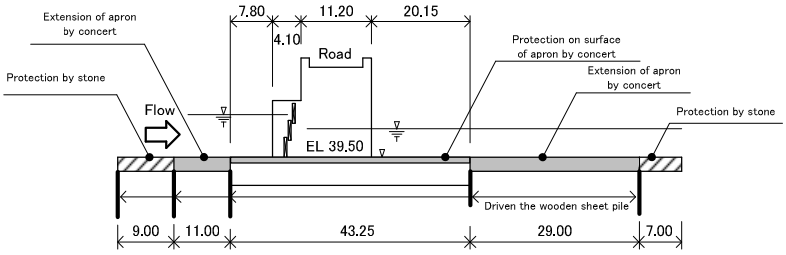


Figure 3.3.8 Rehabilitation of Bahr Yusef Regulator in 1962

The rehabilitation works of DGR was implemented in 1962. It consisted of expansion works for the apron bed of the Bahr Yusef regulator and the Ibrahimia regulator. The main purpose of the rehabilitation works is countermeasures for the increase of discharge volume through gates to canals by increasing the upstream water level of DGR. To increase the upstream water level of barrages, differences of water level between upstream and downstream beyond the gates was expanded, creating risk of an uplift pressure increase. Accordingly, to reduce of uplift pressure, an existing apron bed was expanded. At the same time, prevention work was completed for the surface of the existing apron bed by concrete, and the driving of wooden piles below of apron and rubble foundation works for the end of the apron were done. (Refer to Figure below) Replacement works of the lifting machine of gates and chains, and a navigation lock and steel-made bridge were completed.

3.3.2 Present Situation of Dirout Group of Regulators as Major Irrigation Facilities

(1) Site Survey

To grasp the present condition of the required function and the deterioration of DGR, the following field surveys were done by the Team.

- Geographical survey (mainly at upstream of DGR)
  - ➢ Topographic survey
  - ➢ Profile leveling on four canal at U.S of DGR
  - ➢ Cross leveling on four canal at U.S of DGR
- Geological survey
  - ➢ Borehole drilling
    - ・8 holes (upstream 2 holes, downstream 6 holes)
    - ・Depth 20m×2 holes, 30m×6 holes
    - ・Laboratory test (Density, Water content, Grain size analysis,
    - ・Standard penetration test, Liquidity limit test, Plasticity limit test)

Figure 3.3.9 location of boring hole in 2009

Additional borehole drilling of two (2) holes, which are shown on Figure 3.3.9 as "Add. BH1" and "Add. BH2", through the bodies of regulators was carried out on December 2009 at the Ibrahimia regulator and Bahr Yusef regulator individually, with collaboration of the RGBS and the study team. The main purpose of additional borehole drilling is to grasp detailed situation of deterioration on the two main regulators in DGR.

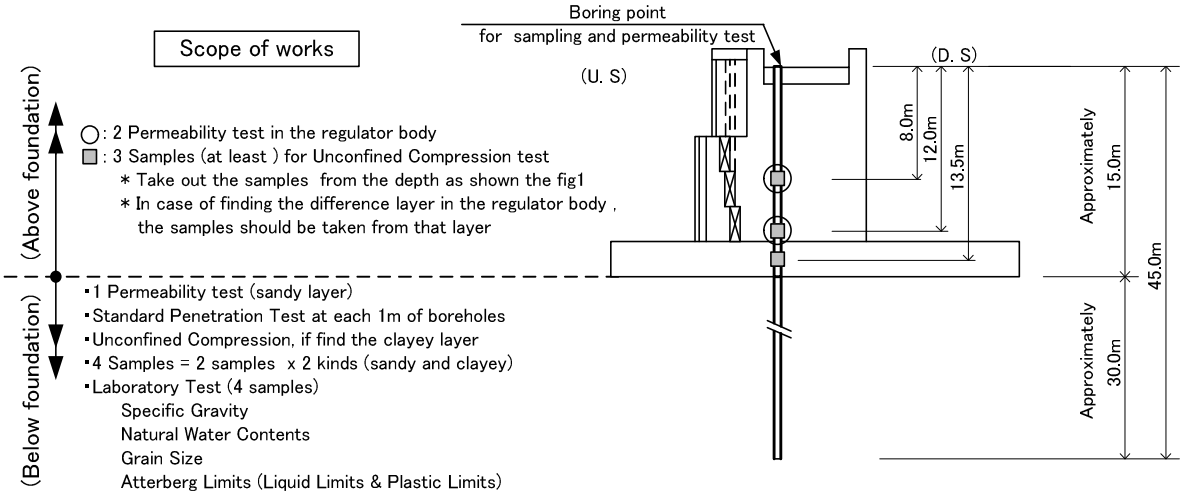


Figure 3.3.10 Outline of Additional Boring Survey

● Structural survey

- Measurement of structural dimension of regulators and drawings.
- Strength test on regulators
  - ➢ Core sampling from pillars and unconfined compression test
  - ➢ 10 pieces ϕ 75 mm, Length 50 cm depth of 50 cm from surface

● Diving survey (survey into the vent with underwater camera)

- Location of the vent for survey (refer to the right Fig.)
  : Second vent from right side on Bahr Yusef Reg.
  : Fifth vent from right side on Ibrahimia Reg.

● Report of the unconfined compression test

- Number of the sampling core (examined at each Reg.)

Total number is 74 pc. (65 pc. in 2006 / 9 pc. in 2009)

● Report of the permeability test inside of the regulator body

- Location of the vent for survey (refer to the right Fig.)
  : Bahr Yusef Reg. and Ibrahimia Reg.

● Examination of the Up-lift under the foundation at regulator

- Location of the vent for survey
  : Bahr Yusef Reg. and Ibrahimia Reg.

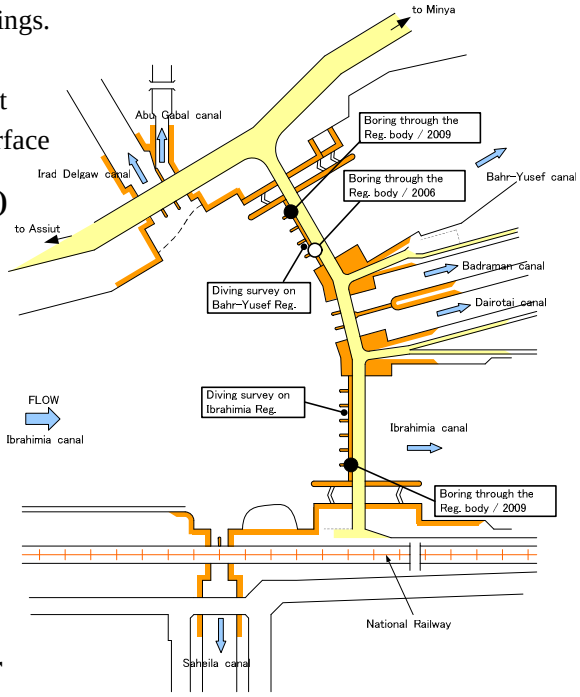


Figure 3.3.11 Location of the diving survey and permeability test in the body

(2) Conclusion of the Site Survey

a) Topographic survey

The survey were carried out at upstream of the existing DGR mainly. The results of the geographical survey, geological survey and structural survey are applied to make an alternative plan for

rehabilitation and improvement of DRG. The report and consideration of the sedimentation on the canal bed will be done with the result of the profile leveling survey.

b) Geological survey

- The alluvium layers of composed soil materials by boring investigation are simply classified with 2 layers: an upper layer of silty clay (very stiff, brown) and a lower layer of silty medium to fine sand (brown).
- There are two main different layers, a kind of clay layer and a sand layer, with a clear boundary between them at the elevation EL 36 m to 37 m, which corresponds to the elevation of the existing foundation of DGR.
- Penetration test (appeared by "N value") by SPT show a range of 4 to less than 30 at the silty clay layer. At the upper part, the silty medium to fine sand is ranged approximately between 11 and 50, and the lower part of silty medium to fine sand exceeds 50.
- The results of the field permeability test examined the layer of silty medium to fine sand ranging between k=1.53 to 2.87×10^{-4}m/s as judgment of less permeable layer although, those layer will require attention for soil technical treatment caused by that the grain size distribution of the lower layer of silty medium to fine sand which is partly concentrated to a very tight range of grain size between 0.15mm to 0.425mm.
- The foundation at the upstream of the existing DGR, Sahelyia and Abo Gabal, is located on a silty clay layer with approximately 20 of N value. In generally, the suitable clay layer for the foundation of the structure is shown 20 of the N value. Therefore, at upstream of Regs are located on good foundation comprehensively. However, the clay layer has the feature that is easy to settle down and sensitive for the increased the weight on regulator. Therefore using the regulator in the future might have to take the measure for the settle down and pay for the attention of the increased the weight on regulator.

  On the down stream of the existing DGR, Bahr Yusef, Badraman and Ibrahimia, is located on the boundary between silty clay and silty medium to fine sand layer. The foundation of Bahr Yusef Reg is located on silty clay although, the actual layer for the foundation is silty medium to fine sand layer. Because that thickness of the silty clay layer below the Bahr Yusef Reg. foundation level is less than 1m. The silty medium to fine sand layer as the foundation of Bahr Yusef Reg. is 19~27 of N values. However, in generally the suitable fine sand layer for the foundation of the structure o is shown 30 of the N value. Therefore it is considered that this layer has not enough bearing.

  Especially, in case of using the existing Reg. to the future, existing Regs., Bahr Yusef Reg may pay for attention of settle down. Because that foundation is located on the layer changing geological feature greatly that has geological heterogeneous. Also it needs to pay for the attention of the increased the weight on regulator.

  The foundation of Badraman and Ibrahimia Reg. is located on 30~40 N value. Therefore it is considered that those Reg. are on good layer for the structure. However, in the silty medium to fine sand layer within 2m below the foundation of Ibrahimia Reg., there is 26 of N value partly, therefore it needs to pay for the attention of the settled down, in case of changing the weight of the regulator in the future.

  Totally, the foundation of the existing DGR has not enough stability, in case of using it in the future. Therefore, in this case and especially increasing the weight on regulator, the regulators need to pay attention for the stability of the foundation,

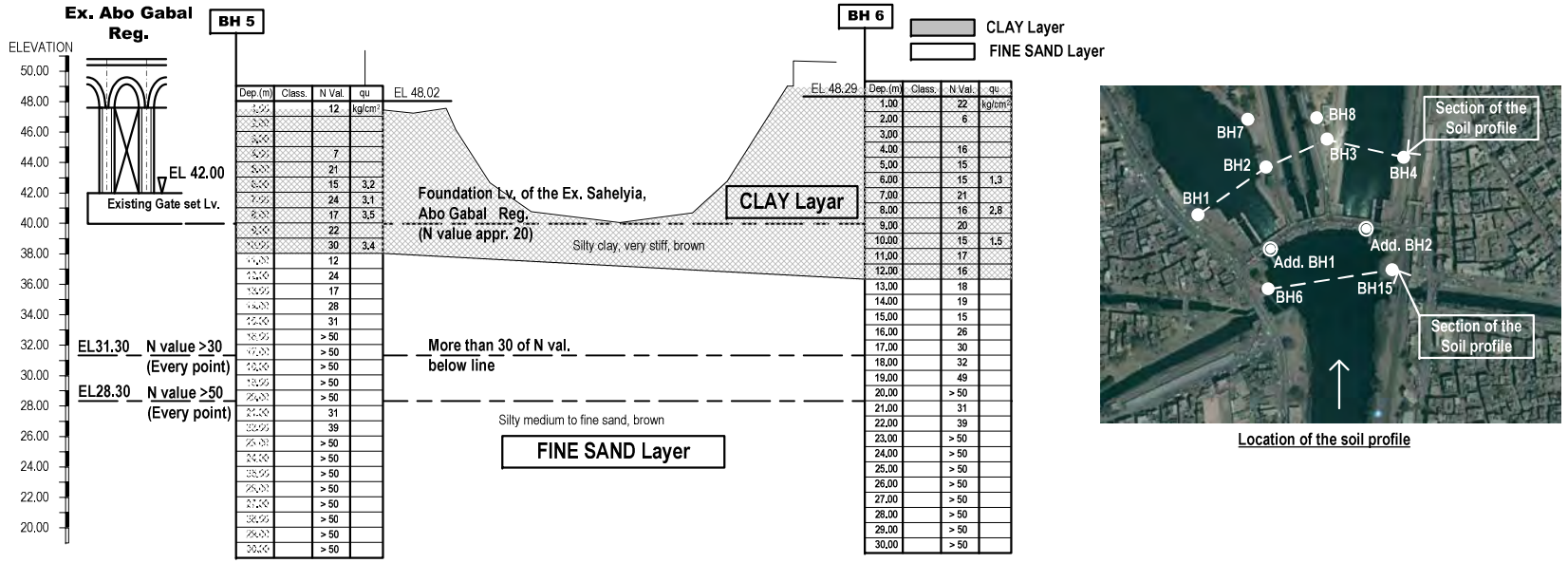


Figure 3.3.12 Soil Profile at Upstream

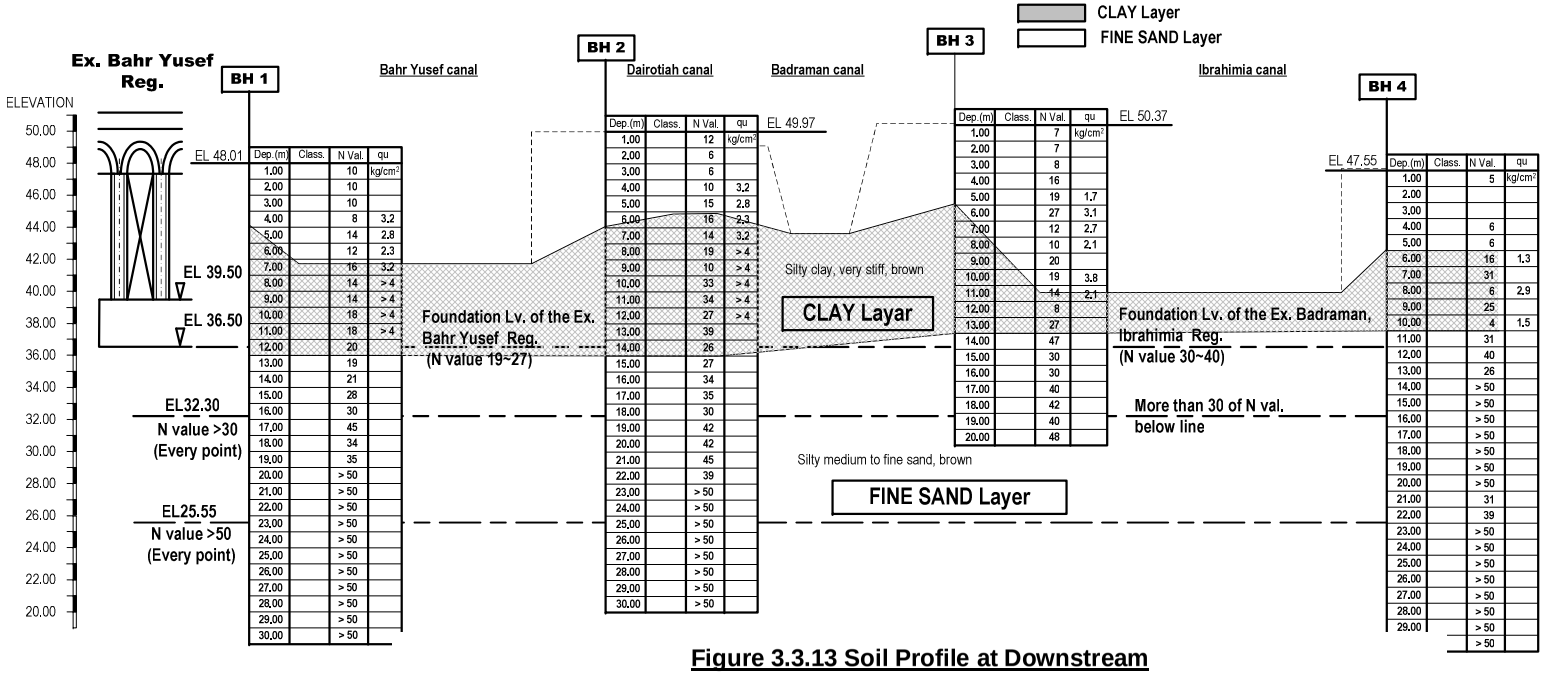
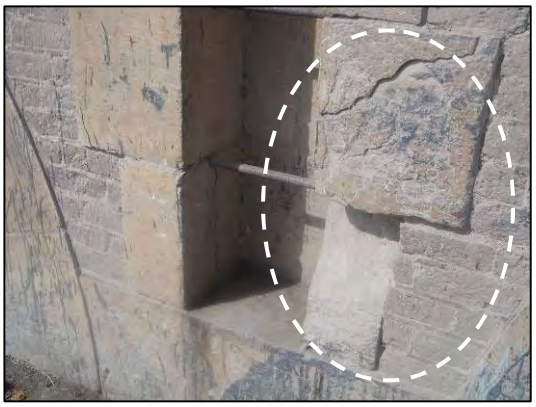


Figure 3.3.13 Soil Profile at Downstream

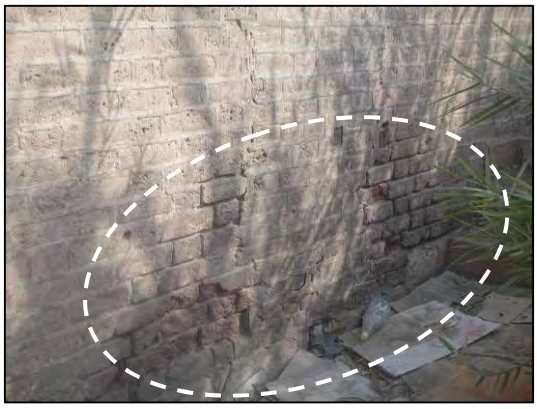
c) Structure survey

c-1) Visual investigation for outside

- The deteriorations of DGR above water face are the lack of brick and stone on the surface of the body where there is a small range and the clacks of the brick with 2mm maximum width. These deteriorations are not considered to be caused by long-term stress as the damage seems to have occurred at the time construction was completed, but they do have a temporary impact or affect part of the sink. Therefore, these deteriorations are not considered to expand anymore. (Refer to Pictures 1 and 2)

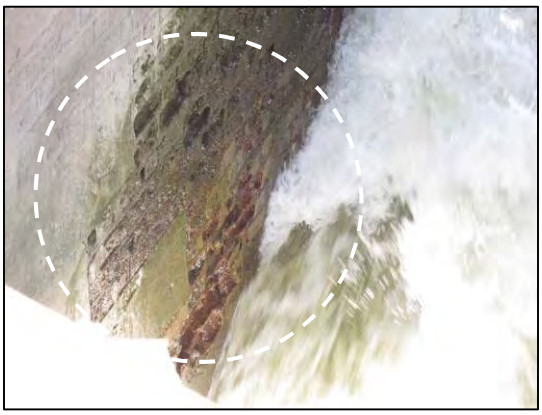


(Picture-1 at Ibrahimia)

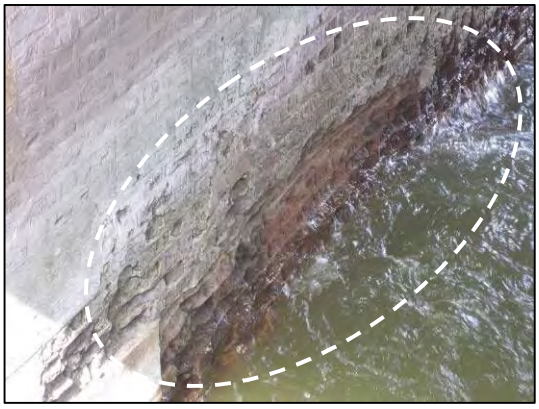


(Picture-2 at Sahelyia)

- At the blow water face, the scouring and lack of bricks are confirmed at the surface of the vent downstream from the gate. Especially, the hard scouring, which is approximately 30cm deep from the surface of the regulator body, is viewed at the vent of the Ibrahimia Regulator. This scouring situation is entirely the same condition as the Dahab Regulator experienced for about 100years on the Bahr-Yusef canal, which is under construction by the Japan's Grant Aid. The process of scouring is not only the abrasion of the brick itself, but also the lack of and repeated falling off of the brick causing abrasion of the mortar between the bricks. Therefore, the scouring will expand rapidly in the future and has an adverse effect on the regulator body (Refer to Pictures 3 and 4). The Team will use divers to examine the foundation into the water in January 2010, during the time of the water closure for maintenance of the canal, to study the scoring in detail.



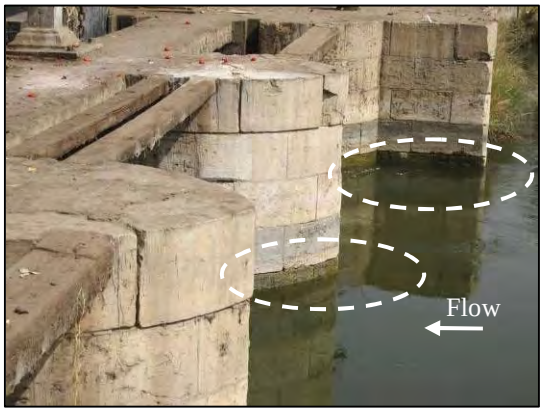
(Picture-3 at the vent No 5 of Ibrahimia)



(Picture-4 at the vent No 6 of Ibrahimia)

- The surface at the top of the pier upstream from the Ibrahimia and Bahr-Yusef Regulators is protected by the stones, although, the ancient mortar which is deferent with modernized mortar,

used between the stones is viewed to be unprotected. Especially, the mortar near the water face is affected by being washed out by the up-and-down motion of the flow. Although the depth of the lacking of the mortar is unknown, it is considered to have such an adverse effect so as to lead to the collapse of the pier by expanding the lack of mortar in the future. (Refer to Pictures -5 and 6)



(Picture-5 at Bahr-Yusef)

(Picture-6 at Bahr-Yusef)

- The situation of the gates at DGR does not allow for the operation of the lower gates at the Ibrahimia regulator, due to the cut chains, which are viewed in five (5) vents of the seven (7) vents. Other gates in the regulators can operate and are not viewed to have any mechanical trouble themselves. (Refer to the following table; ○: movable, ×: not movable) However, the gates located upstream, Abo Gabal and Sahelyia, cannot be closed completely due to the sedimentation. And the gates located downstream, which are hung on one chain, are stuck to the gate's guide sometimes, due to the difficulty in keeping the balance of the gate itself. Additionally, the common trouble of each gate is the difficulty to operate them smoothly and rapidly, which is caused by the manual operation of many gates

Table 3.3.2 Current Status of the Gates of the Dirout Group of Regulators

Regulator Name	No. from left bank	Upper Gate	Mid. Gate	Lower Gate	Remarks
Ibrahimia Reg.	No. 1	○	○	○	
	No. 2~6	○	○	×	without chain
	No.7	○	○	○	
Bhar Yusef Reg.	No.1~5	○	○	○	
Badraman Reg.	No.1~2	○	○	○	
Abo Gabal Reg.	No.1~3	○			
Sahelyia Reg.	No.1~2	○			

- The Bahr-Yusef and Ibrahimia regulators have navigation locks. However, these are not used now, and the gates are closed ordinarily. (Refer to Picture-7) The width of the existing navigation lock is appr. 8.5 meters on both regulators. In this study, RGBS request to design the new navigation lock on the Ibrahimia Regulator, by contrast, they order that the Bahr Yusef regulator does not need to design one. In fact, according to other project on Bahr Yusef canal which were carried out by Japan Grant Aid, these regulators does not set new navigation locks.

(Picture-7 Navigation lock at Ibrahimia)

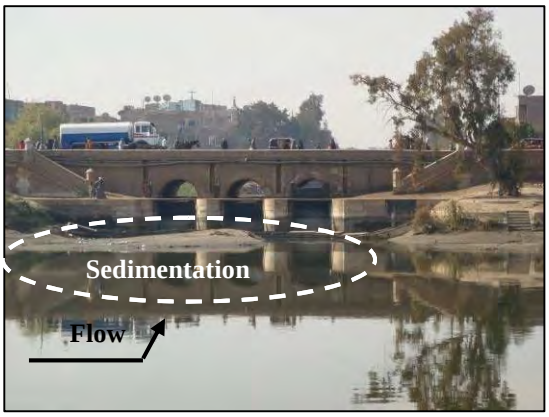
● Upstream of DGR, much garbage that flowed from upstream is stuck in front of the gates, which is considered an adverse effect to water quality. Additionally on the DGR, there is much garbage thrown away from the bridge causing the DRG to be dirty. (Refer to Pictures -8 and 9)

(Picture-8 upstream of DGR)

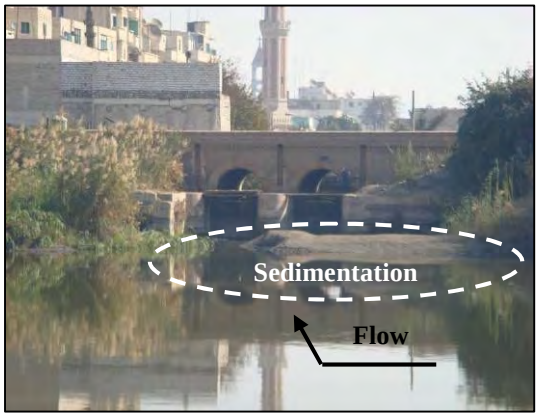
(Picture-9 upstream of DGR)

c-2) Canal condition (sedimentation at upstream on DGR)

● At the intake of Abo Gabal and Sahelyia, on the upstream regulators, remarkable sedimentation is viewed. Since that is occurring constantly, the dredging work is executed every year. However, the sedimentation dredged from the canal is put to the side of the intake; therefore, it is considered to be an ineffective measure against the sedimentation. (Refer to Pictures -10 and 11)



(Picture-10 at Abo Gabal)



(Picture-11 at Sahelyia)

The team considers the cause of the sedimentation at the Abo Gabal and Sahelyia regulators as follows.

・i. The shape upstream of DGR is like a large pond. Because of this, the velocity of the flow into the DGR is reduced at DGR and sedimentation occurred near here.

・ii The Bahr Yusef, Ibrahima,and Badraman regulators are located on the canal where the direction is similar to the upstream flow direction. Therefore the flow goes mainly toward these regulators. (This is

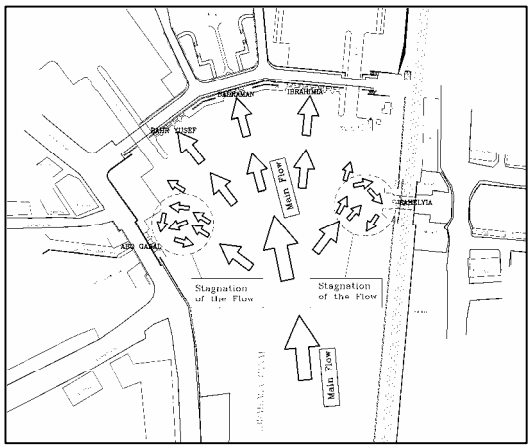


Figure 3.3.14 Vector of Upstream Flow

considered as one of the reasons that Abo Gabal and Sahelyia are difficult to take in the water.)

- iii On the other hand, the Abo Gabal and Sahelyia regulators are located like a right angle or an acute angle against the direction of the upstream flow. Therefore, the condition of flow, such as the direction and velocity, are changed greatly in front of both regulators as the figure on the right shows.

- iv In front of the Abo Gabal and Sahelyia regulators, some flow occurred, preventing the flow from going toward the Abo Gabal and Sahelyia regulators; in addition, that flow has the effect to offset the velocity of other flow. Therefore, the flow in front of both regulators is stagnated, and the sedimentation is developed continually.

- At the upstream side of DGR, the sedimentation can be observed by longitudinal survey. (Refer to right Fig.) According to the survey, the sedimentation is expand from the 30m point toward the upstream. and downstream on canal. These situation does not effect the Bahr Yusef, Badraman and Ibrahimia reg directly, however it is shown that Sahelyia and Abo Gabal are effected to intake in order to shallow the water depth by the sedimentation

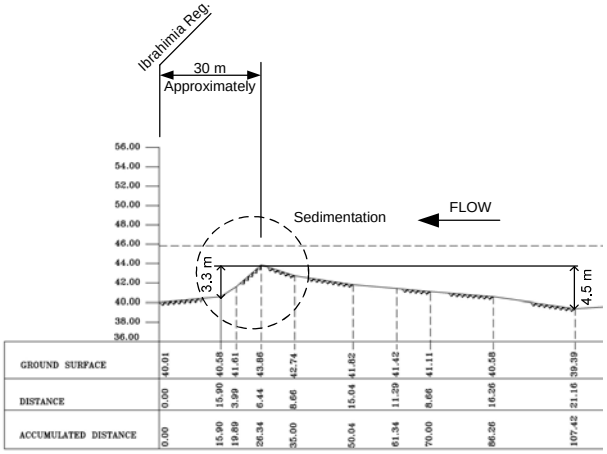
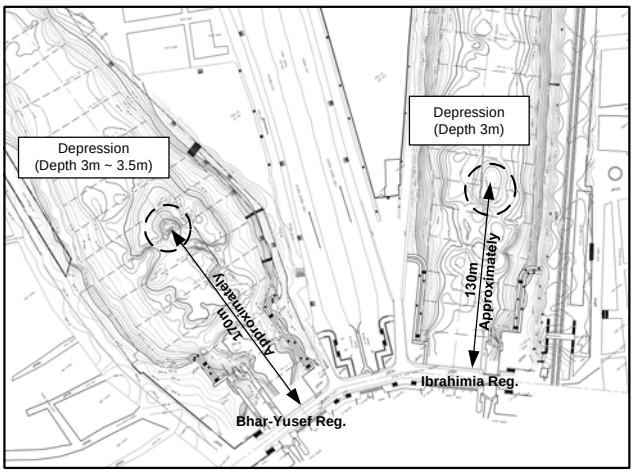


Figure 3.3.15 Longitudinal Profile of Upstream Ibrahima Canal

- At the downstream side of DGR, in the canal beds with around 1m difference between the top and bottom are observed, which would have been caused by the discharge from the gates. It is especially observed that there are dents in spots with the depth of around 3m to 3.5m at the points around 150 m downstream from the regulators of the Bahr Yusef and Ibrahimia canals.



The following explains the preliminary analysis of the causes of the dents based on the hydraulic conditions:

When roughly estimating the required length of canal bed protection by the Bligh formula in the case of the Bahr Yusef regulator, it comes up with about 130m as shown below. The result implies that apparent dents caused by scouring should occur within 130m from the regulator. However, it is difficult to identify the cause of the above dent as the scouring, becouse the distance of the dent from the regulator is 170m. Likewise, the estimation for the Ibrahimia canal using the same method indicates that the possible dent caused by scouring should occur within 100m from the regulator, but the above dent in the Ibrahimia canal is found at 130m from the regulator.

From the analysis above, it is considered that the deep dents on the canal bed do not caused by the

keeping discharge from the gate ordinarily, however the irregular vortex at local point etc. is raised up suddenly which might be caused of the deep dents. Therefore it need to keep pay attention for the changing the canal bed situation.

The length of doubt to scoring the canal is examined by Bligh.

・Bahr-Yusef Reg.

$L = 0.67 \cdot C \cdot \sqrt{\triangle H \cdot q} \cdot f$, where

L_r : Length of protection work (m)

L : Total length including length of apron (l_a) and length of protection work (L_r), (m)

$\triangle H$: Maximum head difference at up/downstream (m)

$\triangle H$ = W.L. 46.30m - D.W.L. 43.00m = 3.30m

q : Discharge per unit width at maximum discharge, (m^3/sec/m)

q = 230 $_{(Approximately)}$ / (3.0m/vent x 5vent) = 15.3 m^3/sec/m

$L = 0.67 \times 18 \sim 15 \times \sqrt{3.30 \times 15.3} \times 1.5 = 107 \sim 129$ m

・Ibrahimia Reg.

$L = 0.67 \cdot C \cdot \sqrt{\triangle H \cdot q} \cdot f$, where

L_r : Length of protection work (m)

L : Total length including length of apron (l_a) and length of protection work (L_r), (m)

$\triangle H$: Maximum head difference at up/downstream (m)

$\triangle H$ = W.L. 46.30m - D.W.L. 43.00m = 3.30m

q : Discharge per unit width at maximum discharge, (m^3/sec/m)

q = 180 $_{(Approximately)}$ / (3.0m/vent x 7vent) = 8.6 m^3/sec/m

$L = 0.67 \times 18 \sim 15 \times \sqrt{3.30 \times 8.6} \times 1.5 = 80 \sim 96$ m

c-3) Diving survey (survey into the vent with underwater camera)

The diving survey was carried out during the period between the 2nd and 4th of January 2010 at the Bahr-Yusef and the Ibrahimia Reg., second vent from the right on the Bahr-Yusef and fifth vent from the right on the Ibrahimia Reg., respectively. The selected photographs are shown below.

The following facts were found as mentioned below:

●A mortar which serves as a glue, has already been lost at the Bahr-Yusef and the Ibrahimia Reg.

The above mentioned phenomenon is concerned to lead the lost of unification of the structures and to develop the falling bricks out from the body.

●At the sites of the Bahr-Yusef and the Ibrahimia Reg., additional concrete was put on the surface of the apron concrete in 1962 for repair work. However, in this diving survey, the repaired concrete was lost due to the frictional wear. Specifically, at the Bahr-Yusef Reg., only the reinforcing bar was left. This shows that the effectiveness of repair has been already lost. On the other side, at the Ibrahimia Reg., an aggregate which has the size of 10cm to 20cm, was exposed remarkably. It shows that the original effective thickness has been lost already. According to the drawing of the last rehabilitation, the original thickness of the concrete apron of the both regulator could be confirmed on the drawings; the Bahr-Yusef had approximately 25cm of thickness and the Ibrahimia had approximately 55cm.

●This kind of repair work was implemented for the purpose of reinforcement to follow the increase of the upstream water level. However, the effectiveness of the repair works has been already lost.

Consequently, developing the frictional wear is a continual concern for the future.

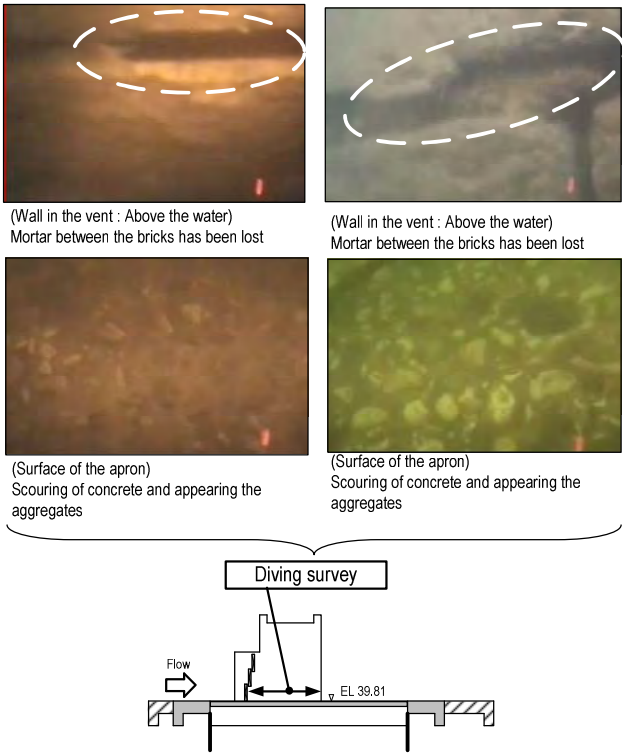


Figure 3.3.16 Diving survey at Bahr-Yusef Reg.

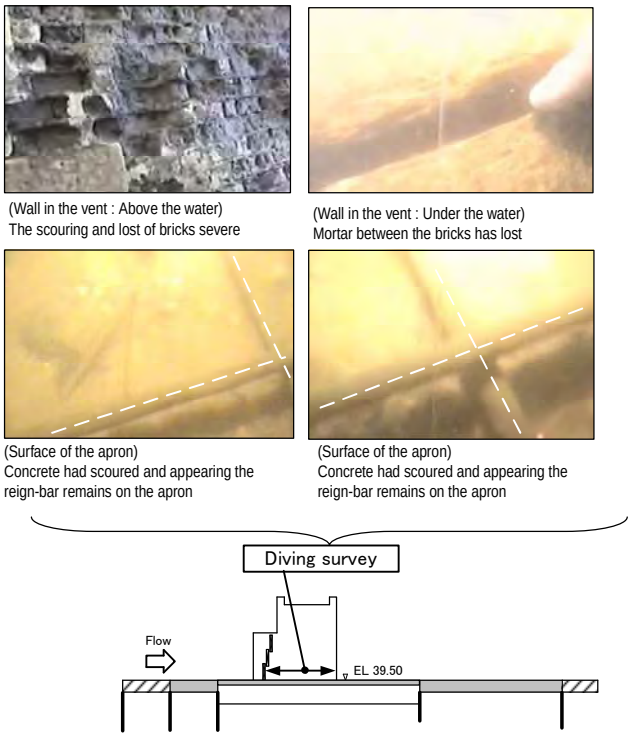


Figure 3.3.17 Diving survey at Ibrahimia Reg.

c-4) Report of the unconfined compression test (U.C.T)

● The strength of the surface of the regulator body

As a result of the unconfined compression test to the core obtained at 50cm from the surface of piers, it was revealed that the current strength of the piers is less than the required strength of the brick-made structures in Egypt, which is 70~80kg/cm^2 (Egyptian Code for the Design and Implementation of brick and buildings ECP 204-2005). The manufacture of the brick has been so long experience and the high technology to make it from ancient that it is assumed almost same quality and strength compared with current those. Therefore, to assume the strength of the brick as of the construction of DGR, the current criteria of the brick can be used as rough standard strength.

According to the current criteria of the brick, the surface of the piers has been damaged by the weathering and consider of lead to the less strength of brick. In case of keep using the existing DGR by the rehabilitation, it need to pay attention for these situation. The result of the unconfined compression test each regulator is shown following:

Table 3.3.3 Result of Unconfined Compression Test (U.C.T)

Name of Regulator	Actual strength (kg/cm^2)	Required strength (kg/cm^2)	Remark
Bahr-Yusef Reg.	21	70~80	less than Required strength
Ibrahimia Reg.	24	70~80	less than Required strength
Badraman Reg.	13 and 7	70~80	less than Required strength
Abo Gabal	16 and 27	70~80	less than Required strength
Saheliya	11 and 12	70~80	less than Required strength
Average of the actual strength (kg/cm2)	16.3	-----	

● The strength of the deep inside of regulator body

These core tests are carried out which are obtained more than 0.5m to 11m from the surface of the pier. The unconfined compression test of the existing DGR was carried out in 2006 by "The Construction Research Institute (CRI) under the National Water Research Center," and also it was done by the JICA preparatory survey team during this study. The average of the result of the unconfined compression test of both tests is summarized as follows.

Table 3.3.4 Summary Table of the Unconfined Compression Test (U.C.T)

Name of Regulator		Depth of Core Sampling (m)	Site of sampling	Year/2006※1) Average Strength (kg/cm^2)	Year/2009 Average Strength kg/cm^2)
D.S Reg.	Bahr-Yusef	0.5~11.00	Pier	38.2	26.0
		11.00~	Foundation	40.7	80.3※2)
	Ibrahimia	0.5~11.00	Pier	38.9	26.3
		11.00~	Foundation	39.6	72.3※2)
	Badraman	0.5~11.00	Pier	38.7	10.0
		11.00~	Foundation	―	―
U.S Reg.	Abo-Gabal	0.5~9.00	Pier	39.1	21.5
		9.00~	Foundation	80.8※3)	―
	Saheliya	0.5~	Pier	―	11.5
			Foundation	―	―

※1) The Construction Research Institute (National Water Research Center, MWRI) 2006
※2) Value of the brick situated on the foundation. It was considered that the brick has not weathered and degradation was caused by being submerged below the water's surface.
※3) Value of the plain concrete.

The value of the test sampled from the pier is less than $40kg/cm^2$, and the value of the foundation shows $80kg/cm^2$. The strength capacity between the pier and the foundation are found to have a substantial difference. (Remark : the sample collected from the foundation of the Abo-Gabal Reg. consists of plain concrete, so it should be excluded from the evaluative test.)

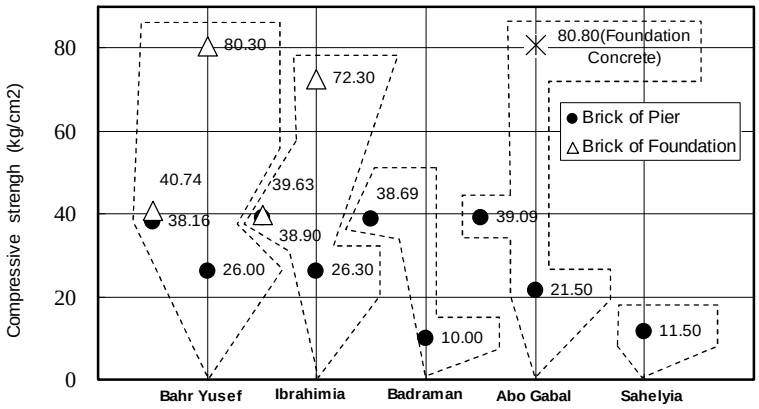


Figure 3.3.18 Distribution of the compressive strength of the inside regulator

The differences of the strength capacity between both materials can be judged to be caused by the foundation having been submerged below the water's surface since construction, and there has been no affection from weather over time. The value of the foundation was shown to be $40kg/cm^2$ to $80kg/cm^2$, and a part of the value is similar to the value of the pier.

Accordingly, the every part of foundation did not escape deterioration but a part of the foundation has been affected by deterioration. The foundation's deterioration is cause for concern. Furthermore, the strength capacity of the locally made brick in Egypt is $70kg/cm^2$ to $80kg/cm^2$, as mentioned in the Egyptian Code for the Design and Implementation of brick and buildings ECP204-2005.

According to the result of the test of brick situated on the foundation, the average value of the data of more than 70kg/cm^2 shows approximately 75kg/cm^2, so the strength capacity of the original structure of the DGR can be assumed to be 75kg/cm^2 and over.

c-5) Report of the permeability test inside of the regulator body

The permeability test on the bricks of the existing regulators was carried out to grasp the situation of the cracks being inside of the regulators at the moment of the implementation of the borehole drilling on the existing regulators. The same test was carried out in 2006 at the Construction Research Institute of the National Water Research Center (MWRI). The summary table of results of the both tests is shown as bellow.

Table 3.3.5. Summary Table of the Permeability Test for the Bricks of existing Regulators

Name of Regulator		Depth of the test point (m)	Place	Year/2006※1) Average Permeability(cm/sec)	Year/2009 Average Permeability(cm/sec)
D.S Reg.	Bahr-Yusef	7.00~8.00	Pier	—	1.01E-04
		11.00~12.00	Foundation	0.725E-04	0.843E-04
	Ibrahimia	7.00~8.00	Pier	—	1.13E-04
		11.00~12.00	Foundation	—	1.12E-04

※) The Construction Research Institute (CRI) of The National Water Research Center 2006

The bricks have a feature of hygroscopicity originally, so the structure in the combination of bricks and mortar is a concern, with the deterioration of the high hygroscopic condition being due to the deterioration of mortar and cracks. According to the literature on this subject, a permeability of ordinary brick is 1×10^{-6}cm/sec, with the result of a permeability test on the existing regulators showing 10 times to a 100 times. The hydraulic conductivity of the pier portion especially shows 1.2 times to 1.6 times of the foundation portion, which is rather high. Therefore those results can be assumed that the pier portion is affected by wet-dry cyclic conditions, depending on the water level, and furthermore, brick has a feature of water absorption, causing the deterioration on the pier portion to develop further.

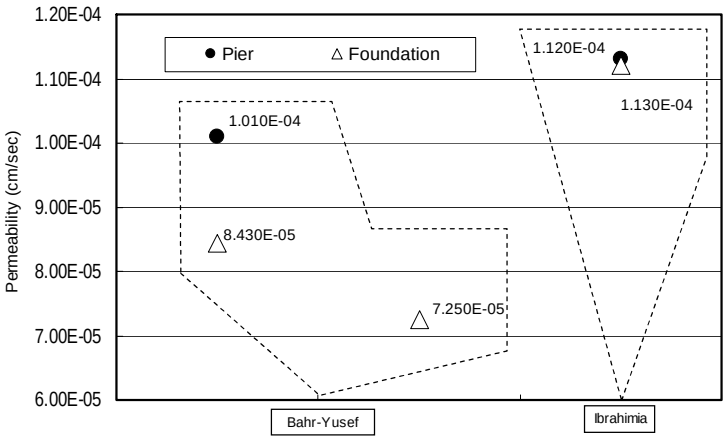


Figure 3.3.19 Distribution of the data of permeability

That tendency of the deterioration grasped by permeability test is similar with the tendency of the deterioration grasped by the unconfined compression test. Therefore the glue of mortar is a concern as it declines with the developing of deterioration on the pier portion.

c-6) Examination of the Up-lift under the foundation at regulator

The study for the uplift pressure on the Bahr-Yusef Regulator and the Ibrahimia Regulator was carried out based on the upstream water level and downstream water level to confirm the real condition in satisfaction of the required thickness of the apron.

●The condition applied is shown below.

- Upstream water level : WL. 46.30m (sourced by existing drawing)
- Downstream water level : WL. 43.00m

●Hydraulic conductivity is shown as follows based on the result of geological survey.

Tabel 3.3.6 Coefficient of Permeability

Soil Type	Permeability(m/sec)
Silty medium to fine sand	2.2×10^{-4}
Sitly clay	1.3×10^{-7}
Wooden sheet piles	1.0×10^{-7}

●Since, the result of the diving survey shows that the apron of the existing regulators were damaged considerably, it can be assumed that effectiveness of the water stop had already decreased.

Therefore, the water stop was taken for the model to be analyzed. (Refer to the right figure)

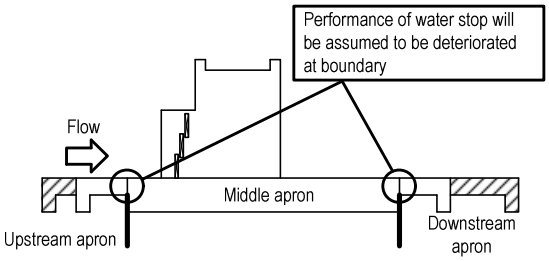


Figure 3.3.20 Assumed position of the damaged water stop

The result of analysis is shown as follows.

The uplift pressure at just under the gates is distributed as follows.

Up-lift at the Bahr Yusef Reg. : 2 tf/m =1 tf/m^2 × (EL45m – LWL43m)
Up-lift at the Ibrahimia Regs : 2 tf/m =1 tf/m^2 × (EL45m – LWL43m)

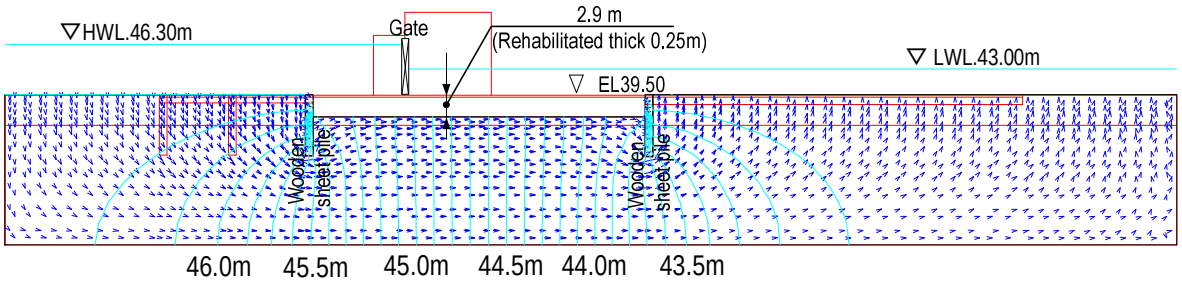


Figure 3.3.21 Analysis of seepage on Bahr Yusef

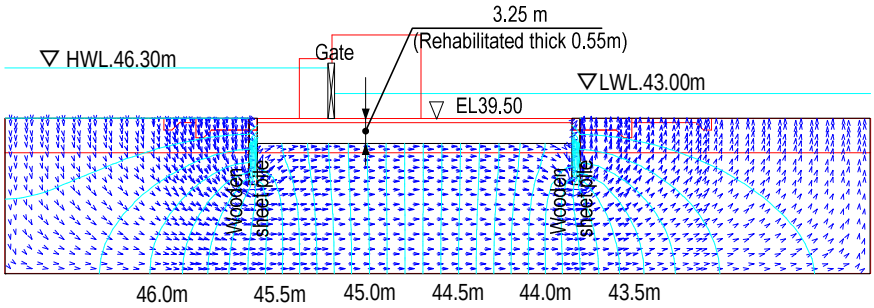


Figure 3.3.22 Analysis of seepage on Ibrahimia

In the design criteria for " The Head Works" by Ministry of Agriculture, Forestry and Fisheries of Japan, the required thickness of the apron is defined using following equation:

$$t \geqq 4/3 \cdot (\triangle H - H_f) / (\gamma - 1)$$

t: Thickness of the apron at point examined
γ: Unit weight; γ= 2.1 t_f/m^3 (result of field survey)
4/3: Safety factor
△H (Maximum difference of water depth both upstream and downstream) －Hf (Head loss of seepage water at point examined); a simplified formula to grasp the uplift pressure at just under the gates. In this study, the analyzed value was applied

instead of this formula, which was grasped through the seepage analysis done by the FEM (The Finite Element Method).

In Egypt, the required thickness of the apron was defined using following equation:

$t_2 = (0.80 \sim 1.00) \sqrt{H}$

t_2: Thickness of the apron at point examined (m)

H: Difference of water depth both upstream and downstream (m)

The difference between the Japanese criteria and Egyptian criteria is found to be that the Japanese criteria use the safety factor of 4/3, considering safety first. The result of estimation is shown as follows.

Furthermore, the designed drawings show the thickness of the apron for the Bahr Yusef and the Ibrahimia Reg. to be 2.9m and 3.25m, respectively. According to the diving survey, the real thickness of the existing apron is not ensured, and the applied thickness for the analysis was defined as follows:

Thickness of the foundation at Bahr Yusef Reg. 2.65m = 2.9m – 0.25m
Thickness of the foundation at Ibarahimia Reg. 2.70m = 3.25m -0.55m

Tabel 3.3.7 Checking of the thickness of apron

Checking ofthe thick of apron by the design code of Japan

	Water pressure at checking point	Density of apron	Necessary thickness	Actual thickness of apron	Surplus thickness of apron	Judge
Bahr-Yusef Reg.	2.00tf/m2	2.1tf/m3	2.42m	2.65m	0.23m	OK
Ibrahima Reg.	2.00tf/m2	2.1tf/m3	2.42m	2.70m	0.28m	OK

Checking of the thick of apron by the design code of Egypt

	Difference of head	Necessary thickness	Actual thickness of apron	Surplus thickness of apron	Judge
Bahr-Yusef Reg.	3.30m	1.45m ~ 1.82m	2.65m	1.2m~0.83m	OK
Ibrahima Reg.	3.30m	1.45m ~ 1.82m	2.70m	1.2m~0.88m	OK

According to the result of the analysis, the required thickness by using both equations defined by both criteria were satisfied under the present situations, and it can be judged that both aprons are safe. However, the remaining surplus thickness of the apron can be understood as 1.0m using Egyptian criteria and 0.3m using Japanese criteria. There is the historical background behind the establishment of the design criteria in both countries; the argument of this subject shall be skipped. Since, for the existing regulators 137 years has already passed, since they were constructed in 1873, applying the concept of the safety factor should be applied to evaluate the safety of the facility by using the safety factor.

Consequently, the existing apron satisfies the required thickness in this situation, and the remaining surplus thickness for safety is judged to be 0.3m. In case of continuous use in the future, the improvement works should be done as soon as possible.

3.3.3 The evaluation of the existing DGR

(1) Forecasting of the progress of the deterioration of facilities

According to the result of the laboratory test on the unconfined compression test, the bearing capacity of the piers shows a tendency to decrease. Generally, deterioration of the bearing capacity of the material of the facilities constructed shows a tendency to decrease not in linear but in quadratic curves with accelerated speed as time passes for the final stage of the deterioration of facilities.

Accordingly, the deterioration curves of the bearing capacity of the piers for the regulators were established and the assumed bearing capacity in the future will be examined.

- The original bearing capacity of the regulators for the implemented time is assumed to be 76kg/cm^2. (Average value from the result of the unconfined compression test for sampling the core from the foundation portion of the piers, 2009 : (80.3kg/cm^2+72.3kg.cm^2)/2=76.3kg/cm^2)

- According to the unconfined compression test carried out in 2006 (133 years after construction), the average bearing capacity of the piers was 39kg/cm^2. As for the unconfined compression test carried out in 2009 (137 years after construction), the average bearing capacity of the piers was 19kg/cm^2. Evaluating these results, the average of the above data, namely 29kg/cm^2 (135 years after construction) is employed as a bearing capacity.

- It is assumed that the deterioration curve figures into the quadratic curve.

- The deterioration of the compression strength of brick for the future is forecasted by the deterioration curve and then, evaluate the stability of the structure in the future by comparing forecast value with analyzed stress based on currency load.

Regarding analyzed stress, the Construction Research Institute of the National Water Research Center in Egypt carried out a 3-D stress analysis by FEM (SAP2000 software). This analysis has confirmed the stability of the structure on compression stress. These analyzed stress shall be used in this review. The following table shows the degree of compression stress revealed by 3-D FEM analysis:

Tabel 3.3.8 The result of the stress analysis by 3-D FEM

Regulator \ Location		Guide Wall (kg/cm^2)	Middle pier (kg/cm^2)	Abut pier (kg/cm^2)	Average (kg/cm^2)
D.S. Reg.	Bahr Yusef	3.82	3.50	12.00	5.0
	Ibrahimia	2.70	3.38	3.00	
	Badraman	4.41	3.15	9.33	
U.S. Reg	Abo-Gabal	1.78	1.45	0.87	1.4
	Shahelyia	-	-	-	

1) Data is from the Construction Research Institute, National Water Research Center in 2006
2) The difference of the average compression stress between the D.S. Regulators and the U.S. Regulators is around 5 times. This would be due to the fact that the size of the U.S. Regulators is smaller than the D.S. Regulators.

The following shows the deterioration curve:

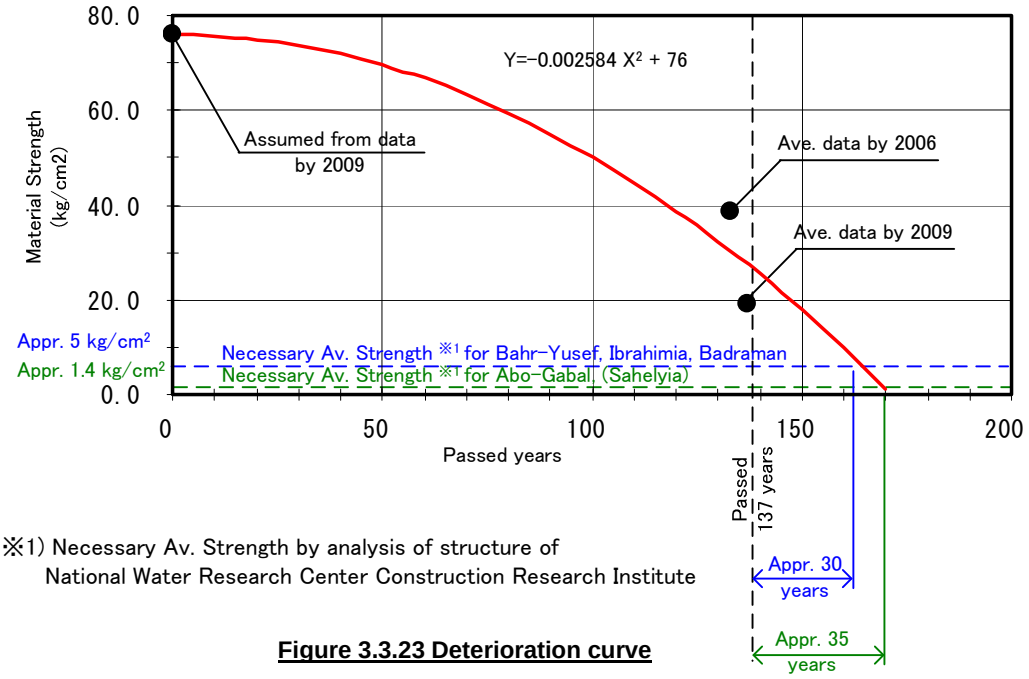


Figure 3.3.23 Deterioration curve

(2) Comprehensive Evaluation of the Survey Results

According to the survey results, it is judged that there is no damage or deterioration, which would lead to immediate danger in the stability of the existing DGR. However, the following points have to be considered in case of continuously using the existing structure.

[Geological Conditions]

- ●The N-value of the geological layer for Bahr Yusef is from 19 to 27. It is considered that the foundation of Bahr Yusef is rather weak since the N-value of the sand gravel layer, which should be the foundation of the structure, should be more than 30.
- ●The N-value of the sand gravel layer near the foundations of the Badraman and Ibrahimia Reg. is from 30 to 40, and therefore, it is considered that these two regulators are constructed on a good geological layer. However, the N-value in some parts within 2m of depth under the foundation of the Ibrahimia regulator shows 26. This fact should be taken into consideration in case the load of the regulator changes in the future.
- ●The foundations of the Sahelyia and Abo-Gabal Reg. are on the clay layer with the N-value of around 20. As the N-value of the clay layer for the foundation should be more than 20, it is considered that these two regulators were constructed on the suitable layer. However the clay layer might be settlement by consolidation or by immediate.

[On Structural Conditions]

- ●As for the Bahr Yusef and Ibrahimia Reg., severe scouring and loss of bricks just downstream of the side of the gates are observed. For the situation under water, it is observed that mortar between the bricks and stones have been washed out and therefore, the merit as a single piece of structure has been weakened.
- ●The above two regulators have been reinforced with concrete in 1962, but it is observed that the concrete has been washed out. It is confirmed that the thickness of the aprons meets the requirement at the moment. However, additional reinforcement would be required to prevent the aprons from further scouring. Also, canal bed protection with concrete block and stone would be required to prevent from scouring.
- ●Bricks in the existing DGR are consistently deteriorating. According to the deterioration curve, the time that the strength of the bricks falls below the requirement would be around year 2040 (30 years from the present) for the D.S. Regulators (Bahr Yusef, Ibrahimia and Badraman) and year 2045 (35 years from the present) for the U.S. Regulators (Abo Gabal and Sahelyia).

(3) Requirement of the rehabilitation and reinforcement of existing DGR for using the irrigation facility

Based on the evaluation of the survey results, the following repair and reinforcement work would be required in case of continuously using the existing DGR as the irrigation facility:

- ●Grouting inside the regulator bodies is suggested in order to reinforce the weakened bricks. The regulators necessary to be reinforced are the Bahr Yusef, Badraman and Ibrahimia Reg. Six borings and over with a 1.5m interval on each regulator body will be carried out for grouting. In order to reinforce the foundation, the depth of the boring would be around 20m. It should be noted that excessive pressure injection would give an additional load to the existing structure.

- Scouring on the aprons of the Bahr Yusef and Ibrahimia Reg. should be repaired. The area of the repair should cover the entire set of aprons, and it is suggested to cast high strength concrete (at least σ ck = 30N/mm^2) with the thickness of more than 50cm in order to prevent scouring. If there are remains of concrete by the previous reinforcement, these should be removed before casting new high strength concrete. It is suggested to install water stops between the upper part of the apron and middle part and the middle part and lower part in order to de-concentrate uplift effects. The apron of the Badraman Reg. should also be repaired since the regulator is as old as 138 years.

- For the Bahr Yusef and Ibrahimia Reg., which have been severely scoured, it is suggested to lay concrete blocks on the canal beds in order to dissipate flow energy at the downstream side of the aprons. The blocks would be laid around 30m to 50m from the edge of the lower part of the aprons. Furthermore, on down stream of the block area, it is suggested to lay stones on canal bed to prevent from scouring. The same repair with the above two regulators should be done on the Badraman Reg.

- For the parts of the body, which have been scoured and whose bricks have been lost, it is suggested to replace all the bricks of the damaged parts. At the area in which mortar has been lost, mortar should be re-filled. This repair is based on the understanding that the existing DGR is a historical monument, so the same materials with the existing one should be preferentially used for repair. It should be noted that the same scouring may occur in the future. The same repair would be applied for the Badraman Reg.

- It is suggested to electrify all the gates of the DGR. This would reduce the labor load for the operation of the gates and enable smooth gate operation. The number of the gates is the same with the existing number.

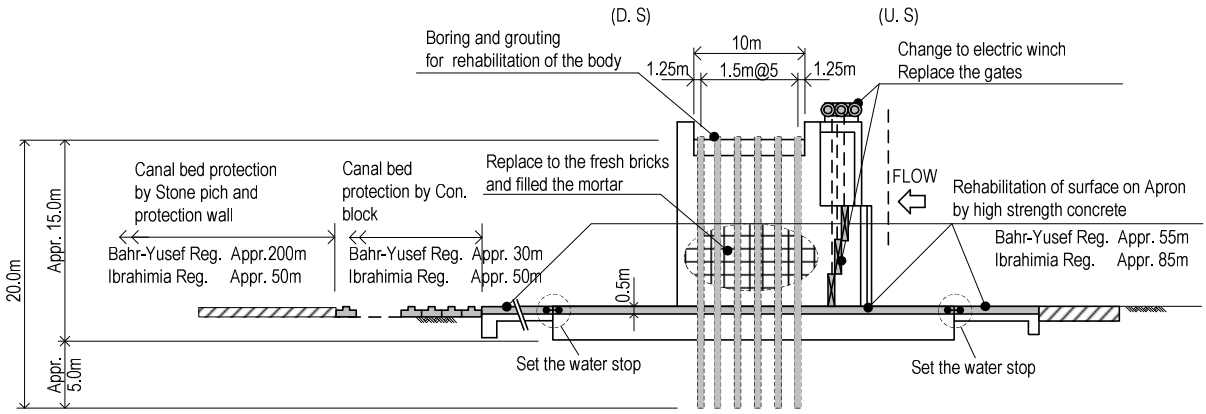


Figure 3.3.24 Rehabilitation of the DGR on standard section

(4) Observation for Using the Existing DGR and proposal of the construction of a New DGR

It is considered to expect the extension of the life of DGR for approximately 10 years by the rehabilitation and improvement suggested on the basis of the this survey. Specially, the grout would be executed into the regulator body to rehabilitate the brick of strength. However the effect of rehabilitation is expected on the condition of injecting completely to every corner, it is difficult to confirm the degree of the injection from outside. Therefore the rehabilitation by grouting is needed to take into consideration of the lack on certainly. Furthermore it is required to pay the attention of the over pressure with the injection in order to prevent from expanding the clacks.

It is suggested to rehabilitation and improvement of the existing DGR based on this survey, however that are hardly expected to improve the function of distribution to the suitable. The gate facilities can be done the improvement from the manual type to the electric type, but the function of distribution and maximum distribution water on each regulators can not be improved because of the same vents and same number of the gates. That means not to be able to solve the issue on water management of Bahr Yusef canal and Ibrahimia canal as follow;

- In Bahr Yusef and Ibrahimia canal on term of maximum discharge (June~August), it is impossible to regulate the discharge for the gates opened fully.
- There are 5 vents on Bahr Yusef Reg. and 7 vents on Ibrahimia Reg. According to the protocol of the distribution of MWRI on 2002, the ratio of distribution between Bahr Yusef and Ibrahimia is 50% and 40% each other. That means to reverse against the relationship of the size of facility.
- The gate facilities of existing DGR would be improved to electric type. However it is difficult to operate the gates which made of triple gates for a gate, therefore it would be complicated operation and required the visual operation by each local winch. Additionally, it would be impossible to be done the advanced operation of distribution by the control house such as remote control.
- From the view of the horizontal expansion of farm land, on the project target area, the toward of the expansion of farm land would be to the west for the desert. Bahr Yusef canal supplying the water toward the west would be forecasted well to larger discharge in the near future. Therefore it would be required to suitable and rapidly gates operation in order to efficient water management.

Accordingly, even if the rehabilitation and improvement of existing DGR, it can not be expected to use for 50 years or 100 years and it can not be adjusted supply of the water at the present and for the future, because of not to improve the function and performance of the DGR. Furthermore, to keep use existing DGR would be considered to be loss the opportunity of the improvement of the water management and the horizontal expansion for the future.

Therefore existing DGR should be newly constructed as regulators with suitable facilities of the distribution.

Additionally, in terms of the social and environmental concerns, the using of the existing DGR will scarcely create an environmental problem for the surrounding area; although, with the construction of a new DGR it could be assumed that an environmental problem might exist, such as a main road, railway or mosque near the canal, depending on the location of the new DGR. Therefore, the examination of the location of a new DGR should be considered in the evaluation for the social environment. (Refer to Chapter 4.2: Formulation of DGR)

The policy of the construction of the new DGR was accepted by third steering committee on 18 February 2010.

3.4 Present Situation of Operation and Management along Main Canal

3.4.1 Organization and structure of water management

The water distribution of the MWRI is managing the water distribution of the irrigation ranging from the Nile River to the branch canal. The organizational chart of the water management in the Study area is shown in Figure 3.4.2.

In general, the operation for the water level adjustment in each gate is done twice a day. The gate operator reports a water level to the staff of the directorate irrigation office using a wire telephone. Then, the staff of the directorate irrigation office reports the water level by a wire telephone to the water distribution for Upper Egypt in Assiut. Furthermore, the staff of the water distribution for Upper Egypt in Assiut reports this water level to the water distribution in Cairo. The staff of Cairo and Assiut determines the amount of water supply to the lower stream which is based on the existing water distribution plan. This volume of water is converted into the water level, and the instruction is given by wire telephone from the staff of Assiut to the directorate irrigation office.

The staff in the directorate irrigation office that received this instruction puts out the instruction of the operation of the gate to the operator at each gate. This water level is an instruction for keeping the water level on the downstream side of each regulator. The communication of instruction for the water level is shown in Figure 3.4.1.

Additionally, in the Assiut Barrage, the Ibrahimia Intake and Dirout Group of Regulators, water level information is directly exchanged between a gate operator and the staff of the water distribution for Upper Egypt in Assiut, without going through the directorate irrigation office. In this case, the water level is reported four times a day.

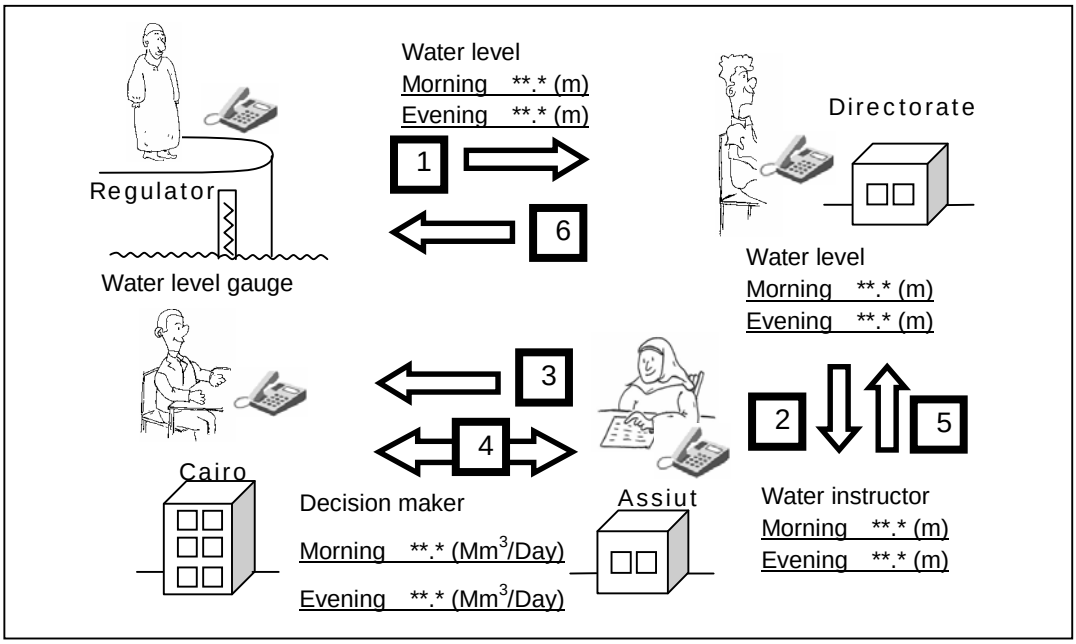
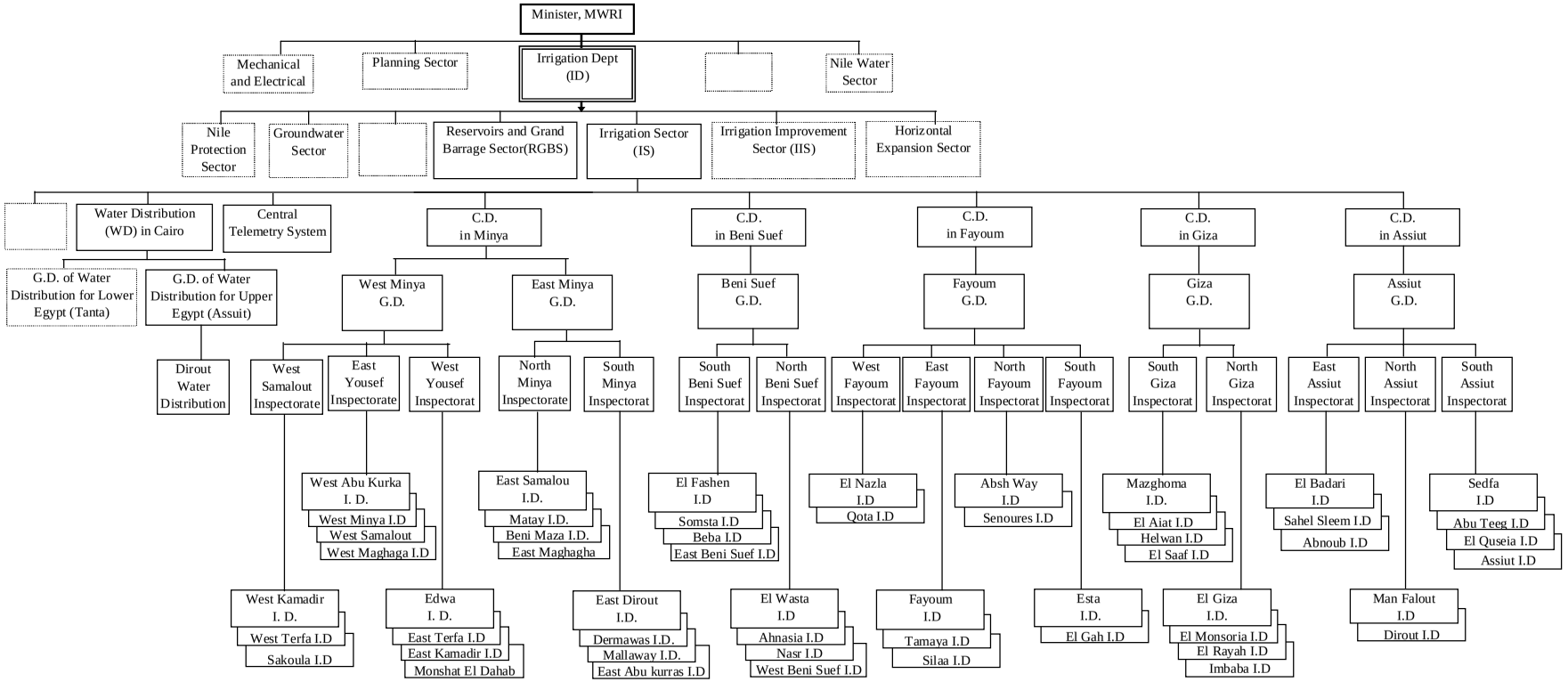


Figure 3.4.2 Water Instruction System

Organization Structure for Irrigation Water Distribution related to Dirout groups of Regulators



C.D. : Central Department (Directorate)
G.D. : General Directorate
I.D. : Irrigation District

Figure 3.4.1 The Organizational Chart

3.4.2 The situation of the water management system

(1) The existing daily operation of water level observation

In the Study area, there are about 30 water level observation and recording points managed by the water distribution for Upper Egypt. Figure 3.4.3 shows a schematic diagram of regulators and the observation item (water level and discharge) of each point. Discharge is measured in the regulator located in the boundary of directorate and the main water distributing facilities. The HQ curve is updated once a year in the regulator where the discharge observation is done.

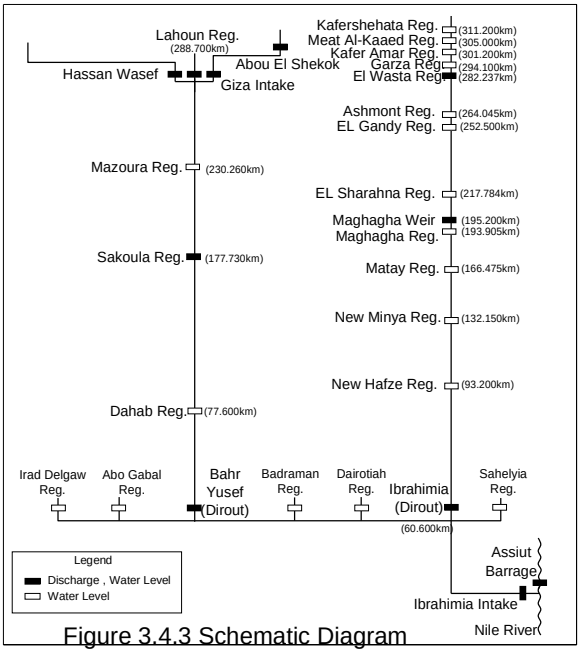
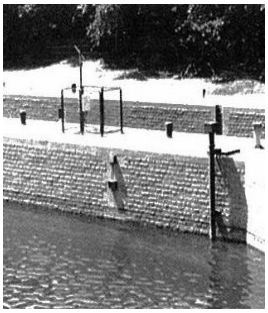


Figure 3.4.3 Schematic Diagram

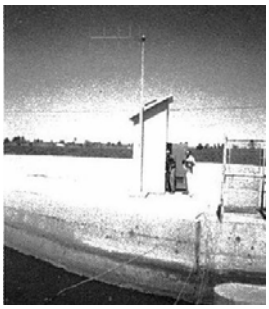
Table 3.4.1 shows the collected data of each regulator. Figure 3.4.5 shows the measuring points of the water level at the Dirout Group of Regulators.

(2) Existing Telemetry & Telecontrol System

A water level observation system carried out by USAID during the project implementation period of 1989-1995 is famous for an existing telemetry system in Egypt. About 800 telemetry systems were installed across Egypt for the purpose of managing the area wide situation of water supplies. There are two kinds of systems: one is the Meteor Burst Telemetry System (about 200 locations), and the other is the Voice and Data Communication System (about 600 locations).



The meteor burst-communication can communicate the long distance in which the prospect is not effective. However, because the ionosphere generated by the meteor only for a short time is used, this correspondence procedure is unsuitable for a real-time communication that treats a large amount of data. On the other hand, the voice communications system is a suitable method for a real-time communication using the VHF wireless. However, the coverage of the electric wave is limited within around 200km.



This telemetry system has played an important role such as obtaining the wide area's real time water level. However, because this telemetry system had been easy to receive the influence of the atmospheric noise situation greatly, the communication situation had at times been unstable. Moreover, in recent years, maintaining this system has become difficult because it does not obtain the repair support of machine parts from the manufacturer when the system breaks down.

From the background of such a problem, there is no plan of a new additional installation of an existing USAID type telemetry system. The system which is still working now is the Meteor Burst Telemetry System at about 100 sites and the Voice and Data Communication System at about 50 sites. If the system at an important observation station breaks down, water level continues to be observed by substituting the machine parts of other sites.

Figure 3.4.4 is a schematic diagram of the Telemetry System in the Study area. This was made referring to the Mimic System Display Board at the MWRI Telemetry Central Directorate. According to this schematic diagram, telemetry systems were installed in approximately 200 locations in the Study area. However, even if the breakdown occurs, as well as with other telemetry systems, these systems are not repaired.

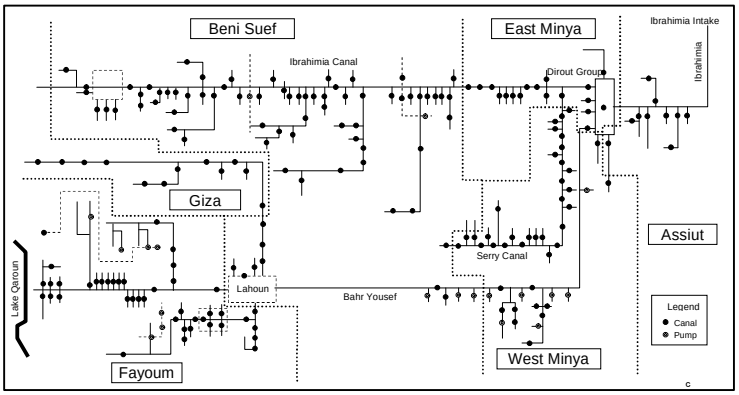


Figure 3.4.4 Schematic Diagram of Telemetry System

At the gate of the Serry Canal Intake along the Ibrahimia Canal, the project which operates a gate by a remote control system was also carried out during this project implementation period. In this project, the electric gates were installed into the Serry Canal Intake, and the experiment of remote control was conducted. However, since the Voice and Data Communication System was in an unstable situation, this was ended as an experimental project.

The existing telemetry system executed by USAID is not scheduled for repair in the future because a large initiation of electrical power and a sizable installation space of this system is more necessary than that of the small telecommunication technology, such as mobile phones. As for the Meteor Burst Telemetry System and the Voice and Data Communication System, it is scheduled to be abolished in roughly 2-3 years, according to the interviewing survey.

(3) The precedent project of the water management system at the other site

Instead of the existing Telemetry System by USAID, a new Telemetry System project is carrying out a pilot project in the Salam canal. This project is called Salam Canal Operation and Management System and is carried out by the MWRI Telemetry Central Directorate. This project is a system which is going to utilize water level data, the gate position, the pump status, etc. for real time monitoring or remote control using the GSM service of a private mobile phone company (Global System for Mobile Communications).

The Meteor Burst Telemetry System and the Voice and Data Communication System were required in the engineering under exclusive contract for system maintenance. However, in the GSM system by this mobile phone company, since users such as MWRI are using this only as the service of a mobile phone company, MWRI does not need the engineer under exclusive contract for a large system or for maintenance. There is an advantage that technical correspondence according to rapid progress of the information technology skill is executed under a private company because it corresponds to the upgrade under the responsibility of a private company as the telecommunication technology progresses.

According to the interviewing survey, there is a plan to execute the observation of the water level of the large area by using this GSM. The Ibrahimia Intake and the Dirout Group of Regulators are included in the future project.

Table 3.4.1 List of Collected Water Level and Discharge Records

19-Jun-10

		Items	1	2	3	4	5	6	7	8	9	10	11
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Asyut	Asyut Barage	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
	Ibrahimia Intake	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
Dirout group of Regulators	El delgawy canal	WL(U),WL(D)	✓	$✓_{1-6}$	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Abo Gabal canal	WL(U),WL(D)	✓	$✓_{1-6}$	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Bahar Yosef canal	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
	Bedraman canal	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Diroutiya canal	WL(U),WL(D)	✓	$✓_{1-6}$	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Ibrahimia canal	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
	Sahelya canal	WL(U),WL(D)	✓	$✓_{1-6}$	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
Bahar Yosef Canal	Dahab regulator	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Sakoula Regulator	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
	Mazoura Regulator	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Lahoun Regulator	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
	Hassan Wasef Intake	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
	Giza Intake	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
Ibrahimia Canal	New Hafze Regulator	WL(U),WL(D)	✓	–	$✓_{2-12}$	✓	✓	✓	✓	–	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	New Minya Regulator	WL(U),WL(D)	✓	–	$✓_{2-12}$	✓	✓	✓	✓	–	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Matay Regulator	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Maghaga Weir	WL(U),WL(D)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
		Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
	El Sharahna Regulator	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	El Gandy Regulator	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Ashmont Regulator	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	North El-Wasta Regulator	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	×	×	×	×	×	×	×	×	×	×	×
	Garza Regulator	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Kafer Amar Regulator	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Meat Al-Kaaed Regulator	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	–	–	–	–	–	–	–	–	–	–	–
	Kafer Shehata Regulator	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	–	–	–	–	–	–	–	–	–	–	–
Giza Canal	Abo El Shekok	WL(U),WL(D)	–	–	–	–	–	–	–	–	–	–	–
		Q	×	×	×	×	×	×	×	×	×	×	×

WL(U):Water Level at Upstream of Regulator
WL(D):Water Level at Downstream of Regulator
Q:Discharge ✓ : Daily discharge data
× : Monthly discharge data

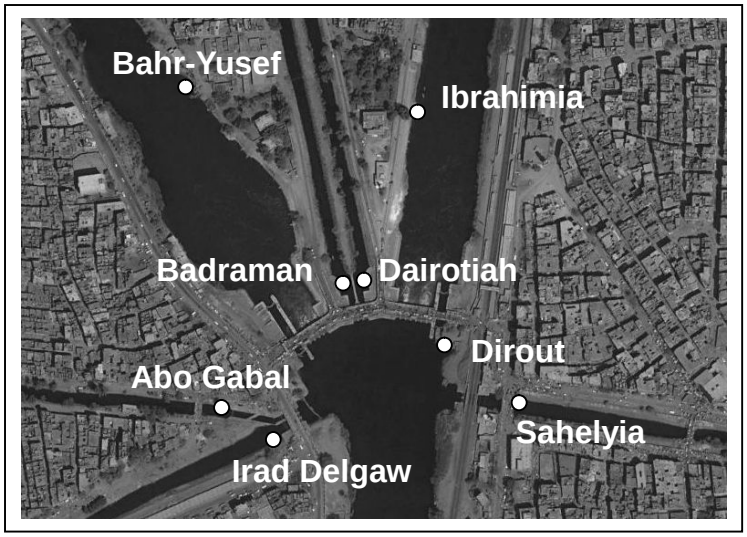


Figure 3.4.5 Measuring Points of Water Level at Dirout Group of Regulators

3.4.3 Present Situation of Water Level and Discharge

The annual discharge at major regulators and monthly discharge records at the Ibrahimia Intake, Bahr-Yusef and Ibrahimia are shown in Tables 3.4.2, 3.4.3, 3.4.4 and 3.4.5. The annual discharge at major regulators, monthly average discharge at major regulators, and monthly average water level at major regulators are shown in Figures 3.4.6, 3.4.7 and 3.4.8. Monthly discharge and water level at Bahr-Yusef and Ibrahimia are shown in Figures 3.4.9 and 3.4.10. The feature of each regulator is shown below.

(1) Assiut Barrage

After recording the smallest annual discharge (36,985 MCM) in 2003 within ten years in the past, the annual discharge is in an uptrend. However, the annual discharge in 2009 was about 8% less than the previous year. There is about 2 to 3 m of water level difference between upstream and downstream. This water level difference is the largest compared with other regulators in the study area.

[Refer to Table 3.4.2, Figure 3.4.6, Figure 3.4.7, and Figure 3.4.8]

(2) Ibrahimia Intake

After recording the smallest annual discharge (9,695 MCM) in 2003 within ten years in the past, the annual discharge is in an uptrend as well as at the Assiut Barrage. However, the annual discharge in 2009 was less than the previous year. The water level difference between upstream and downstream is small throughout the year. The water level difference of the Intake is the smallest from June to August. During this period it can be presumed that the gates are wide open because this is the most necessary period for the greatest irrigation water volume.

[Refer to Table 3.4.2, Table 3.4.3, Figure 3.4.6, Figure 3.4.7, and Figure 3.4.8]

(3) Dirout Group of Regulators

It is only at the Bahr-Yusef canal and the Ibrahimia canal that both the water level and discharge quantities are observed in the Dirout Group of Regulators. As for other canals, only the upstream and downstream water levels are measured. Therefore, whether the water is appropriately distributed to the seven canals in the Dirout Group of Regulators cannot be confirmed by the volume of discharge in the

situation of a present water management system.

[Refer to Table 3.4.2, Figure 3.4.6, Figure 3.4.7 and Figure 3.4.8]

(4) Bahr-Yusef canal

After recording the smallest annual discharge (4,608 MCM) in 2003 within ten years in the past, the annual discharge is in an uptrend. However, the annual discharge in 2009 was about 2% less than the previous year. The water level difference between upstream and downstream is about 1.0 m except for the period from June to August. From June to August, it can be presumed that during this period the gates are almost completely opened because this is the period when the irrigation water is most needed.

In general, there is a peak of the water requirement from June till August. However, only in the Giza Intake, the peak of the water distributed discharge has been recorded in May. The month of harvesting of wheat is May, and the irrigation water is unnecessary in the upstream area at that time. It is because the discharge volume of the Giza canal in the end rises compared with other periods.

The annual discharge of the Sakoula regulator in 2009 was less than that of the average for ten years until 2008. This result will show an increase in the amount of water supply to Minya in 2009 compared with the ten past years.

Approximately, during the past five years, the discharge compares well to the monthly ten-year average discharge. The latest five-year monthly discharge tends to exceed the monthly ten-year average discharge.

[Refer to Table 3.4.2, Table 3.4.4, Figure 3.4.6, Figure 3.4.7, Figure 3.4.8, and Figure 3.4.9]

(5) Ibrahimia canal

After recording the smallest annual discharge (3,804 MCM) in 2005 within the past ten years, the annual discharge is in an uptrend. However, the annual discharge in 2009 was about 12% less than the previous year. The annual discharge of the Ibrahimia canal has decreased greatly while the annual discharge of the Bahr Yusef canal was only 2% less than that of 2008. According to the interview with the farmers, the water level of the Ibrahimia canal in 2009 was lower than that of an ordinary year. It is important that each regulator highly controls the water level in the canal when the discharge volume is smaller than that of an ordinary year.

A lot of discharge from June to August can be analyzed from the graph. It can be guessed that it is an influence of the crop pattern that the discharge volume has increased from March to July. The water level difference between upstream and downstream is approximately less than 2.0 m. From June to August, it can be presumed that during this period the gates are almost completely opened because this is the period when the irrigation water is most necessary. It can be guessed that the discharge volume downstream is adjusted by using the gate compared with the Bahr-Yusef canal during this period.

[Refer to Table 3.4.2, Table 3.4.5, Figure 3.4.6, Figure 3.4.7, Figure 3.4.8, and Figure 3.4.10]

(6) The other five canals

In these five canals, the only observation criterion is the water level, and the discharge is unidentified because there is no H-Q rating curve. The water level downstream of the regulator is not steady in all regulators. Therefore, it can be guessed that these water supplies to the canal are not stable.

Table 3.4.2 Annual Discharge at Major Regulators

unit : MCM

Year	Assiut Barrage	Ibrahimia Intake	Bahr Yusef	Ibrahimia at Dirout	Sakoula Regulator	Hassan Wasef	Lahoun Regulator	Giza Intake	Maghagha Regulator	El Wasta Regular	Abo El Shekok
1999	46,149	10,381	4,759	***	4,080	1,025	1,719	1,052	2,003	111	839
2000	***	10,132	4,690	4,182	4,096	1,011	1,672	1,033	2,005	103	842
2001	43,981	10,206	4,752	4,084	4,177	1,012	1,682	1,013	2,016	101	839
2002	40,617	9,877	4,640	3,965	4,052	985	1,659	967	1,941	104	841
2003	36,985	9,695	4,608	3,821	4,108	980	1,625	***	1,904	96	762
2004	38,795	9,892	4,722	3,907	4,166	1,006	1,649	863	1,882	95	718
2005	38,688	9,907	4,735	3,804	4,255	992	1,662	851	1,875	78	714
2006	39,480	10,271	4,967	3,903	4,252	1,010	1,661	923	1,924	76	741
2007	44,925	10,784	5,050	4,454	4,371	1,037	1,693	1,017	2,107	109	770
2008	43,392	11,065	5,281	4,500	4,331	1,128	1,715	1,057	2,062	106	753
2009	39,893	10,094	5,190	3,975	3,775	1,068	1,513	991	1,866	40	731
Average	41,291	10,209	4,854	4,060	4,151	1,023	1,659	977	1,962	93	777
(Ratio)	–	(100%)	(48%)	(40%)	–	–	–	–	–	–	–

Table 3.4.3 Monthly Discharge Records at Ibrahimia Intake

unit:MCM

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	498	597	875	836	951	1,117	1,194	1,207	908	851	727	620	10,381
2000	175	765	833	847	922	1,159	1,235	1,207	908	808	711	562	10,132
2001	284	700	845	846	901	1,149	1,227	1,199	918	875	707	555	10,206
2002	305	617	839	816	902	1,144	1,208	1,203	879	747	668	549	9,877
2003	187	650	738	778	860	1,133	1,209	1,207	886	781	716	550	9,695
2004	269	668	761	808	899	1,127	1,199	1,206	911	761	727	556	9,892
2005	219	657	786	831	877	1,145	1,216	1,210	918	788	723	537	9,907
2006	258	633	855	848	894	1,185	1,217	1,181	935	785	741	595	10,127
2007	358	728	849	897	916	1,158	1,197	1,223	991	933	894	640	10,784
2008	260	749	929	986	1,025	1,161	1,234	1,250	1,019	942	792	718	11,065
10 years Average	281	676	831	849	915	1,148	1,214	1,209	927	827	741	588	10,207

Table 3.4.4 Monthly Discharge Records at Bahr-Yusef

unit:MCM

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	187	293	394	360	447	521	545	555	427	397	353	280	4,759
2000	55	369	414	406	440	523	550	545	427	384	335	242	4,690
2001	120	310	423	410	446	535	558	551	421	403	334	241	4,752
2002	118	286	435	389	451	521	555	543	392	374	329	247	4,640
2003	81	313	390	393	425	538	558	556	401	376	332	245	4,608
2004	95	303	393	409	435	538	559	558	429	382	361	260	4,722
2005	96	298	403	421	432	541	559	558	419	395	357	256	4,735
2006	174	290	435	425	465	548	563	553	426	422	378	288	4,967
2007	138	346	424	442	441	534	559	564	461	432	403	306	5,050
2008	130	365	492	486	487	551	573	575	469	451	376	326	5,281
Average	119	317	420	414	447	535	558	556	427	402	356	269	4,820

Table 3.4.5 Monthly Discharge Records at Ibrahimia Dirout

unit:MCM

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	274	303	408	411	431	540	522	526	409	***	352	327	***
2000	104	327	346	356	381	455	472	451	365	341	311	273	4,182
2001	128	301	332	331	350	441	460	449	369	359	300	264	4,084
2002	142	274	315	334	350	436	451	442	353	312	293	263	3,965
2003	81	290	302	302	331	430	445	438	335	314	292	261	3,821
2004	124	270	289	409	332	418	433	432	342	305	291	262	3,907
2005	87	275	303	307	329	423	448	444	354	305	286	243	3,804
2006	74	253	324	318	345	442	460	420	378	327	299	263	3,903
2007	151	281	340	382	403	448	475	485	412	397	379	301	4,454
2008	117	318	373	403	422	465	491	479	405	392	334	301	4,500
Average	128	289	333	355	367	450	466	457	372	339	314	276	4,069

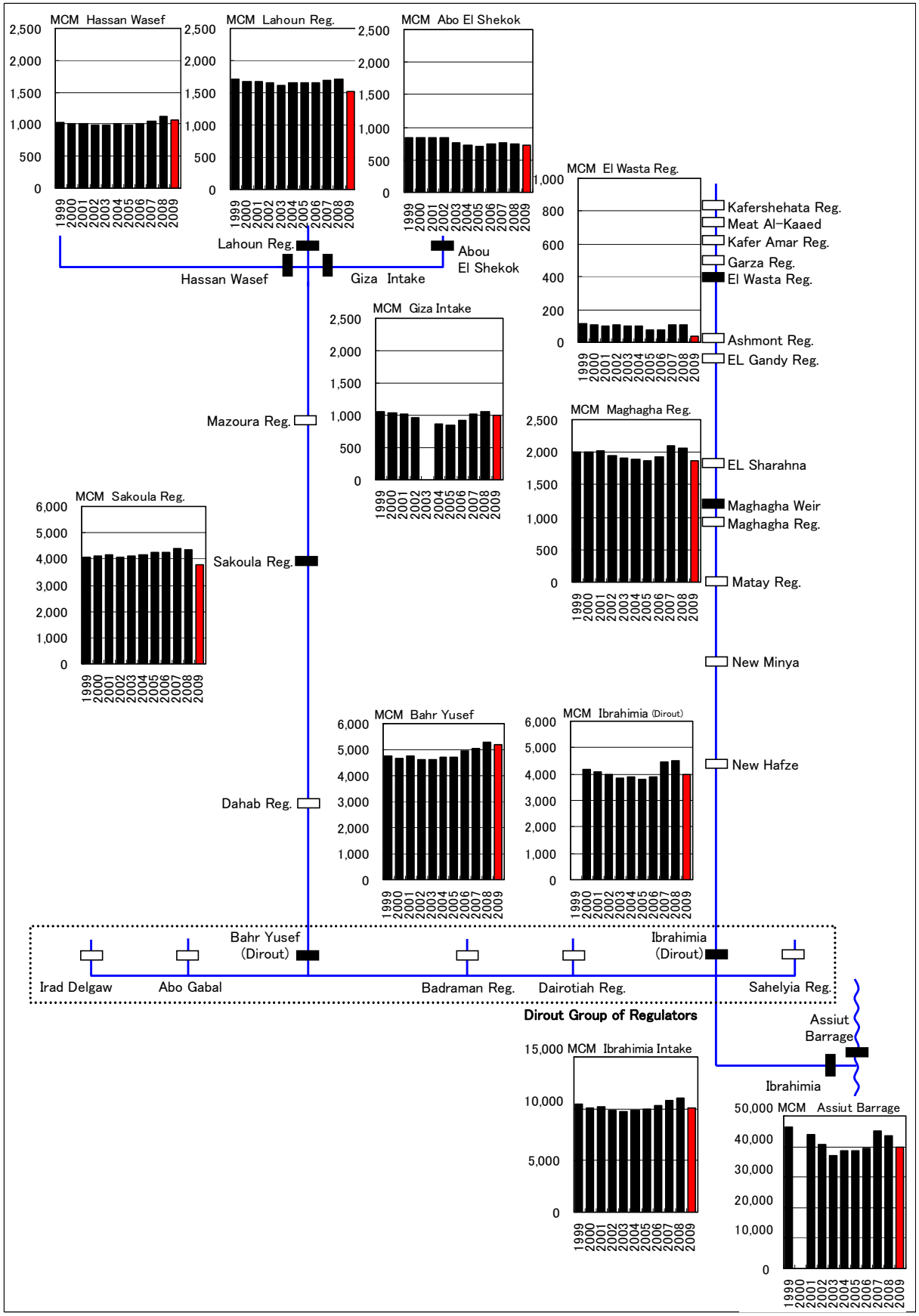


Figure 3.4.6 Annual Discharge at Major Regulators (1999-2009)

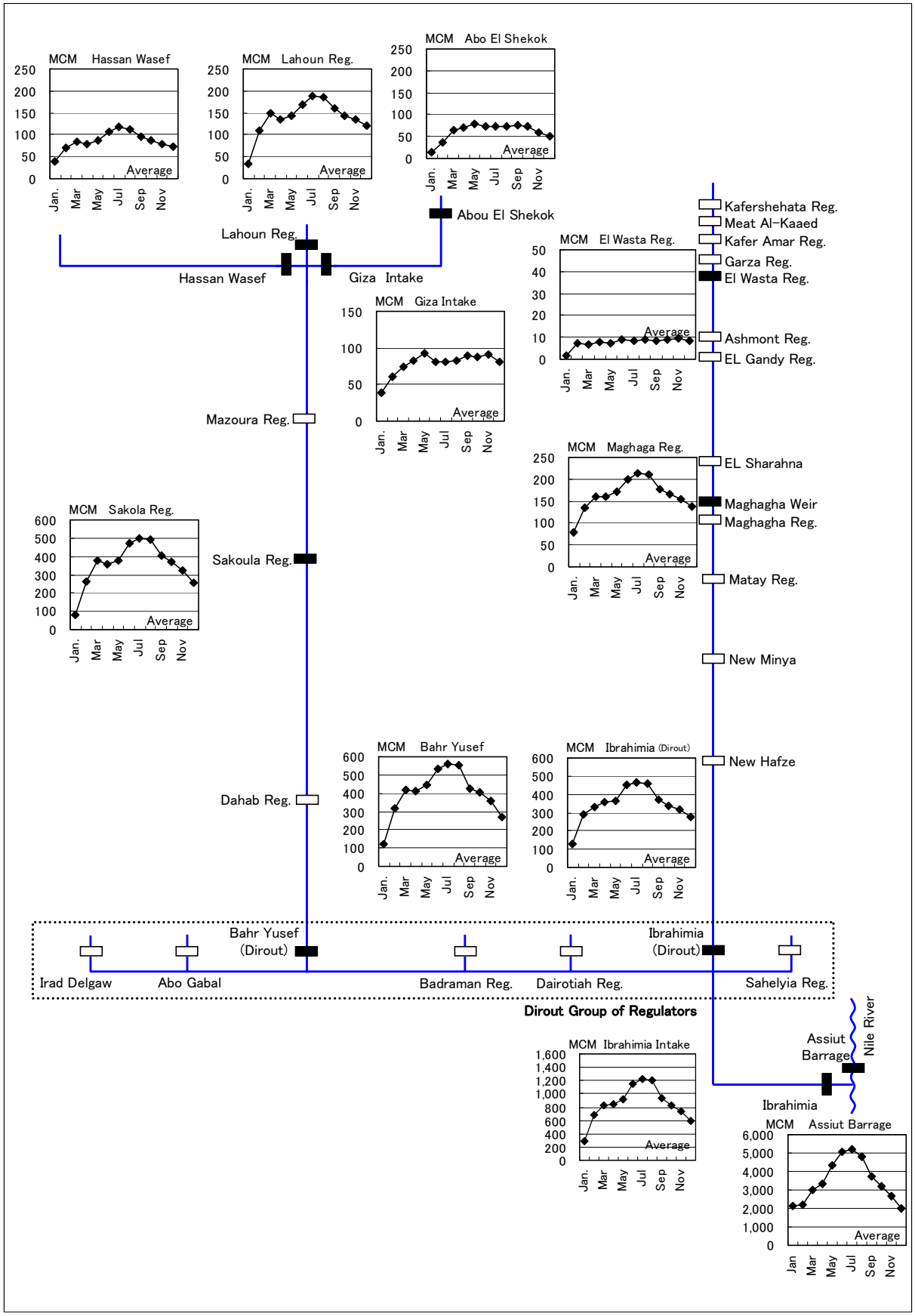


Figure 3.4.7 Monthly Average (10 years) Discharge at Major Regulators

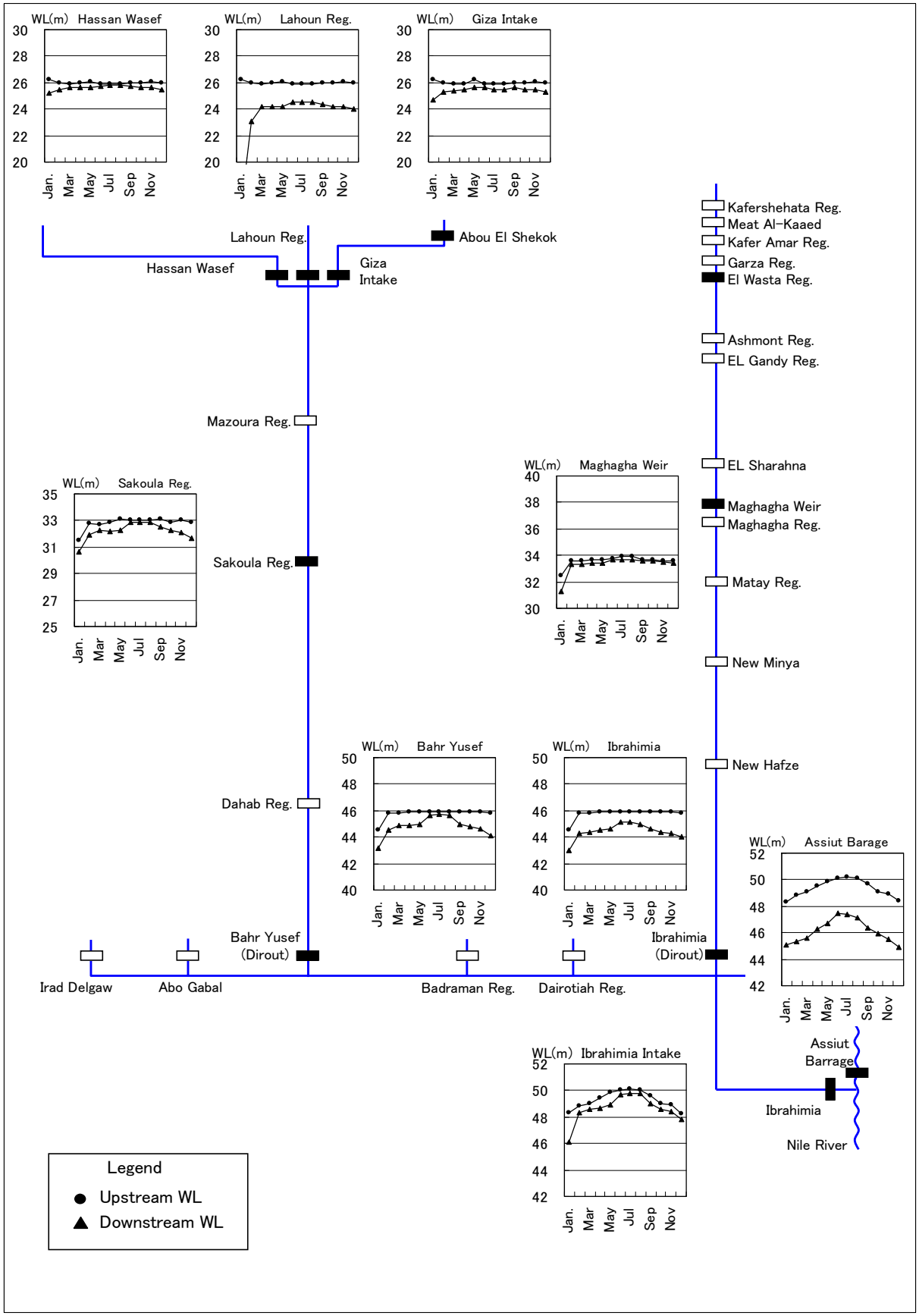


Figure 3.4.8 Monthly Average (10 years) Water Level at Major Regulators

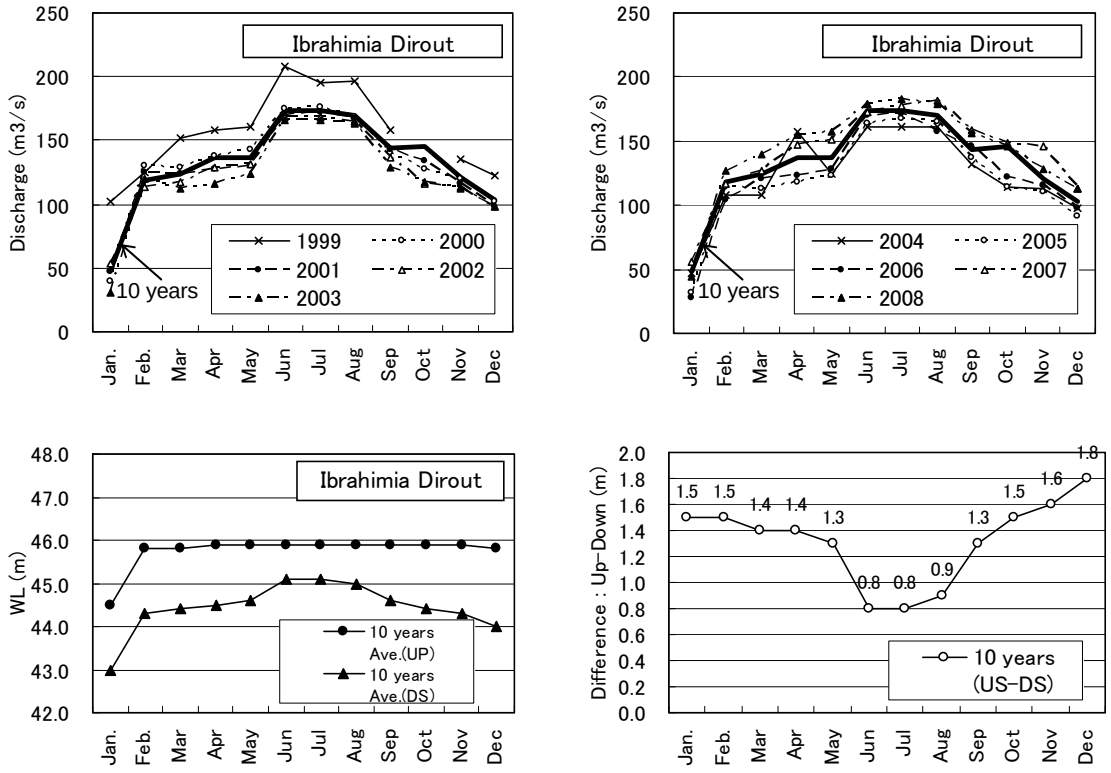


Figure 3.4.9 Monthly Discharge & Water Level at Ibrahimia

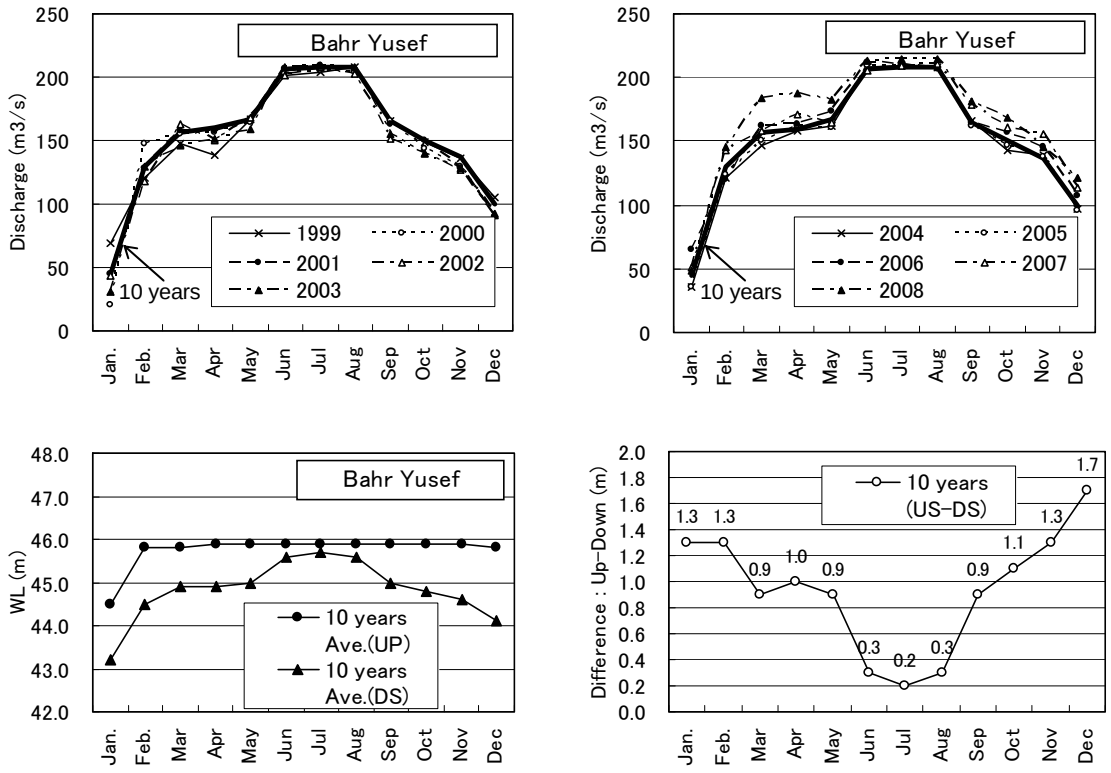


Figure 3.4.10 Monthly Discharge & Water Level at Bahr Yusef

3.4.4 Present Situation and Problems of Water Management

The present situation and problems of water management are shown below.

(1) Dirout Group of Regulators

- Recently, the upstream water level of the DGR has not been steady. It can be guessed that the deterioration of the gate makes it difficult to maintain the upstream water level of the DGR. [Refer to Figure 3.4.11]

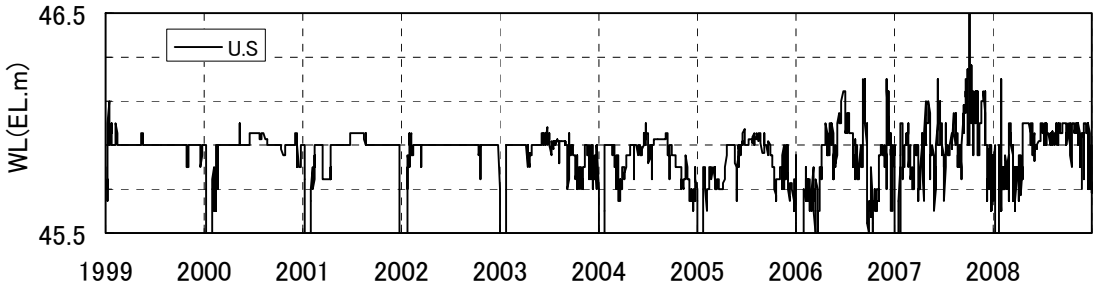


Figure 3.4.11 Water Level on the Upstream of DGR

- According to the agreement of the distribution ratio in 2002, the distribution ratio to the Ibrahimia canal is 37%, and the distribution ratio to the Bahr Yusef canal is 52%. However, the actual five years average distribution ratio is around 38% to 41% to the Ibarahimia canal, and around 47% to 51% to the Bahr Yusef canal. The actual distribution ratio to the Bahr Yusef canal is smaller than the distribution ratio of the agreements. [Refer to Figure 3.4.12]

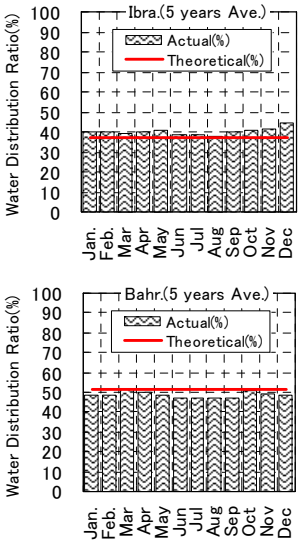


Figure 3.4.12 Distribution ratio at DGR

- The degree of shortage of actual discharge to the agreed quota of Bahr Yusef is shown in Table 3.4.6. The degree of shortage is calculated respectively at the period of wheat and the period of the maize. Because the discharge data in January and December can be presumed to have low reliability by Water Closure's influence, discharge data of two months has been excluded from the table. [Refer to Table 3.4.6]

- In other five canals, except the Bahr Yusef canal and the Ibrahimia canal, discharge is not measured. As for the water level downstream of each gate, it doesn't stabilize, and discharge is unstable.

Table 3.4.6 Increment ratio by the Project

		Winter season	Summer season
		Feb-May	Jun-Sep
Ibrahimia Intake(2005-2009)	(MCM)	3,403	4,492
Quota to Bahr Yusef canal	(%)	52	52
	(MCM)	1,800	2,300
Actual Distributed water(2005-2009)	(%)	50	47
	(MCM)	1,700	2,100
Shortage of water quantity	(MCM)	100	200
Actual distribution ratio to quota	(%)	94%	91%
Increment ratio by the Project	(%)	106%	110%

(2) Bahr Yusef canal

- The distribution ratio to the Minya governorate, Beni Suef governorate, the Fayoum governorate, and the Giza governorate that supplies irrigation water from the Bahr Yusef canal is 26%, 9%, 48%, and 17% respectively, according to the quota in 2002. However, the distribution ratio to Minya is smaller than the distribution ratio of the quota according to the evaluation result of each

regulator. The distribution ratio to Minya is 19% in February to May with the wheat season and 14% in June to September with the maize season. [Refer to Figure 3.4.13]

- Figure 3.4.14 shows the distribution ratio to the Minya governorate, Beni Suef governorate, Fayoum governorate, and Giza governorate. The degree of shortage in Minya is shown in Table 3.4.7. It is calculated separately for the period of winter crops that made wheat a representative and the period of summer crops that made maize a representative. Because the discharge data in January and December can be presumed to have low reliability by Water Closure's influence, the discharge data of the two months has been excluded from the table.

- The tendency to stabilize the upstream water level can be analyzed according to the actual data of the water level in the upstream and the downstream of each regulator. However, the water level upstream is unstable throughout the year. [Refer to Figure 3.4.15 and Figure 3.4.16]

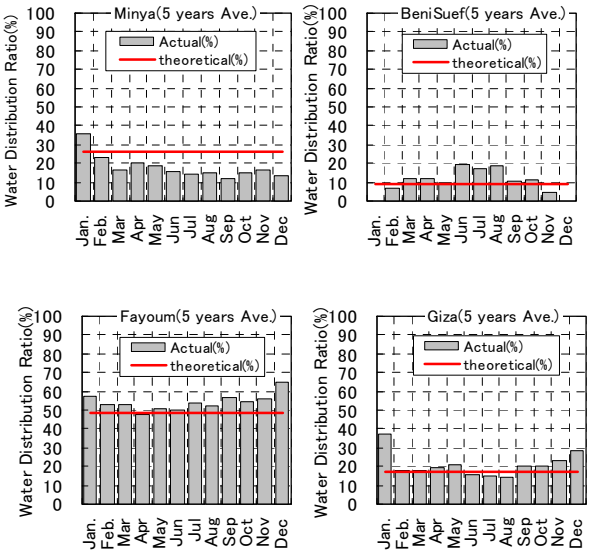


Figure3.4.13 Distribution ratio to governorates

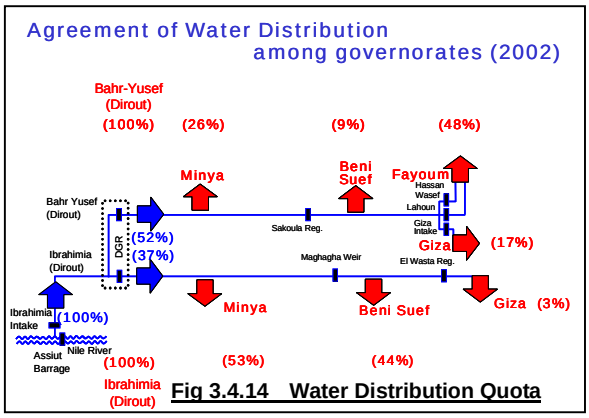


Fig 3.4.14 Water Distribution Quota

(3) Ibrahimia canal

Table3.4.7 Increment ratio by the Project

		Winter season Feb-May	Summer season Jun-Sep
Bahr Yusef(2005-2009)	(MCM)	1,689	2,114
Quota to Minya	(%)	26	26
	(MCM)	400	500
Actual Distributed water(2005-2009)	(%)	19	14
	(MCM)	300	300
Shortage of water quantity	(MCM)	100	200
Actual distribution ratio to quota	(%)	75%	60%
Increment ratio by the Project	(%)	133%	167%

- In the regulators, except the New Hafez regulator, the function to keep constant the upstream water level is not achieved at all. In general, when the regulator is used normally, the water-level difference is caused upstream and downstream. However, it can be guessed that the gate is not appropriately operated because the water-level difference of upstream and downstream is not observed in the regulator along the Ibrahimia canal. [Refer to Figure 3.4.16]

- According to the measurement data in 2009, the annual discharge supplied from the DGR to the Ibrahimia canal was about 12% less than the annual discharge in 2008. It is very important to maintain a high water level on the upstream of the regulator during the year when the discharge is small.

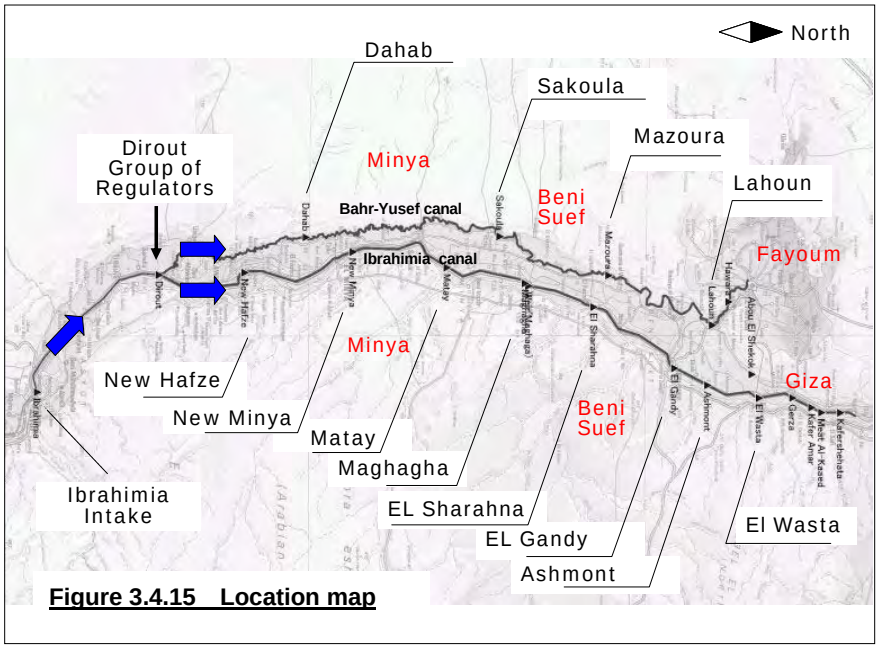


Figure 3.4.15 Location map

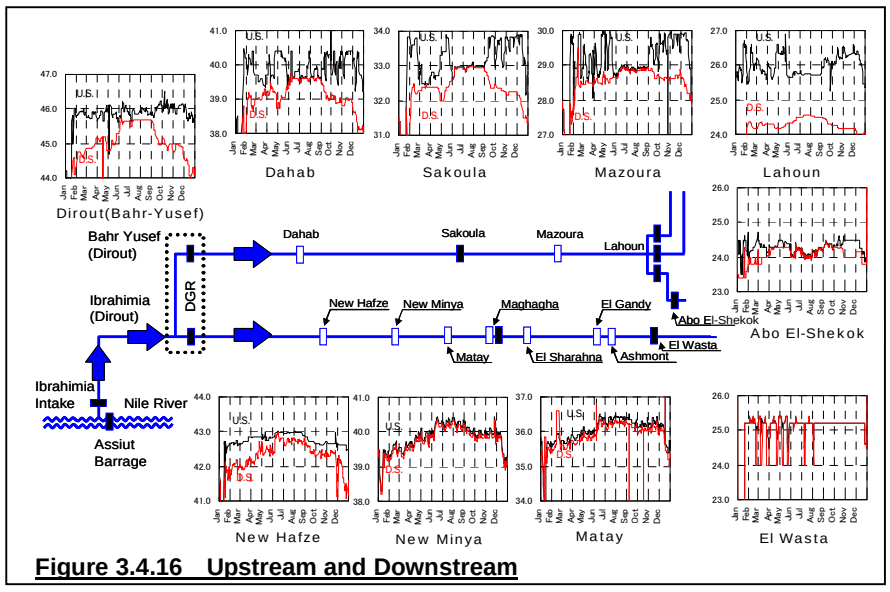


Figure 3.4.16 Upstream and Downstream

(4) Branch canal intake

The discharge distributed from the branch canal intake to the branch canal is not observed. Water management reflecting the actual discharge of branch intake is not carried out.

(5) Water management organization

In the project area, the water management of the wide area, such as the report of water level data, transmission, decision, instructions, gate operation, and monitoring has been performed. However, the flows of these works are transferred by telephone, and record of the water level information is done by handwriting. The flow of such work tends to cause clerical errors in the records. Moreover, it is not

possible to visualize it to understand a lot of information for a prompt judgment from one view. In addition, the water distribution in Assiut has weakness in real-time evaluation system, which is to promptly evaluate the water level after the gate operation and reflect it to the following gate operation.

(6) Water level of Quarun Lake

The Quarun Lake is a natural lake located at the end of the Bahr Yusef canal. In recent years, there has been a tendency for the water level of the Quarun Lake to rise up, and there is a possibility of affecting the inundation damage and the tourist industry around the lake. The water which flows into the Quarun Lake is only sourced from the Bahr Yusef canal. From the result of investigation, when there was a great amount of discharge flowing into the Fayoum area from the Lahoun regulator, there was a tendency for the water level of the Quarun Lake to go up, and when analyzed, it was found that there was a correlation between the quantity of discharge from the Lahoun regulator and the water level of the Quarun Lake. In order to control the inundation damage around the lake, it is necessary to control the discharge that flows into the Bahr Yusef canal and to achieve water management that reduces the invalid discharge. [Refer to Figure 3.4.17 and Figure 3.4.18]

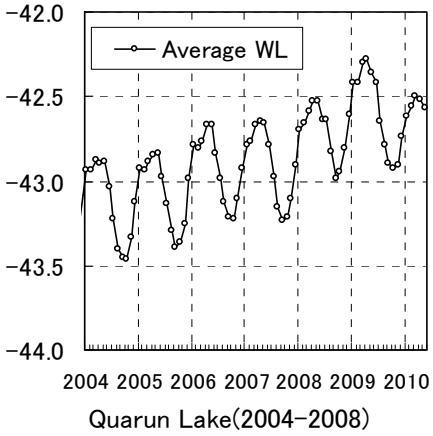


Figure 3.4.17 WL of Quarun Lake

In addition, since the amount of discharge in 2009 from the Lahoun regulator to the Fayoum area was reduced, the water level in 2010 is low compared with the previous year. However, there is a plan to make a new lake as an alternative lake of Quarun. It is necessary to continuously observe the change in the water level of the Quarun Lake in the future and to judge these plans overall.

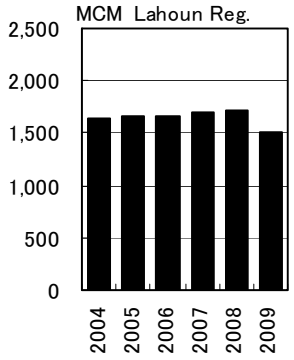


Figure 3.4.18 Discharge from the Lahoun Regulator

(7) Water flow diagram

Figure 3.4.19 shows the water flow diagram of the project area. The data source comes from MWRI.

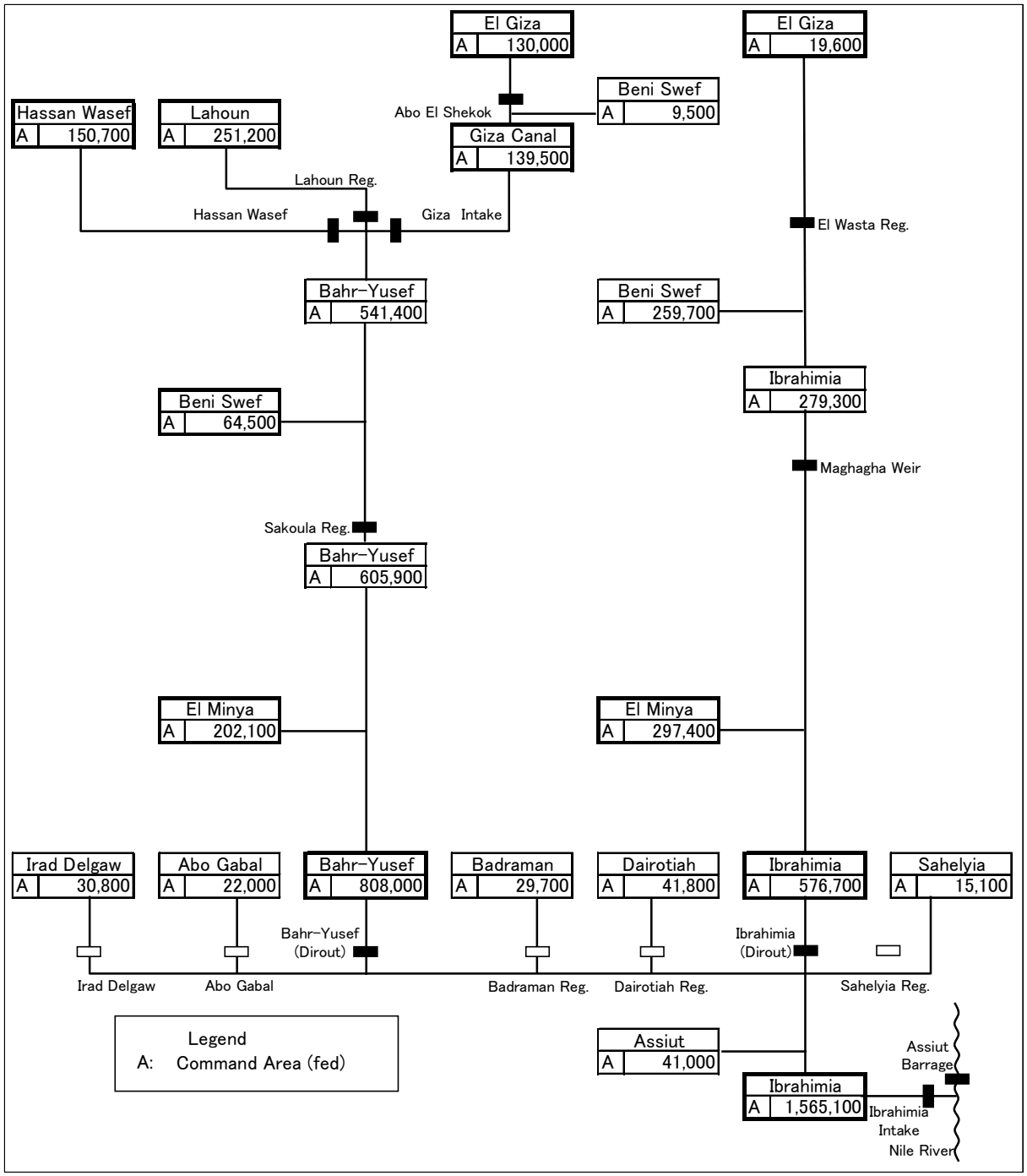


Figure 3.4.19 Water Flow Diagram of the Project Area

(8) Design discharge

The design discharge of the Bahr Yusef canal is shown in the Bahr Yusef feasibility study of 1993. The design discharge of the Ibrahimia canal is calculated based on Bahr Yusef design discharge value. This value is calculated based on the ratio of the Bahr Yusef canal and the Ibrahimia canal in the water distribution quota of 2002.

Table 3.4.8 Design discharge of Ibrahimia canal at DGR

	Bahr Yusef canal regulator	Ibrahimia canal regulator
Maximum design discharge (July)	226.50m^3/s (58%)	161.62 m^3/s (42%)
Minimum design discharge (October)	33.11 m^3/s	23.63 m^3/s

[The water distribution quota in 2001 (Water Distribution in Ibrahimia canal in Assiut and in the governorates: Assiut, Minya, Beni Suef, Fayoum, Giza)]

Table 3.4.9 Distribution ratio based on the quota

Distributed Area	Distribution Ratio
Direct distribution(Assiut)	6.70%
Direct distribution (South Minya)	4.83%
Bahr-Yusef	51.63%
Ibarahimia	36.84%
Total	100%

Design discharge of Ibrahimia regulator at DGR

Maximum design discharge=226.50 m^3/s x (36.84÷51.63)=161.62 m^3/s

Minimum design discharge=33.11 m^3/s x (36.84÷51.63)=23.63m^3/s

Table 3.4.10 Design discharge based on the quota

Area	Command	Ratio(%)	Max. Design Discharge (m^3/s)	Min. Design Discharge (m^3/s)
(1)Ibrahimia	576,700	36.84%	161.62	23.63
(2)Bahr-Yusef	808,000	51.63%	226.50	33.11
(3)Sahelyia	15,100	0.96%	4.20	0.60
(4)Diroutiah	41,800	2.67%	11.70	1.70
(5)Badraman	29,700	1.90%	8.30	1.20
(6)Abo Gabal	22,000	1.41%	6.20	0.90
(7)Irad Delgaw	30,800	1.97%	8.60	1.30
Direct intake(Upstream of DGR)	41,000	2.62%	11.50	1.70
	1,565,100	100%	438.62	64.14

Source: Water Distribution in MWRI

Note: Agrrement of Water Distribution in Ibrahimia Canal (2002)

(9) Summary table of problem analysis and effect of the project

Table 3.4.11, Figure 3.4.20, and Figure 3.4.21 show the problem analysis and the effect that can be expected by improving the problem.

Table 3.4.11 Problem analysis and effect by Project

The present conditions and problems	Countermeasures in project	An effect, degree of the improvement	Area/Object prefecture	Reference chart
・ The gates of DGR deteriorate and quick operation and suitable operation cannot be performed. The upper water level of DGR is not stabilized and proper distribution cannot be performed to the five other small canals.	Renewal of the gate of DGR	・ In the Bahr Yusef canal, although the shortage of quota of 100MCM (200MCM) had arisen to 1,800MCM (2,300MCM) of a water supply allotment, it can be avoided by implementation of this project. It becomes 106% (110%) of an increased effect. (The first value indicates wheat and the numerical value in a parenthesis indicates maize.) ・ In the five other canals, distributed water is stabilized by implementation of this project and degrees of a water shortage will be improved.	Bahr Yusef (808,000fed =339,360ha) Other five canals (180,400fed =75,768ha)	(1)
・ There is no real-time water management system and organization which can determine quickly the water supply to each directorate, and there is no integrated water management system which is based on a real-time monitoring system.	Installation of integrated water management facilities.	・ In the Minya directorate along the Bahr Yusef canal, the lack of 100MCM (200MCM) was caused for the water supply quota of 400MCM (500MCM), but it can be avoided by implementing the project. It creates the effect of an increase of 133% (167%). However, the effect of the project sums up only the effect of an increase of 133% during the wheat crop period, which can be presumed to have an invalid discharge. ・ In the branch canal along the Ibrahimia canal, the degree of water shortage is improved by monitoring the adequate amount of water distribution.	Minya (Bahr Yusef) (202,100fed =84,882ha) Ibrahimia (576,700fed =242,214ha)	(2)
・ Because the appropriate operation of the gate is not performed along the Bahr Yusef and Ibrahimia canal, upstream water level of the regulator is not managed appropriately.	Implementation of a technical cooperation project.	・ Because the upstream water level of the regulator is stable, the quantity of water that flows to the branch canal is stable. The integrated water management is operated by the whole area in four directorates, and the adequate amount of irrigation water is distributed to each directorate and each canal.	Project area (1,565,100fed =657,342ha)	(3) (4)
・ 138 years have passed since DGR was constructed, and deterioration is increased.	Renewal of DGR	・ If the adequate water distribution is not performed because of the deterioration, 26% of water distribution loss will occur. However, compared with the case where it is not carried out, 26% of loss is avoidable by implementing the project. Loss of one-rank down of the degree of water shortage will be avoidable.	Bahr Yusef (808,000fed =339,360ha)	(5)

1),2) : Analysis period : Wheat (February to May), Maize (June to September).

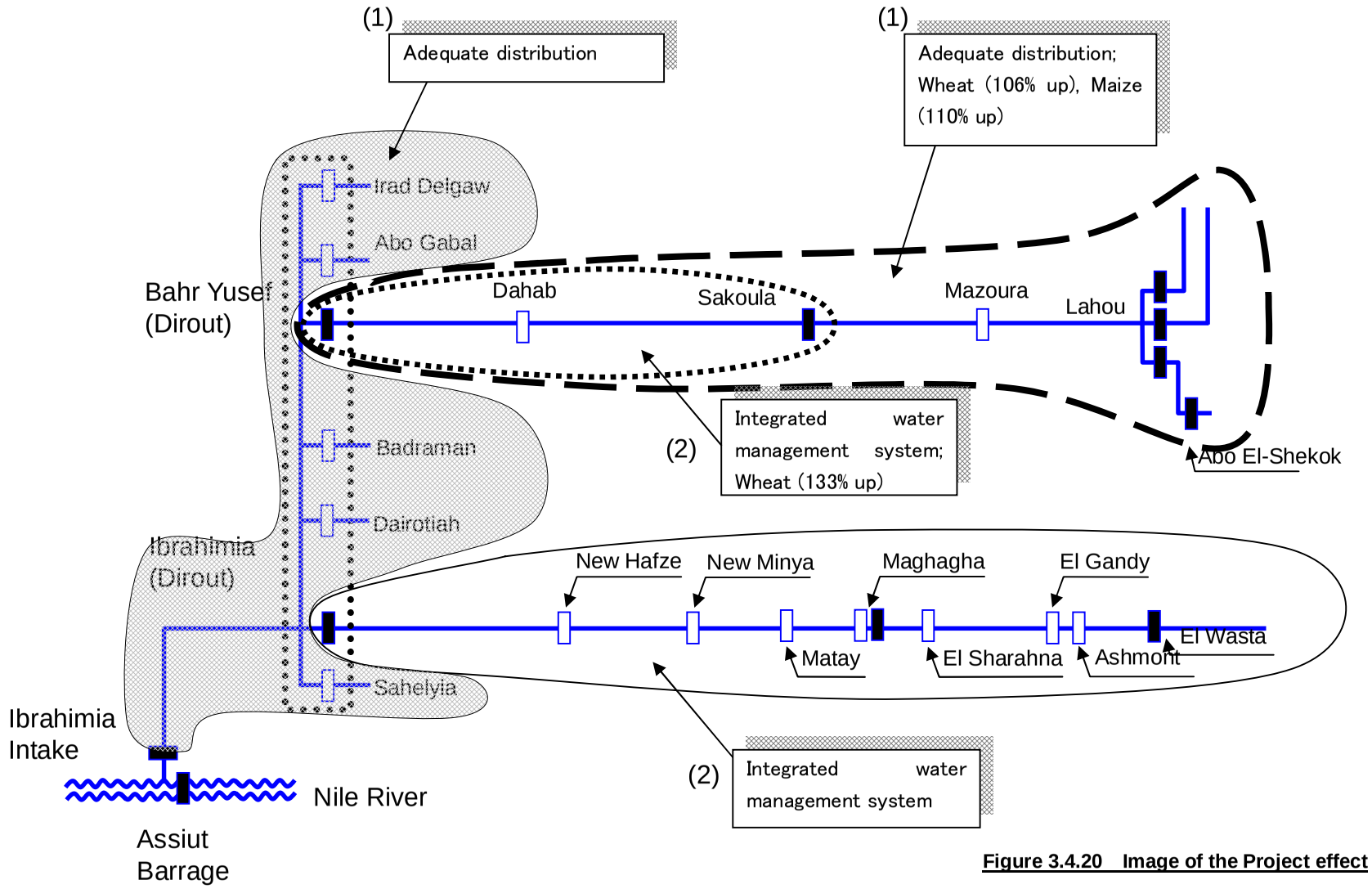
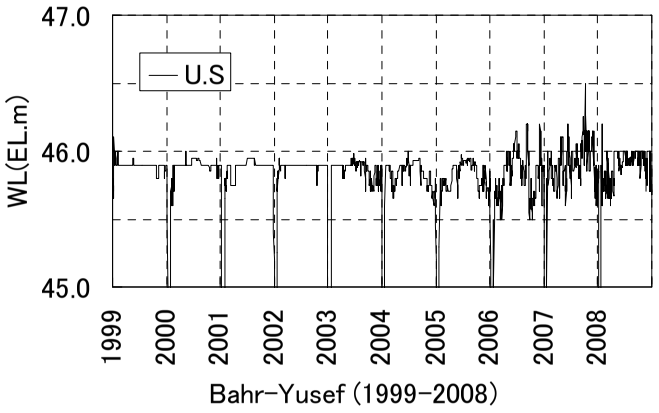


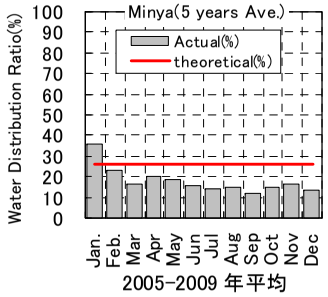
Figure 3.4.20 Image of the Project effect

(1)



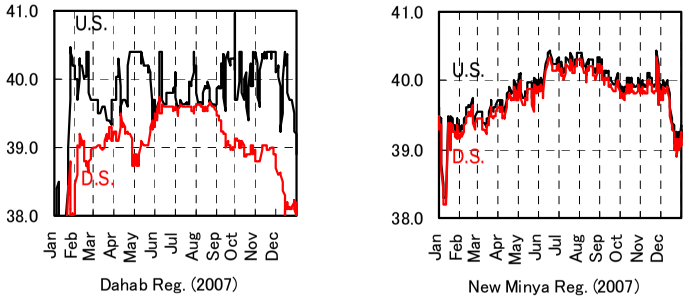
Fluctuation of upstream water level of DGR

(2)



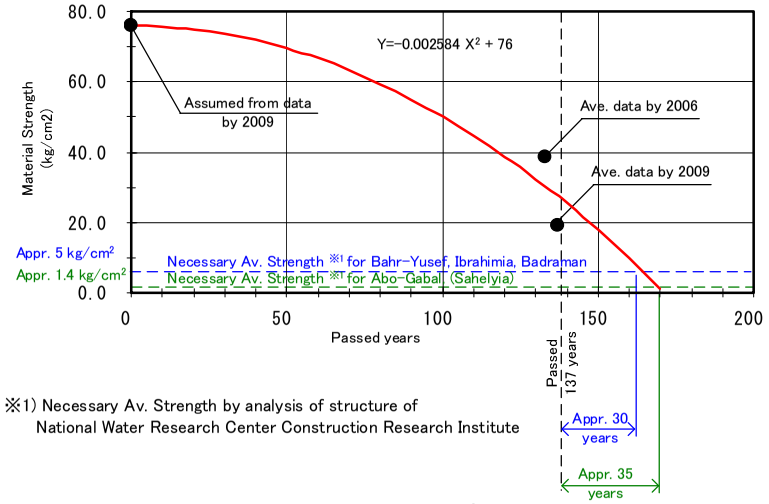
Water distribution ratio of Minya (Bahr Yusef)

(3)
(4)



Left figure : Water level at Dahab regulator
Right figure : Water level at New Minya Regulator

(5)



※1) Necessary Av. Strength by analysis of structure of
National Water Research Center Construction Research Institute

Deterioration curve of DGR

Figure 3.4.21 Reference chart

3.5 Evaluation and selection method for Minor Structures

3.5.1 Policy of the MWRI concerning Improvement of the Minor Structures

The Upper Egypt region is one of the main areas for food production in the country. The Dirout Group of Regulators, which is one of the main structures in Upper Egypt, has seven (7) main canals and there are many structures concerning the irrigation along those canals. In this study, the team will focus on the minor structures to control the distribution of the irrigation water, which are constructed on the branch canal belonging to the main canal of the Dirout Group of Regulators. According to "the minutes of meetings on the mission for the preparatory survey for the rehabilitation and improvement of the Dirout Group of Regulators in the Arab Republic of Egypt agreed upon between the Ministry of Water Resources and Irrigation and the Japan International Cooperation Agency on May 19 2009", the minor structures are mentioned as follows.

(Page-2)

These minor structures are constructed on the branch canals to control water distribution. Deterioration of these water structures is an obstacle to effective management and equitable allocation of water among users. It also delays water arrival to the tail of the canal which could lead to reduction in crop yield.

(Page-9)

3)Assessment of existing minor structures in the command area of the Dirout Group of Regulators.

Here, it should be noted that;

a) the assessment will be done on the basis of information/data (location of structures with map, type of structure, construction year, command area of structure, length of canal downstream the structure, description of existing problems of the structure with photographs and drawings, necessary works with cost, etc.) which will be provided by MWRI by the commencement of the Preparatory Survey,

b) maximum number of the minor structures to be studied will be 150 and their command area could be used as a selection criteria to consider the impact of each structure, and

c) considering the concept of the Project indicated in the Project title requested by GOE, "the rehabilitation and improvement of the Dirout Group of Regulators for the Integrated Water Resources Management in Middle Egypt," assessment of the minor structures will be conducted paying due consideration on the effect to maximize the benefits of improvement of the Dirout Group of Regulators and the integrated operation of the rehabilitated regulators.

~~ Based on the minutes of meetings on May 19 2009 ~~

3.5.2 Selection Method of Minor Structure

Basically, the minor structures are selected by RGBS. The team proposed the criteria of selection and the data sheet form so that the selected minor structure of information and situation are shown uniformly. This proposal was accepted by a Technical committee on 23 November 2009 and then

the selection of the minor structure was carried out.

In this study, the command areas of the DGR are the Minya directorate, the Beni Suef directorate, the Fayoum directorate and the Giza directorate.

1) Target minor structures shall be contributed to make benefit of the project which is the rehabilitation and improvement of the Dirout Group of Regulators.

2) Command area of the minor structures shall be more than 1,000 feddans as possible, and those structures have not executed the rehabilitation and improvement within three (3) years.

3) The minor structures shall belong to the main canal, branch canal or delivery canal. (Refer to the right Fig; image of the target area is surrounded by gray)

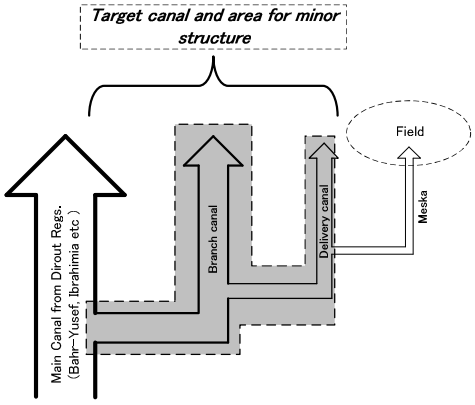


Figure 3.5.1 Concept of Selection of Minor Structures

4) The target Minor structures are classified into nine (9) types as follows.

1. Intake
2. Regulator
3. Tail escape
4. Culvert and Siphon
5. Aqueduct
6. Bridge
7. Weir
8. Pipe line
9. Pump Station

Table 3.5.1 The type of the minor structure in this study

Type of the minor structure	Picture or illustration of the minor structure as sample	Remarks
1. Intake		・Intake is identified as where it is at start of canal
2. Regulator		・Regulator is identified as where it is along the canal and across the canal.
3. Tail escape		・This structure is a boundary between the canal and drain, the purpose of which is to discharge excess water during an emergency.

4. Culvert and Siphon		・This structure is set under the road or canal. The picture shown is the culvert.
5. Aqueduct （水路橋）		・This structure has the purpose of transpotation of the irrigation water over the canal or the drain by the steel pipe.
6. Bridge		・This structure is a bridge over the canal. Its specific purpose is to cicumvent the irrigation water.
7. Pump Station		・This structure has the purpose of re-using the irrigation water. It is set on the end of the canal and can almost be seen in Fayoum.
8. Pipe line		・This structure has the purpose of supply the irrigation water with concrete pipe between canals.
9. Weir (drop weir)		・This structure has the purpose of raising the water level or protecting the canal. It can almost be seen in Fayoum.

(2) The Form of Data sheet

The form of data sheet was made for each type of the minor structures, and then it was distributed to the district engineers belonging to the directorates in five Governorates through the RGBS. The contents of the form of data sheet were designed based on the minutes of the meeting held on 19th May 2009; additionally these include the basic information regarding each structure, such as the detailed dimension of the structures. (Refer to next Fig: it is a sample data of the weir in the Fayoum)

The required data of each minor structure consists of the following items.

- Location map
- Types of structures
- Year constructed
- Areas of the beneficiaries
- Length of beneficiary area covered by the canals
- Subjects to be solved
- Photographs or drawings
- Required works and cost for rehabilitation and construction

This data is provided by the Egyptian side and mentioned on the data sheet. After collection of the all data sheets by the Egyptian side, the evaluation on the data will be done by the JICA Study Team.

3.5.3 Methodology of the Assessment of the Minor Structures

The field surveys for selected minor structures were carried out by the observation and interview methods for the assessment. The meaning of the assessment is defined as evaluating the data and evaluation of the validity of the necessity works and cost estimation for each structure.

(1) Form of Evaluation Sheet

The JICA Study Team has carried out the field surveys to confirm each item written on the data sheets with the cooperation of the district engineers in each directorate and made the evaluation sheets for the individual structures for further assessment activities. (Refer to right fig.: it is a sample data of the weir in the Fayoum)

The evaluation sheet consists of 12 items, such as hydraulic functions, stability of structures and machineries, past maintenance records, social and environmental considerations and operation/maintenance situation, which can be used to evaluate the 9 types of minor structures. The results of evaluation will be expressed as three ranks of A, B and C.

Additionally, in the evaluation sheets, the team

Data Sheet of the Minor Structure For Weir **F1**

1. Name	Hear weir	**2. Construction Year**	Before 1943
3. Type			Weir
4. Canal's name	Bats Drain		
5. Command Area (feddan)	86,000 + 118,688 m3/d	**6. Max discharge of canal (m^3/day) or (m^3/s)**	16.4 m3/s
7. Length of Canal downstream the structure (km)			22.6
8. Necessary works for improvement / Rehabilitation or Reconstruction			Reconstruction
9. Commencement of the necessary works for improvement			Within 5 years
10. Cost of the necessary works for improvement			10,000,000 LE
11. Contents of the necessary works for improvement		Need the reconstruction and replace all the gates	
12. Existing problems of the structure		The structure has been damaged by scouring and erosion. The structure is very dangerous condition by the much discharge.	
13. Material of the structure / Wood, Brick, Stone, Steal, Concert			Brick
14. Question and Dimension of the structure (If nothing of information, please write "N")			
1) Width of the Weir (m)			9.00
2) Height of the Weir from the canal bed (m)			28.04
3) Crest level of the Weir EL (m)			----
4) Width of up stream of the canal (m)			Appr. 15m
5) Width of down stream of the canal (m)			more than 15m
6) Up stream water level EL(m)			Up Stream EL 3.54
7) Down stream water level EL(m)			Down Stream EL -24.50
8) Structure condition / Excellent, Good, Bad, Already Expire			Bad
9) Please write remarks, if any		The two pump stations are near here.	
15. Picture	**Front**	**Down stream**	**Side or Behind**
16. Location / Also show the Location other MAP	El Bats Drain → Haar Wear		

Fig 3.5.2 Sample of the data sheet

Data Sheet for the Evaluation

Reference Number of the structure or facility	F1	Location of the structure or facility	Bats Drain	
Type of Structure or facility	Weir	Name of the structure or facility	Hear weir	
ITEMS	Rank : A	Rank : B	Rank : C	Selection of Rank
Hydraulic performance				
1 Actual water level	very low level or Actual<2/3Plan	low level or 1/3 Plan<Actual<2/3Plan	enough	C
2 Fair discharge volume	hard to fair water	difficult to fair water	not difficult or suitable to fair water	A
3 Sedimentation around the structure	--------	much vol.	not so much	C
4 Garbage around the structure	--------	much vol.	not so much	C
Structure stability				
5 Weathering of the structure	heavy	light	few or no	A
6 Crack or scouring of part on structure	many	not so many	few or no	A
7 Settling of the structure or mechanical facility or steel material	heavy	light	little or no	A
8 Damage of the mechanical facility or steel material	heavy	light	little or no	A
Rehabilitation in past time				
9 Times of the rehabilitation	--------	not experienced but need the rehabilitation	more than one (1)	B
Social environment				
10 Condition of the surround	--------	density area or main road	not so density area	C
Operation and Maintenance				
11 Problem of Operation	Fatal problem (not working all etc.)	some problem (not working some etc.)	few or no problem	A
12 Cost for maintenance at present	--------	high	not so high	C
Remarks, if any	The structure is very dangerous condition by the much discharge. Need the reconstruction and replace all the gates			
Additional Survey, if any	The geographical survey at surround area, geological survey (at least one boring), measurement in more detail of the structure, check of the discharge volume in a year.			

Evaluation

Items	number	evaluation
Number of the Rank : A	6	Need the suitable works Urgently within 5yrs
Number of the Rank : B	1	
Number of the Rank : C	5	Recommend the reconstruction and replace all the gates
Working life by empirical	within 5yrs	

"Need the suitable works Urgently within 5yrs" ---- "Rank: A" = 2~12, anyway

"Need the some works within 10yrs and keep watching the condition and maintenance" ---- " Rank:A = 1 ", anyway or " Rank:B = 6~12 and Rank:C = 0~6 "

"Need the some works within 20yrs and keep watching the condition and maintenance" ---- "Rank: A" = 0 and Rank: B = 0~5"

"*" : Evaluation does not depend on target structure but other condition or reason

Fig 3.5.3 Sample of the evaluation sheet

will take note of important points for further stages and what is required as survey items before the implementation stage, which are ascertained during survey periods.

(2) Evaluation Method

After the evaluation of 12 items in the evaluation sheets, the suitable time for implementation and urgent rank will be mentioned based on the total numbers of A, B and C. Furthermore, mainly in terms of the method of observation and interview, it is difficult to judge or assume the highly accurate time of implementation of each structure based on the life estimation. Therefore, the evaluation will be shown by the suitable time, including the contingency against the real suitable time. According to the above mentioned, the standard of the priority for the minor structures is shown as follows.

Table 3.5.2 Standard of Implementation time judged by the evaluation sheet

Total numbers of A,B and C	Standard of Implementation time
Number of rank A is two (2) to 12, in spite of number rank B and C.	Appropriate work should be implemented within five (5) years. (High priority of urgency)
Number of rank A is one (1), in spite of number of rank B and C, or number of rank B is six (6) to 12 and number of rank C is zero (0) to six (6).	Appropriate work should be implemented within 10 years, or keep monitoring the present situation and maintenance. (Mid. priority of urgency)
Number of rank A is zero (0), number of rank B is zero (0) to five (5) and number of rank C is seven (7) to 12.	Appropriate work should be implemented within 20 years, or keep monitoring the present situation and maintenance. (Low priority of urgency)

Basically, the judgment of the required works will be shown by reconstruction, rehabilitation and continuous maintenance. These judgments will be evaluated not only based on the result of evaluation regarding hydraulic functions, stability of structures and machineries, and past maintenance records but also on information of interview and others, which will be considered as integrated information. And the information interview and other related information will be mentioned on the evaluation sheet of the remarks.

The cost for the required implementation will be considered based on data provided by the Egyptian side. However if there will be a difference in evaluation of implementation works between the Egyptian side and the Team, that cost will be assumed by other site works as similar size or works. Furthermore, the cost offered by the Egyptian side consists of direct cost and indirect cost.

Additionally, the cost shown by the Team will be added to the cost of survey for implementation activities, such as topographic survey, geological survey, measurement survey for minor structures, discharge measurement, strength test of the structure, and other related tests. Since, the cost for these surveys is still a rough cost, and it depends on the scale of the structures, it will be mentioned as percentage of construction cost. The ratio will be considered as follows:

- in case more than three (3) surveys required: five (5) %
- in case two (2) surveys required: three (3) %
- in case one (1) survey required: one (1) %

3.5.4 The existing situation and feature of the site for the selected minor structures

The structures identified as minor structures have major features made from bricks and were widely functioning not only as irrigation facilities but also as roads. This means the structure has diversity of purpose for living and irrigating in Egypt. Herein, the existing situation and features of these command areas will be reported based on listening to the people who are engineers, farmers and others

at the site.

(1) Minya directorate

The Minya directorate is located in the upper area of the middle of Egypt and is diverted to East and West Minya. In the East Minya area, the irrigation water is an intake from the Ibrahimia canal mainly, and the East Minya area is an intake from the Bahr-Yusef canal mainly.

In both areas there are many intakes and diversion facilities. During the survey, the team heard claims often made by farmers that they need to lower the bed level of intake to introduce more water due to the diminished canal water level. Accordingly, the team studied and checked the amount of the intake water on the existing condition. Consequently, we judged that it is not necessary to lower the bed level of intake because the existing intake has enough dimension to take the irrigation water.

On the other hand, the team grasps the fact that the irrigation water at the Ibrahimia canal has been decreasing by approximately 10% max recently. [Refer to Chapter 3.4.3(5)] Consequently, it shall be proper to keep the required water level by the control of gates because it is doubtful that lowering the intake level would affect the entire water management.

In Egypt, the gate named Fahmy Henen is installed widely. That gate is driven as a sluice gate which does not need an operation deck and seems to have a low cost of installation; although the structure of this gate is getting opened higher, the gate will stick out over the groove and then lose balance. After all, some of the gate's functioning declines, making it more difficult to operate. The team recommends replacing it with another type of gate, such as a spindle or rack type.

Picture-1 Fahmy Henen gate

In Minya, there is the big scale of pump stations in order to send the irrigation water to the West, near the desert area. These facilities seem to be in good condition even though the team heard of the shortage of the intake volume due to the lowering water level. A detailed study to check water amount and water level annually will be needed.

(2) Beni Suef directorate

The Beni Suef directorate is located around the middle of the command area, in which there are two main areas: south and north. The south area intakes water from the Ibrahima canal and the north area intakes from Bahr-Yusef.

In the south area, there are many intake facilities along the Ibrahima canal. Intakes on the right bank area at the Ibrahimia canal are located across the railway; therefore, it seems to be very difficult to maintain the facility because of lack of road maintenance.

Picture-2

On the left bank in this area, the ground level seems to be relatively lower, since the canal velocity has a tendency to be high. The team can see the concrete canal lining. During the survey, the team often heard claims by farmers that they need to be lowering the bed level of intake to introduce water, due to

the decrease of the canal water level. That is the same case as Minya. The team recommends keeping the required water level by the control of gates first.

In the north area, where urbanization has developed, the team can see much garbage preventing fair discharge of the irrigation facility. Therefore, the team often heard requests to change the open canal to a tunnel type canal in order to solve the problems caused by garbage. However, the team recommends preventing thrown garbage into the canal by humans and the removal of existing garbage as a permanent measure first. The issue of garbage is common to the whole command area.

Picture-3

(3) Fayoum directorate

The Fayoum directorate has a different geographic feature from the other directorates. There is great geographic change because of the lowered elevation of approximately 20m to 30m and the canal reach at Lake Quarun. In accordance with the geographic feature, the gravity irrigation method has been major. For this feature, the distribution of the water to each canal can be done by changing the size of intake. This method is discharged naturally by over-flow. Therefore, in this area, the team seems this to be the smaller problem being the garbage. Also, there are many drop weirs to protect the canal bed from scoring, due to the different geographic level.

Incidentally, there are a few claims against a shortage of irrigation water level, although it seems to the team that this directorate is taking enough water in comparison with other directorates. Therefore, it seems the necessity works for this area will involve a change in the size of the facility to be more appropriate for suitable distribution.

(4) Giza directorate

The Giza directorate is located at the lowest of the command area and adjacent to the capital city of Cairo. There are different views about some irrigation facilities being in the city area, and the team saw the large scale regulators and so on in the area, because it might have a role as food supply to Cairo, to be developed in advance of the other directorates. Furthermore, the facilities are quite old and large and seem to be in most urgent need of reconstruction even though it would be costly in proportion to the size of facility.

Picture-4

Accordingly, in addition to the examination of this survey by the observation, the team recommends a detailed survey and investigation, such as strength tests, prior to making the plan of the construction. And in this area, the team saw the greatest amount of garbage compared to the other areas due to the end of the canal and to being in the middle of the most densely populated area. It seems the first need for this area is to prevent garbage from being thrown into the canal and to carry out the removal of existing garbage as an essential and one of the most urgent issues.

3.6 Present Situation of Agriculture Sector

3.6.1 Agriculture Production

The beneficiary governorates are located in the northern part of Upper Egypt (sometimes defined as Middle Egypt). Most of the agricultural lands in the beneficiary governorates are irrigated by the Bahr Yousef and Ibrahimia canals. In general, agriculture in the beneficiary area is characterized by the majority of small-scale farmers growing staple grains such as maize in the summer and wheat in the winter, then berseem and some vegetables. As indicated in Section 3.2, 50% of the farm households are cultivating less than one (1) feddan (0.42ha), or farm households with less than three (3) feddan (1.26ha) occupy 86% of the total. But the Agriculture Sector provides 40% of employment in the area (56% excluding Giza governorate). The area is also known as a producing center of ornamental, herbal and medical crops, though their cropped areas are rather small.

1) Cultivated Area and Cropping Intensity

Based on the available data (Table 3.6.1), the cultivated area in 2004/05 of the beneficiary governorates is estimated at 1.43 million feddan (0.6 million ha), out of which old land and new reclaimed land share 1.35 million feddan (0.57 million ha) and 0.08 million feddan (0.03 million ha) respectively. The cultivated area of the four (4) governorates occupies around 20% of the total cultivated land in 27 governorates[1] of the country. The cultivated area of Minya is the largest with 485 thousand feddan (204 thousand ha) followed by Fayoum, Beni Suef and Giza with 434 thousand feddan (182 thousand ha), 293 thousand feddan (123 thousand ha) and 218 thousand feddan (92 thousand ha) respectively. New reclaimed land in each governorate occupies aroun5% to 6%.

Table 3.6.1 Cultivated Area, Cropped Area and Intensity in the Beneficiary Governorates (2004/05)

Governorate	Category	Cultivated Area	Cropped Area (fed) and Cropping Intensity (%)											
			Winter		Summer		Nile		Short Clover		Permanent		Total	
		(fed)	fed	(%)	fed	(%)	fed	(%)	fed	(%)	fed	(%)	fed	(%)
Giza	Old Land	207,097	152,389	74%	158,510	77%	85,902	41%	8,907	4%	54,708	26%	460,416	222%
	New Land	10,789	10,789	100%	7,856	73%	2,973	28%	2,113	20%	0	0%	23,731	220%
	Total	217,886	163,178	75%	166,366	76%	88,875	41%	11,020	5%	54,708	25%	484,147	222%
BeniSuef	Old Land	274,878	218,621	80%	143,408	52%	80,163	29%	22,711	8%	56,257	20%	521,160	190%
	New Land	18,452	18,240	99%	11,722	64%	0	0%	0	0%	212	1%	30,174	164%
	Total	293,330	236,861	81%	155,130	53%	80,163	27%	22,711	8%	56,469	19%	551,334	188%
Fayoum	Old Land	404,521	338,893	84%	249,056	62%	78,517	19%	19,534	5%	65,628	16%	751,628	186%
	New Land	29,050	23,413	81%	2,061	7%	0	0%	0	0%	5,637	19%	31,111	107%
	Total	433,571	362,306	84%	251,117	58%	78,517	18%	19,534	5%	71,265	16%	782,739	181%
Minya	Old Land	459,996	358,270	78%	338,097	73%	27,042	6%	4,184	1%	101,726	22%	829,319	180%
	New Land	24,671	24,410	99%	27,256	110%	100	0%	0	0%	261	1%	52,027	211%
	Total	484,667	382,680	79%	365,353	75%	27,142	6%	4,184	1%	101,987	21%	881,346	182%
Total	Old Land	1,346,492	1,068,173	79%	889,071	66%	271,624	20%	55,336	4%	278,319	21%	2,562,523	190%
	New Land	82,962	76,852	93%	48,895	59%	3,073	4%	2,113	3%	6,110	7%	137,043	165%
	Total	1,429,454	1,145,025	80%	937,966	66%	274,697	19%	57,449	4%	284,429	20%	2,699,566	189%
National	Old Land	6,648,330	5,005,154	75%	4,620,370	69%	529,971	8%	490,248	7%	1,643,176	25%	12,288,919	185%
	New Land	1,736,438	1,094,951	63%	787,672	45%	75,714	4%	16,236	1%	641,487	37%	2,616,060	151%
	Total	8,384,768	6,100,105	73%	5,408,042	64%	605,685	7%	506,484	6%	2,284,663	27%	14,904,979	178%
Share to Nation	Old Land	20%	21%	105%	19%	95%	51%	253%	11%	56%	17%	84%	21%	103%
	New Land	5%	7%	147%	6%	130%	4%	85%	13%	272%	1%	20%	5%	110%
	Total	17%	19%	110%	17%	102%	45%	266%	11%	67%	12%	73%	18%	106%

Source: Study of The Indicators Agricultural Statistics Vol 2 Summer and Nile Crops 2005, June 2006 MALR
Note: Permanet crop includes sugarcane and cotton according to the category of MALR.

Cropping intensities in the winter crop (from November to May), summer crop (from March/April to September), Nile crop (May to October), short clover [berseem] (between summer and winter) and permanent crop in the beneficiary governorates in 2004/05 are estimated at 80%, 66%, 19%, 4%, and 20% respectively. Cropping intensity throughout the year counts 189%, which is higher than the national average of 178%. Considering the 20% of permanent crop domination, it is estimated on

[1] Giza governorate has been divided into Giza, 6 October and Helwan governorates since 2007. Therefore, the number of governorates as of 2009 is 29.

average that around 6% of the farmlands are cultivated three times per year.

Table 3.6.2 shows the comparison of the cultivated area between 2005 and 2009. Because the Giza governorate has been divided into three governorates, namely Giza, 6th October, and Helwan, and the data in 2009 does not include that area for Helwan, which is located in the east bank of the Nile, obviously out of the beneficiary area, the data for Giza in 2005 and 2009 are not consistent. Nevertheless, the general trend of the cultivated area in the governorates indicates that the area in the old land is decreasing and new reclaimed land is rapidly increasing. While the share of new reclaimed land in each governorate in 2005 was from 5% to 7%, the share of new reclaimed land in 2009 has increased to around 10%.

Decrease of cultivated area in old land would be due to urbanization accompanied by the population growth and economic development of the country, which is a threatening issue for the Agriculture Sector. Instead, the increase of new reclaimed land is significant as we can observe the expansion of cultivated land into the desert area along the Nile valley, e.g. the lands on both sides of the desert road has been getting cultivated. However, not all the new reclaimed land can receive irrigation water from the canal due to geographical conditions, so that they are irrigated by groundwater.

Table 3.6.2 Cultivated Area in the Beneficiary Governorates

Governorate	Category	2005		2009		Difference
		Area	% old/new	Area	% old/new	
Giza (1)	Old Land (fed)	207,097	*95%*	*158,291*	*78%*	-
	New Land (fed)	10,789	*5%*	*45,067*	*22%*	-
	Total (fed)	217,886	*100%*	*203,358*	*100%*	-
BeniSuef	Old Land (fed)	274,878	94%	259,825	89%	-15,053
	New Land (fed)	18,452	6%	31,561	11%	13,109
	Total (fed)	293,330	100%	291,386	100%	-1,944
Fayoum	Old Land (fed)	404,521	93%	383,177	91%	-21,344
	New Land (fed)	29,050	7%	39,127	9%	10,077
	Total (fed)	433,571	100%	422,304	100%	-11,267
Minya (2)	Old Land (fed)	459,996	95%	470,963	89%	10,967
	New Land (fed)	24,671	5%	59,621	11%	34,950
	Total (fed)	484,667	100%	530,584	100%	45,917
Total	Old Land (fed)	1,346,492	94%	1,272,256	88%	-
	New Land (fed)	82,962	6%	175,376	12%	-
	Total (fed)	1,429,454	100%	1,447,632	100%	-
	Old Land (ha)	565,527	94%	534,348	88%	-
	New Land (ha)	34,844	6%	73,658	12%	-
	Total (ha)	600,371	100%	608,005	100%	-

Source: Agriculture Directorate in Each Governorate
(1) Because the data of Giza in 2009 excludes Helwan, the number is not consistent with 200
(2) Old land in Minya includes the land 2km inside the valley, which may include new land.

2) Major Crops

Major crops in the beneficiary governorates are wheat and berseem in the winter crop seasons, maize in the summer and Nile crop seasons and sugar cane and cotton as permanent crops. Figures 3.6.1 to 3.6.4 show the share of crops in the beneficiary governorates[2]. For the winter crop, the wheat crop shares the largest area with 560 thousand feddan (236 thousand ha) or 49% of the total cropped area in 2005 and 536 thousand feddan (225 thousand ha) or 45% in 2008 respectively. The second largest cropped area is long berseem, which occupies 328 thousand feddan (138 thousand ha) or 29% of the total cropped area in 2005 and 322 thousand feddan (135 thousand ha) or 27% in 2008. Though there is a light shift of cropped area from wheat and long berseem to vegetable crop from 2005 to 2008, these two major crops share 79% and 72% of the total cropped area in 2005 and 2008 respectively.

As for summer crop and Nile crop, maize occupies 517 thousand feddan (217 thousand ha) or 55% of the total summer crop in 2005 and 133 thousand feddan (56 thousand ha) or 48% of total Nile crop in 2005. Rice is a major summer crop in Egypt though the government tries to limit the cropped area due to its high water consumption. Then the rice in Upper Egypt is traditionally cultivated mostly in Fayoum. The cropped areas of rice in 2005 and 2008 in the beneficiary governorates are merely 20

[2] Cropped area of summer vegetables in 2008 in Figure 3.6.2 is not available.

thousand feddan (8.5 thousand ha) and 32 thousand feddan (13 thousand ha). Also due to the restriction of the government due to water shortage, rice was not cultivated even in Fayoum in 2009. Instead, sorghum is cultivated exclusively in the Upper Egypt region. For the beneficiary governorates, total cropped areas of sorghum in 2005 and 2008 are 88 thousand feddan (37 thousand ha) and 102 thousand feddan (43 thousand ha) respectively.

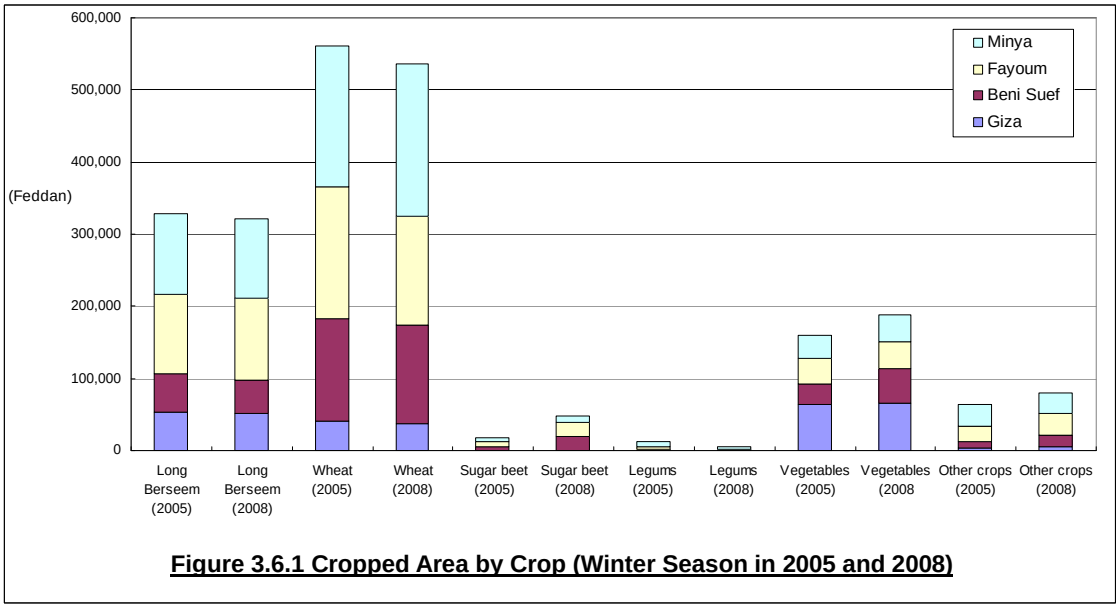


Figure 3.6.1 Cropped Area by Crop (Winter Season in 2005 and 2008)

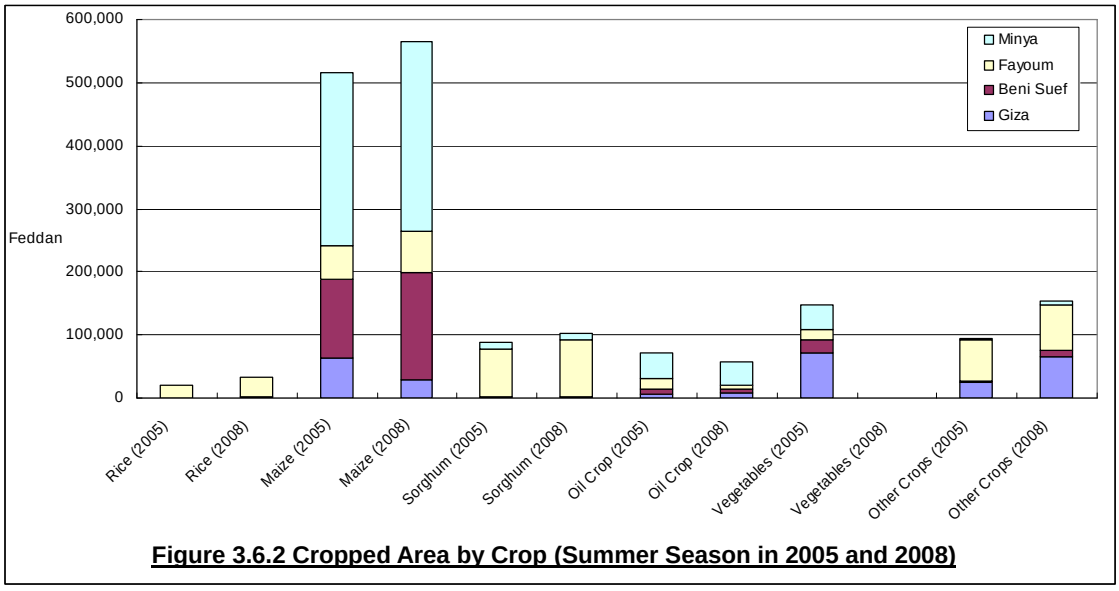


Figure 3.6.2 Cropped Area by Crop (Summer Season in 2005 and 2008)

Total cropped areas of the vegetables with around 30 kinds captured in the statistics in winter and summer share around 15% of the total cropped area. Especially the share of vegetable crop in Giza is higher than the other beneficiary governorates since the Giza governorate has an advantage of having huge markets of the Greater Cairo area in its jurisdiction. Table 3.6.3 shows the cropped areas of the five (5) most grown vegetables, namely tomato, onion, garlic, potato and cabbage, and other crops in total. The total cropped area of the vegetables increased from 2005 to 2008. The tomato crop occupies 39% and 31% in 2005 and 2008 respectively. While the share of tomato decreased from 2005 to 2008, the shares of onion and garlic increased during this period.

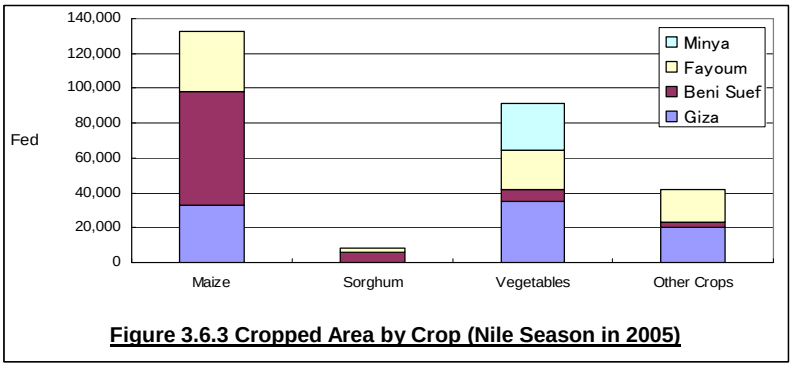


Figure 3.6.3 Cropped Area by Crop (Nile Season in 2005)

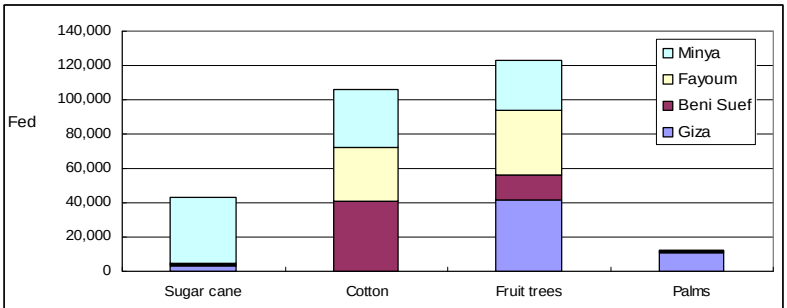


Figure 3.6.4 Cropped Area (Permanent Crop in 2005)

Table 3.6.3 Major Five (5) Winter Vegetables in the Beneficiary Governorates

Crop		2005/06 Cropped Area (feddan) Giza	Beni Suef	Fayoum	Minya	Total	Share	2008/09 Cropped Area (feddan) Giza	Beni Suef	Fayoum	Minya	Total	Share
Winter Crop	Tomato	14,985	10,117	12,704	23,824	61,630	39%	17,958	10,887	13,762	15,786	58,393	31%
	Onion	4,177	8,573	5,234	2,995	20,979	13%	4,914	14,106	11,565	3,289	33,874	18%
	Garlic	485	7,555	1,054	7,368	16,462	10%	722	12,164	2,548	14,383	29,817	16%
	Potato	6,206	3,585	12	0	9,803	6%	5,149	7,020	12	0	12,181	6%
	Cabbage	3,645	173	1,996	694	6,508	4%	5,166	250	2,206	703	8,325	4%
	Others	31,051	1,859	7,142	4,426	44,478	28%	32,069	2,425	7,541	3,348	45,383	24%
	Total	60,549	31,862	28,142	39,307	159,860	100%	65,978	46,852	37,634	37,509	187,973	100%

Source: Study of The Indicators Agricultural Statistics Vol 2 Summer and Nile Crops 2005, Vol 2. Winter Crop 2006, Winter Crop 2008, MALR

Table 3.6.4 shows the cropped areas of the five (5) most grown vegetables and others in total and the five (5) most grown fruit trees and others in the beneficiary governorates. The summer vegetable crop is more diversified as compared to winter vegetables as tomato occupies the largest cropped area in the summer of 2006 but with 22% followed only by cucumber with 15%. As for fruit trees, grape occupies the largest cropped area with 26% of the total fruit tree area, followed by olive with 24% and citrus with 24% of the total fruit tree area. Grape is especially intensively cultivated in Minya while olive and citrus are dominant in Fayoum and Giza respectively.

Table 3.6.4 Major Five (5) Summer Crops and Fruit Trees

Crop		2005/06 Cropped Area (feddan) Giza	Beni Suef	Fayoum	Minya	Total	Share
Summer Crop	Tomato	15,999	12,026	1,112	6,833	35,970	22%
	Cucumber	2,901	13,316	2,225	6,150	24,592	15%
	Potato	6,146	911	2	6,211	13,270	8%
	Pepper	4,202	2,229	784	4,933	12,148	7%
	Sweet melon	3	2,907	4,980	3,998	11,888	7%
	Others	41,834	7,424	8,980	9,258	67,496	41%
	Total	71,085	38,813	18,083	37,383	165,364	100%
Fruit Trees	Grapes	6,185	4,711	1,487	19,451	31,834	26%
	Olive	5,873	769	22,827	311	29,780	24%
	Citrus	14,167	5,881	5,396	4,256	29,700	24%
	Mango	7,755	567	5,147	1,159	14,628	12%
	Banana	3,127	2,186	5	2,133	7,451	6%
	Others	4,152	755	3,224	1,253	9,384	8%
	Total	41,259	14,869	38,086	28,563	122,777	100%

Source: Study of The Indicators Agricultural Statistics Vol 2 Summer and Nile Crops 2005, MALR

3) Special Crops Grown in the Beneficiary Governorates

Major crops grown in the beneficiary governorates are also common in the other part of the country except for rice, which is dominantly grown in Lower Egypt. On the other hand, medical, aromatic (herbal), ornamental and flower crops are dominantly grown in Upper Egypt. Although their cropped areas are tiny, these crops contribute to generating income for farmers. Tables 3.6.5 and 3.6.6 show some of the medical, aromatic, ornamental crops grown in the beneficiary governorates and their share to the nation. As the table shows, the shares of these crops to the total cropped area of the country is as high as 57% to 100%.

Table 3.6.5 Ornamental (Herbal) Crops in the Beneficiary Governorates (1/2)

Governorate	Land	Coriander		Aniseed		Bardacoch		Caraway		Worm wood	
		2006	2008	2006	2008	2006	2008	2006	2008	2006	2008
Giza	Old Land	0	0	0	0	460	488	0	0	0	0
	New Land	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	460	488	0	0	0	0
BeniSuef	Old Land	145	64	0	0	20	1	0	0	1,451	2,102
	New Land	0	0	0	0	0	1,525	0	152	49	128
	Total	145	64	0	0	20	1,526	0	152	1,500	2,230
Fayoum	Old Land	11	0	3	8	702	906	252	625	5,239	5,664
	New Land	0	0	0	0	0	0	0	0	509	1,374
	Total	11	0	3	8	702	906	252	625	5,748	7,038
Minya	Old Land	11,691	7,936	1,704	1,433	1,418	1,206	1,412	921	0	0
	New Land	0	4	4	8	1,649	1,275	421	860	0	2
	Total	11,691	7,940	1,708	1,441	3,067	2,481	1,833	1,781	0	2
Total	Old Land	11,847	8,000	1,707	1,441	2,600	2,601	1,664	1,546	6,690	7,766
	New Land	0	4	4	8	1,649	2,800	421	1,012	558	1,504
	Total	11,847	8,004	1,711	1,449	4,249	5,401	2,085	2,558	7,248	9,270
National	Old Land	11,883	8,009	1,845	1,591	2,606	2,603	2,458	3,415	6,726	7,793
	New Land	38	70	19	28	1,651	2,800	459	1,053	558	1,511
	Total	11,921	8,079	1,864	1,619	4,257	5,403	2,917	4,468	7,284	9,304
Share to Nation	Old Land	100%	100%	93%	91%	100%	100%	68%	45%	99%	100%
	New Land	0%	6%	21%	29%	100%	100%	92%	96%	100%	100%
	Total	99%	99%	92%	89%	100%	100%	71%	57%	100%	100%

Source: Study of The Indicators Agricultural Statistics Vol 2 Summer and Nile Crops 2005, Vol 2. Winter Crop 2006, Winter Crop 2008, Summer Crop 2008, MALR

Note: All crops are winter crop

Table 3.6.6 Ornamental (Herbal) Crops in the Beneficiary Governorates (2/2)

Governorate	Land	Green mint		Dill		Parsley		Green marjoram		Summer Bardacoch	
		2006	2008	2006	2008	2006	2008	2006	2008	2005	2008
Giza	Old Land	0	0	0	0	0	0	17	17	0	0
	New Land	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	17	17	0	0
BeniSuef	Old Land	586	423	202	1,002	322	1,299	2,533	3,110	0	0
	New Land	30	0	0	0	0	0	8	16	0	10
	Total	616	423	202	1,002	322	1,299	2,541	3,126	0	10
Fayoum	Old Land	303	280	0	0	0	0	0	0	834	871
	New Land	0	0	0	0	0	0	0	0	0	0
	Total	303	280	0	0	0	0	0	0	834	871
Minya	Old Land	17	38	0	0	0	0	0	0	0	0
	New Land	0	0	0	0	0	0	0	0	0	2,910
	Total	17	38	0	0	0	0	0	0	0	2,910
Total	Old Land	906	741	202	1,002	322	1,299	2,550	3,127	834	871
	New Land	30	0	0	0	0	0	8	16	0	2,920
	Total	936	741	202	1,002	322	1,299	2,558	3,143	834	3,791
National	Old Land	1,017	832	202	1,012	322	1,303	2,584	3,151	841	873
	New Land	480	476	0	0	0	0	8	16	100	3,033
	Total	1,497	1,308	202	1,012	322	1,303	2,592	3,167	941	3,906
Share to Nation	Old Land	89%	89%	100%	99%	100%	100%	99%	99%	99%	100%
	New Land	6%	0%	-	-	-	-	100%	100%	0%	96%
	Total	63%	57%	100%	99%	100%	100%	99%	99%	89%	97%

Source: Study of The Indicators Agricultural Statistics Vol 2 Summer and Nile Crops 2005, Vol 2. Winter Crop 2006, Winter Crop 2008, Summer Crop 2008, MALR

Note: All crosp are winter crop except for summer baradacoch

4) Trend of Staple Crops and Strategic Crops

Figures 3.6.5 to 3.6.7 show the trends of major staple crops and strategic crops in the beneficiary governorates. Cotton has been identified as an important export crop in Egypt to earn foreign currency and therefore, cotton production and marketing have been controlled by the government to maintain or increase the cotton production. However, regulation for the cotton production was liberalized in the 1990s in order to stimulate the motivation of farmers for increasing the agricultural productivity. As a result, cotton production in Egypt has been sensitive to the world market. As Figure 3.6.5 indicates, the cropped area of cotton in the beneficiary governorates show a decreasing tendency as farmers are free to select what crop to grow since the 1990s.

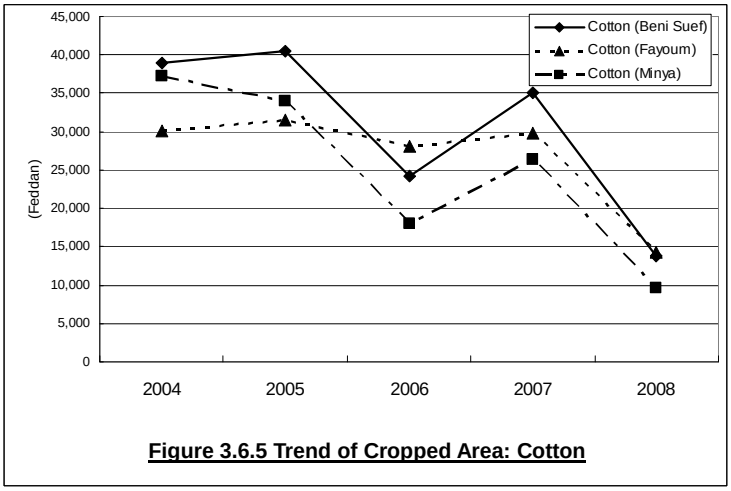


Figure 3.6.5 Trend of Cropped Area: Cotton

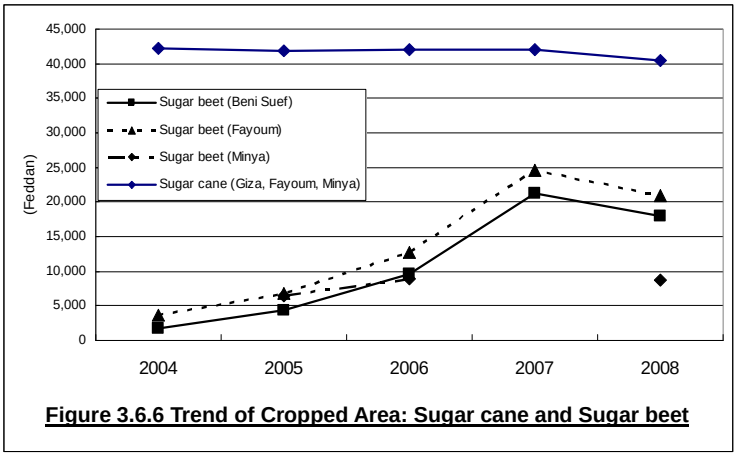


Figure 3.6.6 Trend of Cropped Area: Sugar cane and Sugar beet

Sugar production is one of the major concerns of the government because of its low self-sufficiency ratio with 76.9% in 2007 (Sustainable Agriculture Development Strategy 2030) as well as the water consumption of the sugar cane crop. The sugar cane crop consumes 7,168 m^3/fed in middle Egypt according to the data from MWRI, the highest water consuming crop in Egypt. The government is therefore recommending cultivation of sugar beet as an alternative crop to sugar cane for the production of sugar, since the water requirement of sugar beet is nearly half that of sugarcane. As Figure 3.6.6 shows, the cropped areas of sugar beet in Beni Suef, Fayoum and Minya are significantly increasing especially in Beni Suef and Fayoum, while the cropped area of sugar cane remains stagnant.

As a staple grain of the nation, wheat is one of the most important crops in Egypt. The annual per capita consumption of wheat is estimated at 174.5kg, three times that of rice and 1.5 times that of maize (Egypt: An Economic Geography, 2003). However, the self-sufficiency ratio of wheat is 54.4% as of 2007 (Sustainable Agricultural Development Strategy 2030), hence the increase of wheat production is a priority issue of the

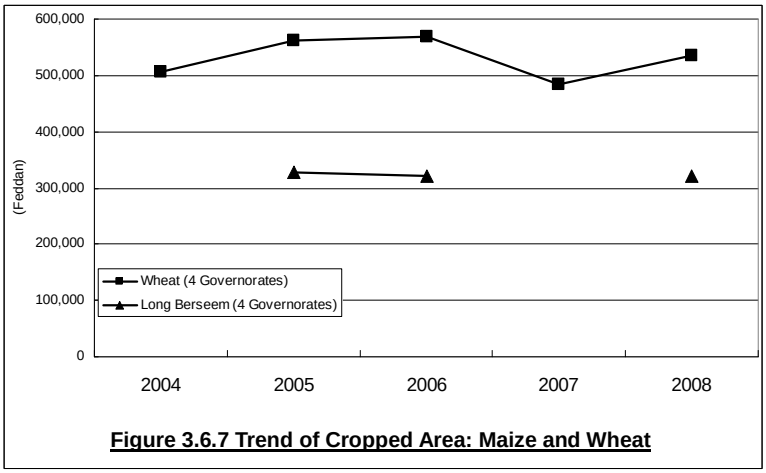


Figure 3.6.7 Trend of Cropped Area: Maize and Wheat

country. One of the measures to increase wheat production is a shift from the long berseem crop to the wheat crop in the winter season. Figure 3.6.7 shows the trend of wheat and long berseem cropped areas. In the beneficiary governorates, crop rotation of both crops are not observed as berseem is also one of the most important crops in the country for feeding animals and maintaining soil fertility since berseem adds nitrogen to the soil.

5) Crop Yield and Production

Tables 3.6.7 to 3.6.9 summarize the unit yield of major crops in the beneficiary governorates and show a comparison with the national average. Basically, the crop yield level in Egypt is fairly high for the world standard, e.g. the yields of sugar, rice, sorghum, and sesame are among the world's highest levels (FAO data in 2004/05). However, understanding in "Sustainable Agricultural Development Strategy 2030" indicates that the productivity level of the major crops is still from 60% to 80% of the potential yield level. The status of the crop yields observed from the statistics in the beneficiary governorates are as follows:

- Crop yield level of the beneficiary governorates is relatively lower than the national level especially in the summer, Nile and perennial crops.
- Yield level of new land at national average is basically lower than that of old land except for long berseem and fruit trees, while the gap of yields between new and old lands in the beneficiary governorates are narrower than the national level and therefore the yield level of the crops in new reclaimed land in the beneficiary governorates is relatively higher than the national average. This may indicate that the condition of farming such as water availability in the new land in the Nile valley would be better than the delta and frontier reclaimed lands.
- Yields in Fayoum are observed to be lower than the average of the four (4) governorates except for onion and the yield level in Fayoum in 2008 shows a declining trend compared to the level in 2005.
- Yield of maize in the Nile season is significantly lower than summer maize.

Table 3.6.7 Unit Yield of Crops by Governorate (Winter Crop)

Governorate	Land	Long Clover		Wheat		Onion		Garlic		Sugar Beet		Tomato	
		2006	2008	2006	2008	2006	2008	2006	2008	2006	2008	2006	2008
Giza	Old Land	30.21	29.96	2.98	2.96	6.47	7.21	8.22	8.00	13.85	20.31	18.69	19.22
	New Land	33.36	25.30	2.98	2.96	10.95	7.71	-	10.61	-	13.06	-	-
	Total	30.28	29.58	2.98	2.96	7.23	7.28	8.22	8.36	13.85	15.76	18.69	19.22
BeniSuef	Old Land	33.55	34.34	2.73	2.88	10.26	12.08	10.00	10.59	23.05	21.94	20.15	21.13
	New Land	-	23.44	2.73	2.85	12.45	-	8.00	-	-	-	16.00	-
	Total	33.55	33.91	2.73	2.88	10.94	12.08	9.99	10.59	23.05	21.94	19.02	21.13
Fayoum	Old Land	17.19	16.84	2.52	2.56	14.32	14.54	8.22	7.39	18.48	16.20	17.42	17.51
	New Land	12.87	16.89	2.52	1.91	-	9.55	7.50	5.91	-	-	16.11	15.73
	Total	16.94	16.84	2.52	2.55	14.32	14.16	8.18	7.33	18.48	16.20	17.24	17.23
Minya	Old Land	26.27	27.80	2.87	2.89	10.65	16.06	10.05	8.58	29.70	27.11	18.48	15.01
	New Land	31.09	27.86	2.86	2.95	10.52	9.75	6.33	5.00	29.70	16.40	15.09	-
	Total	26.52	27.80	2.87	2.90	10.60	13.20	10.05	8.58	29.70	25.97	17.33	15.01
Total	Old Land	25.05	25.22	2.73	2.79	10.80	12.49	9.86	9.30	22.90	20.23	18.56	18.06
	New Land	22.16	23.02	2.76	2.86	11.74	9.24	7.54	8.10	29.70	15.25	15.43	15.73
	Total	24.93	25.12	2.73	2.80	11.00	12.20	9.85	9.29	22.95	20.08	17.92	17.97
National	Old Land	29.67	29.65	2.80	2.81	12.57	15.76	9.66	9.20	21.26	20.41	19.16	18.84
	New Land	31.92	32.64	2.24	2.35	12.49	11.50	6.29	6.13	18.33	17.57	13.65	12.89
	Total	29.89	29.98	2.70	2.73	12.56	14.75	9.28	8.97	20.95	19.92	18.10	17.69
Share to Nation	Old Land	84%	85%	98%	99%	86%	79%	102%	101%	108%	99%	97%	96%
	New Land	69%	71%	123%	122%	94%	80%	120%	132%	162%	87%	113%	122%
	Total	83%	84%	101%	103%	88%	83%	106%	104%	110%	101%	99%	102%

Source: Bulletin of Important Indicators of the Agricutural Statistics Winter Crops Volume (1) 2008 and 2006,EAS, MALR

Table 3.6.8 Unit Yield of Crops by Governorate (Summer Crop)

Governorate	Land	Rice		Summer Maize		Sorghum		Soybean		Potatoes	Tomato	Cucumber	Pepper
		2005	2008	2005	2008	2005	2008	2005	2008	2005	2005	2005	2005
Giza	Old Land	-	-	3.93	4.18	3.36	2.44	-	-	11.65	21.57	7.45	8.22
	New Land	-	-	3.50	2.51	3.16	2.42	-	-	-	-	-	-
	Total	-	-	3.90	4.09	3.33	2.43	-	-	11.65	21.57	7.45	8.22
BeniSuef	Old Land	4.42	3.34	3.24	3.09	2.41	2.27	1.47	1.39	10.59	20.49	8.15	5.91
	New Land	-	-	3.23	3.07	2.20	2.29	1.00	1.40	-	-	-	4.00
	Total	4.42	3.34	3.24	3.09	2.30	2.28	1.47	1.39	10.59	20.49	8.15	5.04
Fayoum	Old Land	3.92	3.85	3.02	2.87	2.16	2.17	-	-	8.00	13.47	6.52	6.10
	New Land	-	-	-	1.87	-	1.61	-	-	-	9.96	-	-
	Total	3.92	3.85	3.02	2.84	2.16	2.15	-	-	8.00	11.20	6.52	6.10
Minya	Old Land	-	-	3.44	3.43	2.75	2.52	1.25	1.42	9.01	14.69	9.14	8.18
	New Land	-	-	3.01	3.27	2.63	2.52	-	1.33	-	-	-	4.00
	Total	-	-	3.43	3.42	2.75	2.52	1.25	1.42	9.01	14.69	9.14	6.45
Total	Old Land	3.92	3.82	3.40	3.35	2.23	2.20	1.28	1.41	10.34	19.74	8.17	7.72
	New Land	-	-	3.18	2.99	2.49	1.87	1.00	1.38	-	9.96	-	4.00
	Total	3.92	3.82	3.39	3.33	2.24	2.19	1.28	1.41	10.34	19.54	8.17	6.78
National	Old Land	4.22	4.10	3.59	3.44	2.40	2.39	1.30	1.41	11.89	16.72	8.92	7.20
	New Land	3.37	0.00	3.09	3.22	1.84	1.96	1.03	1.23	10.93	13.02	9.69	6.43
	Total	4.20	3.94	3.55	3.42	2.37	2.36	1.29	1.41	11.81	15.26	9.16	6.97
Share to Nation	Old Land	93%	93%	95%	97%	93%	92%	98%	100%	87%	118%	92%	107%
	New Land	-	-	103%	93%	135%	95%	97%	112%	-	76%	-	62%
	Total	93%	97%	95%	97%	95%	93%	99%	100%	88%	128%	89%	97%

Source: Bulletin of Important Indicators of the Agricutural Statistics Summer Crops Volume (2) 2008 and 2005,EAS, MALR

Table 3.6.9 Unit Yield of Crops by Governorate (Nile Maize and Perennial Crops) in 2005

Governorate	Land	Nile Maize	Sugar cane	Citrus	Grapes	Mango	Banana	Olive
Giza	Old Land	3.13	36.22	6.83	7.52	3.05	16.23	5.48
	New Land	2.33	-	-	-	-	-	-
	Total	3.09	36.22	6.83	7.52	3.05	16.23	5.48
BeniSuef	Old Land	2.53	28.92	6.82	6.24	2.17	13.50	2.75
	New Land	-	19.00	-	1.19	-	-	-
	Total	2.53	28.10	6.82	6.16	2.17	13.50	2.75
Fayoum	Old Land	1.45	27.97	4.73	6.07	2.34	0.00	1.90
	New Land	-	-	-	2.80	-	-	1.52
	Total	1.45	27.97	4.73	5.96	2.34	0.00	1.81
Minya	Old Land	-	50.51	6.14	7.65	1.57	10.17	1.12
	New Land	-	42.68	-	-	-	-	3.00
	Total	-	50.46	6.14	7.65	1.57	10.17	1.30
Total	Old Land	2.39	48.82	6.35	7.35	2.65	13.68	2.79
	New Land	2.33	36.48	-	1.81	-	-	1.53
	Total	2.39	48.73	6.35	7.32	2.65	13.68	2.55
National	Old Land	2.63	51.20	8.17	7.03	2.85	14.38	2.75
	New Land	2.37	47.24	8.64	10.17	3.85	23.31	2.70
	Total	2.60	50.77	8.31	8.70	2.99	16.72	2.72
Share to Nation	Old Land	91%	95%	78%	105%	93%	95%	101%
	New Land	98%	77%	-	18%	-	-	57%
	Total	92%	96%	76%	84%	89%	82%	94%

6) Livestock

Animal husbandry is also an important economic activity in the rural area. Farmers keep animals for milk production, meat production and also for drafting and transporting. Therefore, intensive berseem and other fodder crops have been traditionally grown for use as animal feed as well as for soil fertility maintenance. Table 3.6.10 shows the number of animals in the beneficiary governorates. The numbers of cows, buffalo, sheep and goats in the four (4) governorates are 1.2 million head, 0.87 million head, 1.06 million head and 0.97 million head respectively.

Average heads per farm household is calculated at 1.03 head in Giza, 3.02 in Beni Suef, 1.50 in Fayoum and 2.50 in Minya. Share of cow is the highest with 0.59 head per household in the total governorates followed by sheep with 0.52, goats with 0.48 and buffalo with 0.43. Shares of cows and goats in the beneficiary governorates are higher than the national average while the share of sheep is lower. Production of berseem and other fodder crop per animal is estimated at 3.72 t/head in Giza, 1.78 t/head in Beni Suef, 4.02 t/head in Fayoum, and 1.60 t/head in Minya. Relatively low production

of fodder crops in Beni Suef and Minya might be a constraint to the shift from berseem to wheat in said areas.

Table 3.6.10 Number of Animals in the Beneficiary Governorates

Governorate	Giza	Beni Suef	Fayoum	Minya	Total	National	Share
No. of Animals (2007)							
Cows	108,977	415,394	201,339	475,167	1,200,877	4,932,656	24%
Buffalos	135,566	172,136	140,925	424,004	872,631	4,041,810	22%
Sheep	142,604	291,294	156,455	468,256	1,058,609	5,467,469	19%
Goats	133,367	241,493	140,227	451,250	966,337	4,210,714	23%
Total	520,514	1,120,317	638,946	1,818,677	4,098,454	18,652,649	22%
No. of Farm household (2006)	504,229	371,293	426,986	727,530	2,030,038	9,444,447	21%
Ave. head per farm household							
Cows	0.22	1.12	0.47	0.65	0.59	0.52	113%
Buffalos	0.27	0.46	0.33	0.58	0.43	0.43	100%
Sheep	0.28	0.78	0.37	0.64	0.52	0.58	90%
Goats	0.26	0.65	0.33	0.62	0.48	0.45	107%
Total	1.03	3.02	1.50	2.50	2.02	1.97	102%
Fodder Production (t) (2005/06)							
Long Berssem	1,523,348	1,782,654	1,898,456	2,795,914	8,000,372	49,529,894	16%
Short Berseem	119,945	208,258	214,146	55,250	597,599	5,625,491	11%
Other Fodders	292,734	5,808	455,019	66,405	819,966	5,643,021	15%
Total Fodder	1,936,027	1,996,720	2,567,621	2,917,569	9,417,937	60,798,406	15%
Prod. per animal (t/head)	3.72	1.78	4.02	1.60	2.30	3.26	70%

Source: Statistics of Livestock, Poultry, Municipality and Production Fish Statistics 2007, EAS, MALR
Population Census 2006, Agriculture Statistics from MALR

3.6.2 Agriculture Marketing and Processing

Information on the present situation of agriculture marketing and processing has been collected from the agriculture directorates of MALR in the beneficiary governorates and from the base line survey. The following summarizes the general feature of agriculture marketing and processing in the beneficiary governorates.

1) Agriculture Marketing

As the government has been deregulating the marketing of agriculture products, farmers are free to sell their produce to any channel of the markets. As for some strategic crops like wheat, cotton, and sugar beet, the governmental institutions such as agriculture cooperatives and the agriculture development bank (PBDAC) are involved in the market competition with private traders. According to the agriculture directorates on the governorates, agriculture development bank and cooperatives are dominant in the marketing of wheat. Otherwise, private traders are dominantly marketing the majority of the crops.

Agricultural products such as vegetables and legumes in the beneficiary governorates are mostly sold at the local markets and some amounts are sold to the big cities like Cairo and exported through private traders. Major export crops are onion, garlic, soybean and grapes in Minya, fruits in Beni Suef, and sesame, green fodder, green beans, squash, okra, potato, pepper, beans, cucumber, mango, and grapes in Giza. Farmers in Giza enjoy more variety of marketing channels (including export) than other governorates due to its close proximity to the capital. Ornamental, aromatic, and medical plants are also marketed to the capital Cairo and exported from the beneficiary governorates as the production center of these crops.

2) Processing

At the village or farm household level, activities on agriculture processing has been limited to simple measures like grading. Otherwise, there are many local processing factories in the beneficiary

governorates such as fodder processing from maize stalk, vegetable oil processing, vegetable drying, macaroni processing, onion drying, medical crop processing, jam and juice processing, etc. Sugar factories are located in the Minya and Fayoum governorates.

3.6.3 Cropping Pattern in the Beneficiary Governorates

As a summary of describing the Agriculture Sector in the beneficiary governorates, a cropping pattern of the present situation is formulated based on the agriculture statistics from the Ministry of Agriculture and Land Reclamation (MALR). The following method has been applied to formulate the present cropping pattern in the beneficiary governorates:

1. Total cultivated area in each governorate is based on the data in 2009 collected from the agriculture directorate of each governorate.

2. Cropping intensities of respective crop seasons and governorates and overall cropping intensity of 189% in 2004/05 is applied.

3. Cropped areas of major crops and groups of crops such as legumes, oil crops, vegetables and others are estimated as an average of the data in 2005/06 and 2008/09.

4. The cropping period of each crop is based on the monthly water requirement for each crop in middle Egypt, prepared by the Ministry of Water Resources and Irrigation (MWRI). Table 3.6.11 summarizes the cropped area by crop in each crop season and governorate and Figure 3.6.8 shows the present cropping pattern in total of the beneficiary governorates.

Table 3.6.11 Present Cropping Pattern by Governorate

Governorate	Cultivated Area (fed)	Cropped Area (fed) and Share (%) in Winter Season															
		Wheat		L. Berseem		Sugar beet		Legums		Vegetables		Other crops		Total		Short Berseem	
Giza	203,358	37,079	18%	49,014	24%	651	0%	227	0%	61,311	30%	4,236	2%	152,518	75%	10,168	5%
Beni Suef	291,386	131,317	45%	46,843	16%	10,528	4%	598	0%	35,397	12%	11,341	4%	236,024	81%	23,311	8%
Fayoum	422,304	165,636	39%	110,595	26%	13,756	3%	2,930	1%	36,245	9%	25,574	6%	354,736	84%	21,115	5%
Minya	530,584	216,875	41%	119,648	23%	8,116	2%	5,182	1%	37,520	7%	31,821	6%	419,162	79%	5,306	1%
Total	1,447,632	550,907	38%	326,100	23%	33,051	2%	8,937	1%	170,473	12%	72,972	5%	1,162,440	80%	59,900	4%

	Cultivated Area (fed)	Cropped Area (fed) and Share (%) in Summer Season													
		Rice		Maize		Sorghum		Oil Crops		Vegetables		Other Crops		Total	
Giza	203,358	0	0%	29,466	14%	472	0%	4,640	2%	91,085	45%	28,888	14%	154,551	76%
Beni Suef	291,386	619	0%	112,851	39%	807	0%	4,811	2%	30,753	11%	4,592	2%	154,433	53%
Fayoum	422,304	21,655	5%	50,826	12%	71,741	17%	10,378	2%	31,020	7%	59,316	14%	244,936	58%
Minya	530,584	0	0%	276,056	52%	9,254	2%	36,978	7%	71,688	14%	3,962	1%	397,938	75%
Total	1,447,632	22,274	2%	469,199	32%	82,274	6%	56,807	4%	224,546	16%	96,758	7%	951,858	66%

	Cultivated Area (fed)	Cropped Area (fed) and Share (%) in Nile Season									
		Maize		Sorghum		Vegetables		Other Crops		Total	
Giza	203,358	30,593	15%	347	0%	33,132	16%	19,305	9%	83,377	41%
Beni Suef	291,386	64,454	22%	5,309	2%	6,623	2%	2,289	1%	78,675	27%
Fayoum	422,304	33,132	8%	2,674	1%	21,587	5%	18,621	4%	76,014	18%
Minya	530,584	0	0%	0	0%	31,666	6%	169	0%	31,835	6%
Total	1,447,632	128,179	9%	8,330	1%	93,008	6%	40,384	3%	269,901	19%

	Cultivated Area (fed)	Cropped Area (fed) and Share (%) of Perennial Crop							
		Sugar cane		Cotton		Fruit trees		Total	
Giza	203,358	2,652	1%	5	0%	48,183	24%	50,840	25%
Beni Suef	291,386	978	0%	39,703	14%	14,682	5%	55,363	19%
Fayoum	422,304	481	0%	29,936	7%	37,152	9%	67,569	16%
Minya	530,584	42,069	8%	37,103	7%	32,251	6%	111,423	21%
Total	1,447,632	46,180	3%	106,747	7%	132,268	9%	285,195	20%

Figure 3.6.8 Present Cropping Pattern in the Beneficiary Governorates

Season	Crop Intensity	Crop	Area (fed)	CI	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter	80%	Wheat	550,907	38%												
		Long berseem	326,100	23%												
		Sugar beet	33,051	2%												
		Legums	8,937	1%												
		Vegetables	170,473	12%												
		Other crops	72,972	5%												
	4%	Short berseem	59,900	4%												
Summer	66%	Rice	22,274	2%												
		Maize	469,199	32%												
		Sorghum	82,274	6%												
		Oil crop	56,807	4%												
		Vegetables	224,546	16%												
		Other crops	96,758	7%												
Nile	19%	Maize	128,179	9%												
		Sorghum	8,330	1%												
		Vegetables	93,008	6%												
		Other crops	40,384	3%												
Permanent	20%	Sugar cane	46,180	3%												
		Cotton	106,747	7%												
		Fruit trees	132,268	9%												
Total	189%		2,729,294	189%												
Cultivated area (fed)			1,447,632													

3.7 Results of the Baseline Survey

3.7.1 Purpose and Method

1) Purpose of the Survey

Since it is necessary to confirm the economic feasibility of this proposed project, basic economic data for estimating the benefit accrued from the Project is required. The baseline survey is carried out in order to collect such required data for the economic evaluation of the Project as well as to study for establishing the baseline of the present situation of the agro-economy in the beneficiary area.

2) Site selection (How to select the 15 sites)

As the beneficiary area is vast having about 600,000 ha of farmlands, the coverage of the baseline survey is limited to a specific spot. Therefore, the Team focused on understanding the state of the water shortage in the area, so the Team tried to pick the area actually suffering from water shortage. The site selection of the survey was, therefore, carried out with the basic criteria of "the area with water shortage."

The method of the site selection was: firstly, classify the beneficiary area at the secondary canal level, secondly, select villages along the secondary canals, and thirdly, hold a one (1) day workshop at the selected village. Selection of the baseline survey sites was made considering the following points:

1. Site with severe water shortage seemingly caused by the aging Dirout Group of Regulators. That is to say, the expected site where there is the highest recovery from water shortage after the rehabilitation and improvement of the Dirout Group of Regulators.
2. Site with severe water shortage seemingly caused by the aging minor structures, which would be proposed by MWRI for physical assessment. That is to say, the expected site where the highest recovery from water shortage after the rehabilitation and improvement of the minor structures.
3. Site which would have large benefit areas (farmlands) after the rehabilitation and improvement of the Dirout Group of Regulators or the minor structures.
4. Site which does not still receive enough irrigation water from the canals, such as reclaimed farmlands, and has relevance to the rehabilitation and improvement of the Dirout Group of Regulators.
5. The project area of the Water Management Improvement Project Phase-2 (Beni-Abed area).

Based on the above criteria, the sites for the baseline survey were selected in consultation with the technical officers of the Irrigation Directorates of Beni Suef, Fayoum and East and West Minya under MWRI. At least one site from the seven (7) main canals diverted from the Dirout Group of Regulators were selected, and for the Bahr Yusef and Ibrahimia canals, several sites from upstream to downstream reaches were selected due to the long length of the canals.

As for the Beni Abed area, the Irrigation Improvement Project (IIP) was implemented in the 1990s, the terminal canals (Meska) have been improved, and the water users associations have been established. WMIP II is now dealing with the site to strengthen the union of water users associations at the secondary canal level. It is expected that the survey at this site would reveal the effects of such a project and that would be utilized for the estimation of the benefit from the Project of the Dirout Group of Regulators.

3) Implementation

The baseline survey was carried out as a one day group meeting. When the participant farmers gathered at the venue, the Team distributed the questionnaire for basic information on agro-economy and assisted the farmers to fill out the questionnaire. Afterwards, a session of group discussion was made to discuss the degree ad causes of water shortage, crop production, etc.

The baseline survey was carried out at a total of 17 sites from the 21st of October until the 24th of November, 2009. Table 3.7.1 summarizes the site and attendance of the baseline survey. In total, 360 farmers participated in the group discussion and the Team managed to collect 230 questionnaires. The questionnaire survey was not materialized in the three (3) sites of Beni Suef due to security reasons (some questions were considered inappropriate and the Team rectified the contents of the questionnaire). At the Irad Delgaw canal in Minya, farmers refused to answer the questions because they were at that time suffering from the severe water shortage caused by the construction work or sewage water in the Dirout city. Their attention was thus diverted to the pressing demand for water release to the canal.

Table 3.7.1 Sites of Baseline Survey and the Attendance

No.	Governorate	Site (Area) name	Main canal	Survey date	No. of participants		Remarks
					Group Discussion	Questionnaire	
1	Beni Suef	Elmasharka	Ibrahimia	21/10/2009	41	-	
2	Beni Suef	El Fant	Ibrahimia	25/10/2009	30	-	
3	Beni Suef	Ashmant	Ibrahimia	27/10/2009	40	-	
4	Beni Suef	El Nawamees	Bahr yussef	5/11/2009	25	20	
5	Beni Suef	El Bhsamoun	Bahr yussef	7/11/2009	18	17	
6	Fayoum	Senors	Bahr yussef	22/10/2009	19	19	
7	Fayoum	Matartars	Bahr yussef	26/10/2009	30	28	
8	Fayoum	Elmokhtalta	Bahr yussef	28/10/2009	24	31	
9	Fayoum	Batn_Heret	Bahr yussef	4/11/2009	13	15	
10	Minia	Ezbet Elbasha	Ibrahimia	14/11/2009	16	15	
11	Minia	Abeed village	Bahr yussef	15/11/2009	18	18	
12	Minia	Dirout Al Sherif	Dairotiah	17/11/2009	9	9	
13	Minia	Beni Yahia	Sahelyia	17/11/2009	18	18	
14	Minia	Badraman	Badraman	18/11/2009	13	13	
15	Minia	Nazlet Sergna	Abo Gabal	19/11/2009	6	5	
16	Minia	Dashlout	Irad Delgaw	19/11/2009	20	-	
17	Minia	Beni Abed	Ibrahimia	24/11/2009	20	22	Site for WMIP II (*)
				Total	360	230	

(*) WMIP II: Water Management Improvement Project Phase II

3.7.2 Results of the Baseline Survey

This section presents the preliminary results of the baseline survey. The questionnaire used for the survey includes family structure, land holding status, crop production and income from crop production, livestock and other sources, and degree of water shortage by season. The Team received a total of 230 answers from the 17 survey sites and valid answers among the 230 samples were selected and used for analysis in each item of the question.

1) Family Structure

The average family size of the valid 218 sample households is calculated at 6.2. Considering the economically productive population, the number of family members aged from 16 to 59 was counted. The number of family members aged from 16 to 59 is calculated at 3.8 on average, which is 61% of the total number of family members. Figure 3.7.1 shows the distribution of the sample households by family size. Major family size is 5 or 6 members per family. There are 20

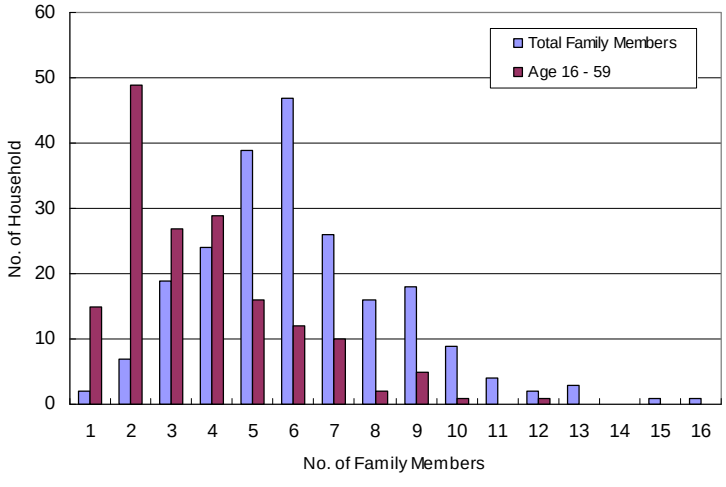


Figure 3.7.1 Family Size and No. of Members from 16 to 59 years old

households, or 20% of the sample households have more than 10 members in their families.

2) Land Holding

Valid answers for land holding status was obtained from 227 sample households. Among them, 48 households or 21% are landless, out of which 29 households or 13% are renting farmlands and 19 households or 8% are just earning their living by labor work. According to the survey, the rent for farmland ranges from 1,000 to 8,000, with the average rent calculated at 3,385 LE/feddan. A rent of 3,000 LE/feddan or 4,000 LE/feddan was most frequently reported from the farmers on the survey.

Farming area of the households is defined as [own land + leased land - land rented out]. Based on this definition, the average farming area per household of the sample households measures 2.7 feddan (1.13 ha). By governorate, the average farming areas in Beni Suef (34 samples), Fayum (93 samples) and Minya (100 samples) are calculated at 3.4 feddan (1.43 ha)/household, 3.9 feddan (1.64 ha)/household and 1.7 feddan (0.71ha)/household respectively. The tendency that the average farming area per household is the smallest in Minya and largest in Fayum is consistent with the statistics at the governorate level as shown in Section 3.2 (table 3.2.8).

Figure 3.7.2 below shows the distribution of the sample households by farming area. In total, 37% of the sample households are having less than 1 feddan (0.42 ha). In Minya, the households with less than 1 feddan occupy 54%, while the ones in Beni Suef and Fayum number at 29% and 22% respectively. The households with less than 3 feddan (1.26 ha) occupy 70%. By governorate, the households with less than 3 feddan share 87% in Minya, 65% in Beni Suef and 53% in Fayum.

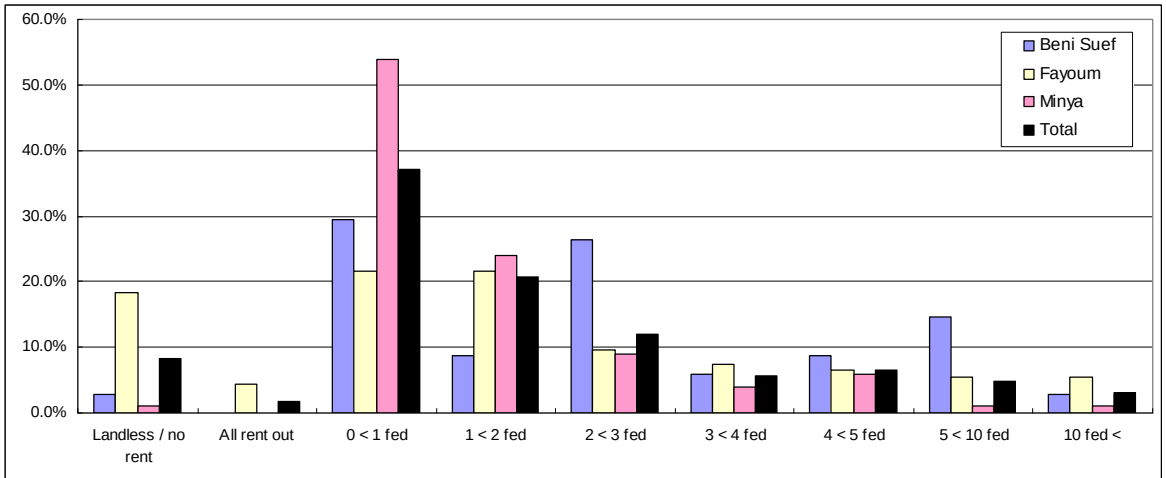


Figure 3.7.2 Distribution of Sample Households by Land Holding (Farming Area)

3) Major Crops and Cropping Intensity

Major crops grown by the sample households are maize, sorghum and cotton in the summer season, wheat and berseem in the winter season, and maize, barley, sorghum, and vegetables such as tomato, cucumber and potato in the Nile season. In Fayum, farmers who grow tomato and sunflower in the summer season were included in the survey. In Fayum, a few farmers who grow wormwood (medicinal/aromatic crop) were included as well. In Minya, there are farmers who grow sugar cane and soybean. Most of the sample households concentrate on cultivating staple grains and a few samples of vegetable growers were included in the survey. Table 3.7.2 below shows the major cropping pattern reported by the sample households of the survey:

Table 3.7.2 Major Cropping Pattern of the Sample Households

Governorate	Summer	Winter	*Nile (few samples)*
Beni Suef	Maize Sorghum	Wheat	*Maize* *Sorghum* *Barley*
Fayum	Maize Sorghum Cotton *Tomato (few samples)* *Sunflower (few samples)*	Wheat Berseem *Sugar beet (few samples)* *Medicinal/aromatic crop (few samples)*	*Tomato* *Cucumber* *Sorghum* *Maize*
Minya	Maize *Sugar cane (few samples)* *Soybean (few samples)* *Peanut (few samples)*	Wheat Berseem	*Maize*

Table 3.7.3 Cropping Intensity By Governorate

	Governorate		Valid sample	Total	Summer	Winter	Nile	Other
Baseline Survey	Beni Suef		33	186%	72%	86%	28%	-
	Fayoum		65	118%	45%	63%	10%	-
	Minya		94	176%	91%	81%	4%	-
	Total		192	149%	64%	73%	12%	-
Agriculture Statistics from MALR '2004/05)	*Beni Suef*	Old land		*189%*	*52%*	*80%*	*29%*	*28%*
		New land		*164%*	*64%*	*99%*	*0%*	*1%*
		Total		*188%*	*53%*	*81%*	*27%*	*27%*
	Fayoum	Old land		*186%*	*62%*	*84%*	*19%*	*21%*
		New land		*107%*	*7%*	*81%*	*0%*	*19%*
		Total		*181%*	*58%*	*84%*	*18%*	*21%*
	Minya	Old land		*180%*	*73%*	*78%*	*6%*	*23%*
		New land		*210%*	*110%*	*99%*	*0%*	*1%*
		Total		*182%*	*75%*	*79%*	*6%*	*22%*

Note: Other: permanent crop and short clover

Cropping intensity of the sample households are calculated as shown in Table 3.7.3. Cropping Intensities in Beni Suef, Fayum, and Minya were calculated at 186%, 118%, and 176% respectively. These data are lower than the agriculture statistics from MALR, especially in Fayum, as also shown in the table, although the tendency of the highest intensity occurred in Beni Suef, followed by Minya, and Fayum is the same as the statistics. As indicated in the following section 3.7.3, the site of Batn Heret in Fayum includes new reclaimed land and the water supply may not meet the demand of the new area. This issue may be the cause of low cropping intensity in Fayum as the cropping intensity of the new land in Fayum even in the agriculture statistics count only 107%.

4) Crop yield

Since the baseline survey was carried out at the sites in which farmers are suffering from water shortage, the result of the survey seems to reflect the situations of the survey sites, namely that the average yields of the survey sites are lower than the statistical data at the governorate level issued by MALR. Table 3.7.4 below shows the average unit yields of crops of the sample households by governorate. Yield level of the sample households in Fayum is found to be the lowest among the three (3) governorates.

The average yields of maize in Beni Suef, Fayum and Minya were calculated at 2.434t/fed (5.8t/ha), 2.052t/fed (4.5t/ha), and 2.528t/fed (6.0t/ha) respectively. All of them are lower than the yields shown in the governorate level statistics. As for the Beni Abed site, in which the Irrigation Improvement Project (IIP) by MWRI and the Japanese technical cooperation, Water Management Improvement Project (WMIP) Phase II have been implemented, the average unit yield of maize measured 3.158t/fed (7.5t/ha), much higher than the yield level of the other sites, though it is slightly lower than the statistics at the governorate level.

As shown on the table, other crops including sorghum, cotton, sunflower, soybean, sugarcane, wheat and tomato show the same tendency that the unit yields at the survey sites did, being lower than the governorate level statistics, except for sugar beet in Fayum. As for wheat in Beni Abved in Minya, the average unit yield of 3.188t/fed (7.6t/ha) is even higher than the governorate level statistics.

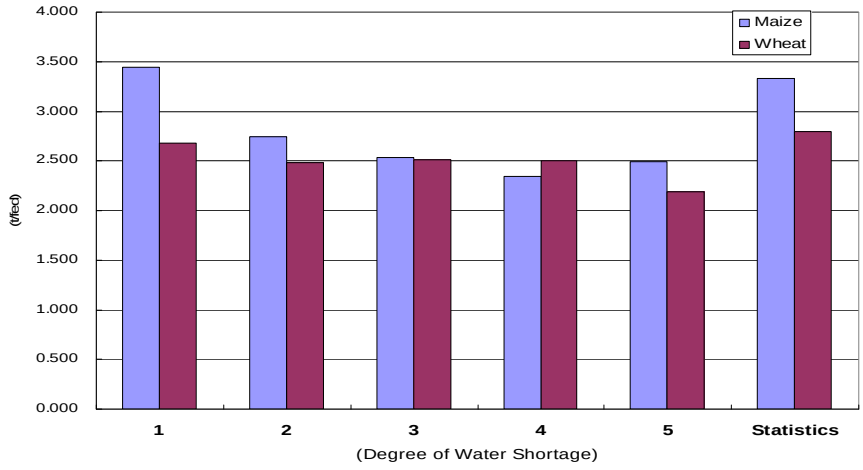
Table 3.7.4 Unit Yield of Crops by Governorate

Crop	Beni Suef			Fayoum			Minya (except Beni Abed)			Beni Abed (WMIP / IIP in Minya)		
	Sample	Baseline t/fed	Statistics t/fed	Sample	Baseline t/fed	Statistics t/fed	Sample	Baseline t/fed	Statistics t/fed	Sample	Baseline t/fed	Statistics t/fed
SummerCrop												
Maize	23	2.434	3.070	14	2.052	2.840	67	2.528	3.420	20	3.158	3.420
Sorghum	11	1.724	2.280	27	1.717	2.150	3	3.260	2.520	-	-	2.520
Cotton	-	-	0.930	17	0.610	-	-	-	0.950	-	-	0.950
Sunflower	-	-	1.380	5	0.660	0.860	-	-	1.240	-	-	1.240
Soybean	-	-	1.390	-	-	-	5	1.200	1.420	4	1.250	1.420
Sugarcane	-	-	28.100	-	-	27.970	5	42.000	50.460	-	-	50.460
Winter Crop												
Wheat	31	2.123	2.880	46	1.902	2.550	61	2.688	2.900	20	3.188	2.900
Tomato		-	21.130	6	9.500	17.230		-	15.010			
Sugar beet	2	20.000	21.940	2	20.000	16.200		-	25.970	-		25.970
Nile Crop												
Maize	4	1.750	2.530	16	1.031	1.450	-	-	-	-	-	-

Note: Statistics is from MALR (2008). As for Nile crop, the statistical data is as of 2005

In the questionnaire survey, the Team asked farmers about the degree of water shortage by crop season with five (5) ranks: (1) water shortage does not occur at all, (2) water shortage occurs only on a few occasions, (3) water shortage often occurs but does not affect crop growth, (4) water shortage frequently occurs and gives little damage to crops, and (5) water shortage frequently occurs and gives considerable damage to crops. For the summer maize crop, 37 farm households out of 109 valid samples, or 34% of the sample households, report the degree of water shortage as (5), while for the winter wheat crop, 49 households out of 144 valid sample households, or 34% of the sample households, rate the degree of water shortage as (5).

Figure 3.7.3 shows the average unit yields of maize and wheat according to the degree of water shortage, which were reported by the sample farm households. The figure indicates that the yield level and the farmer's report on degree of water shortage have a fairly strong correlation. The average unit yield of maize with the degree of (1) is 3.449t/fed (8.2t/ha) and the yield level shows a lowering tendency according to the degree of water shortage. The average unit yield of maize with the degree of (5) is 2.495t/fed (5.9t/ha). The yield level of wheat follows the same tendency, although the tendency is not as clear as maize. The average unit yield of wheat with the degree of (1) is 2.685t/fed (6.4t/ha), while the one with the degree of (5) is 2.191t/fed (5.2t/ha). The difference of the yields according to the degree of water shortage would be the basis of estimating the effects of the Project, which will contribute to improving the irrigation water distribution into the beneficiary area.



Degree of Water Shortage		1	2	3	4	5	Statistics
Maize	No. of Sample	5	21	27	19	37	
	Yield (t/fed)	3.449	2.741	2.531	2.345	2.495	3.330
Wheat	No. of Sample	11	36	23	25	49	
	Yield (t/fed)	2.685	2.483	2.511	2.501	2.191	2.800

Figure 3.7.3 Yields by the Degree of Water Shortage

5) Farm Household Income by Land Holding Size

Income level of the sample farm households (157 valid answers) is estimated. As shown in Table 3.7.5 below, the average annual household incomes of the samples from 2 feddan and less, 2 – 4 feddan, and over 4 feddan are estimated at 5,432LE (average land holding: 1.11fed), 11,341LE (average 3.15fed), and 28,445LE (average 7.37fed) respectively. The share of income from crop production to the total income is estimated at 57% for the samples of 2 feddan and less, 68% for 2 – 4 feddan, and 72% for over 4 feddan. The result indicates the higher income level, the higher share of income from crop production.

Average annual income per capita of the sample households is estimated at 839LE/capita for 2 feddan and less, 1,787LE/capita for 2- 4 feddan, and 4,163LE for over 4 feddan. UNDP "Humand Development Report 2008" defines the lower poverty line at the annual expenditure of 1,156LE per capita and the upper povety line at 1,574LE. Based on the sample household data, the household with less than 1 – 1.5feddan could fall under the poverty line level.

Income from crop production per feddan is averaged at 2,803LE/fed for 2feddan and less, 2,434LE/fed for 2- 4feddan, and 2,791LE/fed for over 4feddan. Referring to the data by governorate, income from crop production per unit area of smaller scale farm households is relatively higher, indicating that the small scale farmers more intensively use the land than larger scale farmers.

The samples of the baseline survey have been selected from the area with water shortage and therefore, the crop yield is lower the standard yield level of the governorates. Also there are few samples who grow profitable vegetables. These facts attributed to lowering the income per unit area. By improving irrigation water distribution, it would be possible to raise the productivity of the land and increase the income of farmers.

Table 3.7.5 Income of Sample Farm Households by Land Holding Size

Income Source	Beni Suef						Fayoum					
	2 fed and less		2 - 4 fed		4 fed -		2 fed and less		2 - 4 fed		4 fed -	
	(LE)	(%)	(LE)	(%)	(LE)	(%)	(LE)	(%)	(LE)	(%)	(LE)	(%)
Crop Income	3,282	40%	8,098	50%	18,721	65%	3,052	54%	5,787	67%	23,023	76%
Livestock	4,273	52%	7,200	45%	8,743	30%	905	16%	1,961	23%	5,722	19%
Others	608	7%	875	5%	1,207	4%	1,698	30%	883	10%	1,664	5%
Total	8,163	100%	16,173	100%	28,671	100%	5,655	100%	8,631	100%	30,409	100%
Ave. Family Size	6.6		4.9		7.1		6.4		6.9		6.7	
Income per Capita	1,230		3,318		4,014		885		1,253		4,561	
Ave. Farming Land	1.01		3.06		7.35		1.38		3.14		8.61	
Crop Income per fed	3,258		2,644		2,549		2,213		1,841		2,674	
No. of Sample	11		8		7		28		9		9	

Income Source	Minya						Average					
	2 fed and less		2 - 4 fed		4 fed -		2 fed and less		2 - 4 fed		4 fed -	
	(LE)	(%)	(LE)	(%)	(LE)	(%)	(LE)	(%)	(LE)	(%)	(LE)	(%)
Crop Income	3,101	63%	8,780	86%	19,412	75%	3,107	57%	7,663	68%	20,564	72%
Livestock	1,309	27%	1,158	11%	5,575	21%	1,514	28%	3,074	27%	6,554	23%
Others	495	10%	213	2%	1,050	4%	831	15%	603	5%	1,326	5%
Total	4,905	100%	10,151	100%	26,037	100%	5,452	100%	11,341	100%	28,445	100%
Ave. Family Size	6.5		6.9		6.8		6.5		6.3		6.8	
Income per Capita	752		1,468		3,857		839		1,787		4,163	
Ave. Farming Land	1.01		3.21		5.99		1.11		3.15		7.37	
Crop Income per fed	3,072		2,737		3,241		2,803		2,434		2,791	
No. of Sample	65		12		8		104		29		24	

3.7.3 Results of the Group Discussion

1) On water Shortage

During the baseline survey, a group discussion was made with the participants of the baseline survey meeting in order to capture the general situations of irrigation and farming in the area with a water

shortage. The participants were asked to discuss degree, trend and peak season of water shortage as well as the causes of water shortage occurring in their areas. Table 3.7.7 summarizes the situation of the water shortage at the survey sites.

Table 3.7.6 Situation of Water Shortage at the Baseline Survey Sites (Group Discussion)

No.	Governorate	Site	Trend of water shortage	when is the most severe	Causes of Water Shortage
1	Beni Suef	EL Masharka	Water shortage has become much more year after year.	Summer	High bed level of intake regulator
2	Beni Suef	El Fant	Water has become less for these recent years, comparing with the past.	Summer	Secondary canal needs maintenance and high bed level of intake from Ibrahimia canal.
3	Beni Suef	Ashmant	Water shortage has been worse year after year.	Summer	Intake structure needs replacement (high bed level) and canal needs maintenance.
4	Beni Suef	EL Nawamees	Water shortage has become more in this year than the past	Summer	Canals and regulators need maintenance.
5	Beni Suef	EL Bhsamoun	Year after year it began to be noticed that there is real shortage problem affecting the yield of crops.	Winter	Low water level in Bahr Yousef canal and high bed level of intake structure.
6	Fayoum	Senors	It is getting worse in recent years.	Summer	Crops need high quantities of water especially in summer but the water levels in the main canal is low.
7	Fayoum	Matartars	Water shortage has been worse in this year than previous years.	Summer	Irrigation facilities especially branch canals need maintenance.
8	Fayoum	Elmokhtalta	Water is enough at the present like as the past.	Summer	They do not have water shortage.
9	Fayoum	Batn Heret	Water shortage has become more in this year comparing with the past.	Summer	Additional reclaimed lands to the old lands' area.
10	Minya	Ezbit Elbasha	Water shortage problem began to appear from 2008 and till this year 2009.	Summer	Low water level in Ibrahimia and branch canals need maintenance.
11	Minya	Abeed village	Water level has been decreased in 2009, and it has been happning from many years ago.	Summer (June)	Low water level in Bahr Yusef canal and crops need high quantities of water especially in summer.
12	Minya	Dirout Al Sherif	There is noticeable lack of water in this year more than last previous years	Summer (July)	Branch canals need maintenance.
13	Minya	Beni Yehia	There is a lack of water in this year than in the past.	Summer (July&August)	Water distribution directorate reduced water level in Ibrahimia canal and branch canals need maintenance.
14	Minya	Badraman	There is problem with irrigation water till year 2008, and it also happened in year 2009.	Summer	Crops need high quantities of water, losses due to high temperature and low water levels in Ibrahimia canal.
15	Minya	Nazlet Sergna	There was not much problem with irrigation water till year 2008, but it happened in year 2009.	Summer (July)	Crops need high quantities of water, losses due to high temperature and low water levels in Ibrahimia canal.
16	Minya	Dashlout	We have a serious problem started from last summer (due to construction work that would end by next year) and in the past there used to be a light water shortage.	Summer (July)	Low water level in main canal (Ibrahimia) and sometimes closed gates of intake structure on secondary canal (Irad Delgaw) and branch canals need maintenance.

The participants in all the sites except for Elmokhatlta in Fayum report that the water shortage is getting worse. The participants were specifically complaining that the water shortage particularly worsened this year (2009). This would be due to the fact that the ministry restrained the water distribution at the Ibrahimia intake in Assuit.

Farmers in Dashlot in Minya are receiving irrigation water from the Irad Delgaw main canal, which starts at the Dirout Group of Regulators. There is on-going construction work for sewage water treatment in Dirout city and the water flow of the canal was diverted for the construction work, which has resulted in lowering the water level in the canal. Therefore, the area is suffering a severe water shortage, particularly this year. The case would cease after the construction finishes.

As for the peak time of water shortage, it is reported that the summer season is the peak of the water shortage at all the sites except for El Bhsamoun in Beni Suef. The report from the participants

corresponds to the result of the water balance analysis discussed in the following section 3.9. Water discharge into the canal from the Nile comes to the peak during the summer season as well. However, the water requirement of crops, such as maize in the summer season, is higher than that of winter, such as wheat. Therefore, it eventually ends up with a higher degree of water shortage in the summer.

As for the causes of water shortage, the participants in most of the sites indicated the problems of irrigation facilities, such as canals and regulators at the secondary canal level. Also, the participants discussed the cause of water shortage from the water level of the main canals, such as Bahr Yusef and Ibrahimia. At the site of Batn Heren in Fayum, the participants see the cause of the water shortage as the expansion of the cultivated land, i.e., an increase of water demand. In summary, the causes of water shortage were discussed regarding the issue of the main canals, the facilities at the secondary canals and the issue of an increased demand for water.

2) Beni Abed Site in Minya

As explained above, the Team carried out the survey at the Beni Abed site, in which the projects of IIP and WMIP Phase II have been implemented. There is an active branch canal water users association (WUA) which is working for better distribution of irrigation water. Also, water users associations at the Meska level are actively operating and maintaining the improved Meska system (one point lifting pump irrigation) with the collection of an irrigation fee from the members. The following shows the effects after the WUA establishment and improvement of the terminal system (Meska) were reported from the farmer members of WUA:

- In general the farmers report that better change was realized after the projects.
- Before the project, rotational irrigation was practiced. Rotation irrigation forced farmers to irrigate at a certain date, but after the project Continuous Flow was introduced, farmers are able to irrigate anytime the plants require water.
- WUA establishment reduced the time and efforts for irrigation. Also, there is a noticeable increase of crop production by 25%. The cost of O&M for Meska has been shared by WUA members, and conflict over irrigation water is also reduced.
- Water shortage still happens occasionally at the end of the canal, especially in July. WUA communicates with the irrigation office for mitigating the issue. Even farmers apply night-time irrigation or use groundwater during the urgent time of the shortage.
- A further issue of the WUA is maintenance of the branch canal and prevention of the residents from dumping waste into canal, which disturbs water flow to reach the end of the canal.

3.8 Environmental and Social Consideration

3.8.1 Environmental Organizations

The Egyptian Environmental Affairs Agency (EEAA) and its Regional Offices (RBO's) are the main environmental bodies responsible for the protection of the environment in Egypt. According to Law 4/1994, the EEAA is mandated to coordinate and work in close collaboration with key ministries and institutions in Egypt. In addition, there are the Environmental Management Units in the governorates (EMUs), which are the entities responsible for the environmental management activities within each governorate. The EMUs work in association with the RBOs under the guidance of the EEAA.

The EEAA was first established in 1982 as the authority responsible for promoting and protecting the environment in Egypt. In 1994, the EEAA was re-established in accordance with the Law 4/1994 for the Environment and was restructured with a new mandate to substitute the initially established agency. Based on Law 4/1994, the EEAA has a public juridical responsibility and is to be affiliated with the competent Minister for Environmental Affairs, who heads the EEAA's governing board.

The EEAA is responsible for ensuring that projects conform to the Egyptian environmental regulations and for projects classified as black listed, reviewing and approving their Environmental Impact Assessment (EIA). The EEAA may also carry out follow-up activities and undertake tests to determine actual levels of impact.

3.8.2 Procedure of the EIA for the Project

(1) Screening

Law 4/1994 states that the EIA of certain establishments or projects must be evaluated before any construction works are initiated or any license is issued by the component administrative authority or licensing authority.

The executive regulations to the Law 4/1994 identify establishments or projects which must be subjected to the EIA based upon the following main principles:

- Type of activity performed by the establishment.
- Extent of natural resource exploitation.
- Location of the establishment.
- Type of energy used to operate the establishment.

The system encompasses a flexible screening system, and projects are classified into three groups or classes reflecting different levels of environmental impacts according to the severity of possible impacts on the environment. The classification is shown below:

- White (A) list projects:
  It is for establishment with minor environmental impacts. The project proponent has to fill in the environmental screening form "A."
- Grey (B) list projects:
  It is for establishment, which may result in substantial environmental impacts. The proponent has to fill out environmental screening form "B". The procedure consists of two stages, filling out form B and possibly followed by a scoped EIA on certain identified impacts/processes.
- Black (C) list projects:
  It is for establishment, which requires a full EIA due to their potential impacts. In case of establishment with production capacity limits specified, all sizes are included.

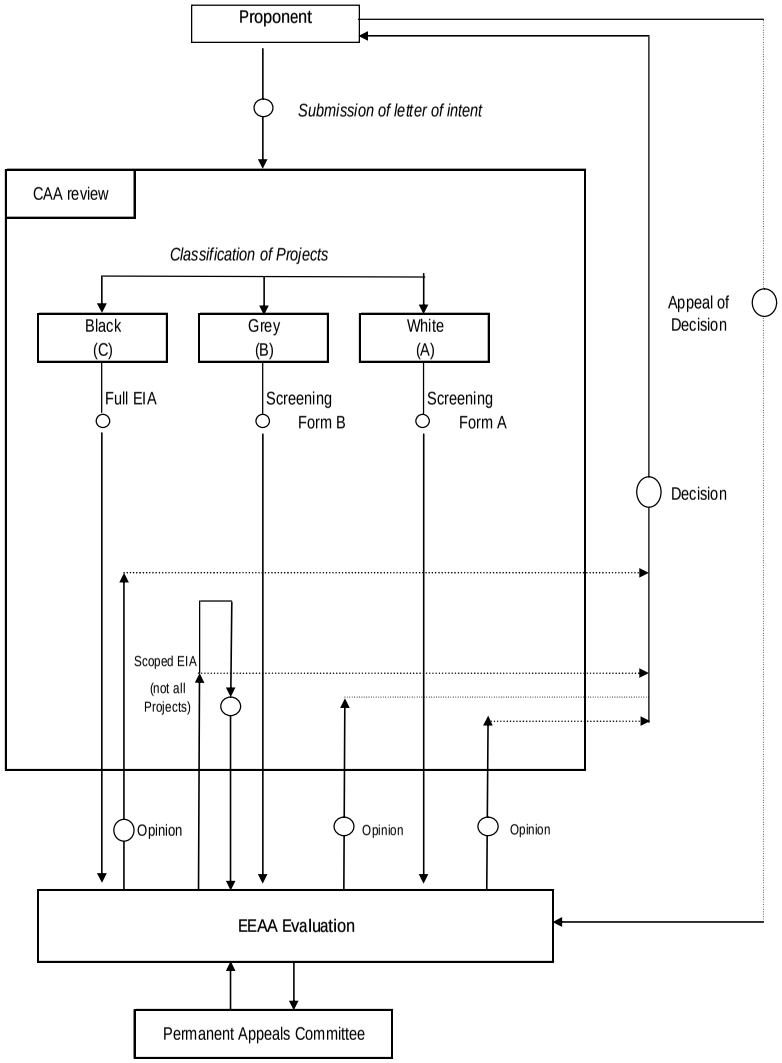


Figure 3.8.1 EIA cycle system to process application in the Egyptian Environmental Affairs Agency (EEAA)
(Source: Guidelines for Egyptian EIA)

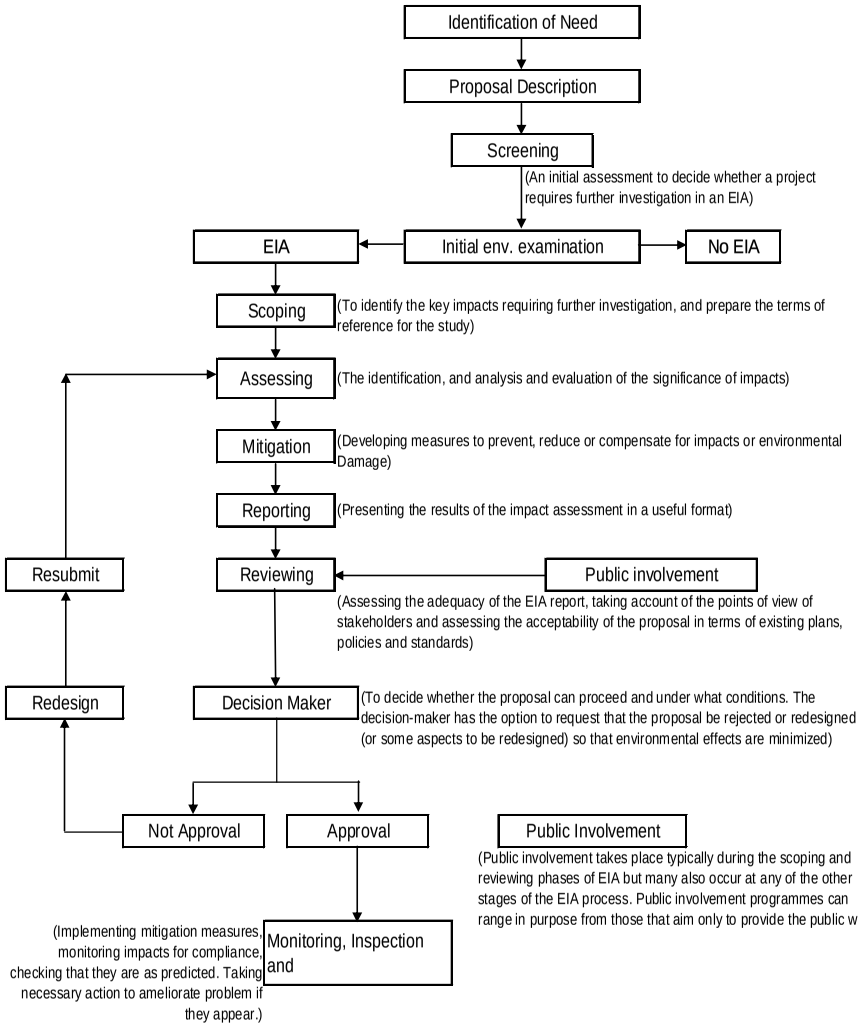


Figure 3.8.1 EIA General Process

According to the EIA Source Book prepared by MWRI, the new irrigation projects include hydraulic structures such as gates (manual and/or automatic), barrages, weirs, diversions, siphons and escapes. And also, the rehabilitation project relocating the existing barrages has been judged as a new project. The case of the rehabilitation and improvement of the Dirout Group of Regulators, in which alignment is planned to be relocated downstream of the existing barrage, is **classified as the black (C) project which required full EIA.**

(2) Environmental Working Group (EG)

Environmental group (EG) was established in RGBS for managing EIA scoping, EIA work plan, public hearing in the project site, EIA report review and other related work. EG was organized in February 2010 and EIA study is taken charge by Environmental and Climate change Research Institute (ECRI) which is one of institute sector in MWRI.

(3) Cooperation with government agencies and public hearings

The Egyptian environmental law requires cooperation with other government agencies and conducting public hearings with NGO and environmental stakeholders. The hearings should be conducted more than twice in EIA study and the records should be kept.

(4) Environmental Impact Assessment (EIA)

The Egyptian environmental guidelines show the required contents in the EIA study as shown below.

- Executive summary
- Policy, legal and administrative framework
- Description of the proposed project
- Description of the environment
- Significant environmental impact
- Analysis of alternatives
- Mitigating management plan
- Monitoring plan
- Inter-agency and public/NGO involvement
- Appendices

(5) Potential impact for irrigation and drainage project

The Egyptian environmental guidelines show the following potential impacts on the proposed project

- Project location
  - Resettlement of people
  - Impact on flora and fauna
  - Impact on historical and cultural sites
  - Effect on water resources outside and inside command area
- Project Design
  - Disruption of hydrology
  - Drainage problems
  - Crossing people and animals

- Construction works
  - Soil erosion
  - Construction spoils (disposal of)
  - Sanitary conditions and health risks
  - Social and cultural conflict between imported workers and local people

- Project operation
  - Changes in groundwater levels inside and outside command area.
  - Changes in surface water quality and risks of eutrophication
  - Incidence of water-borne and water related diseases

3.8.3 Schedule of EIA Procedure

The schedule of EIA and related work are shown as follows:

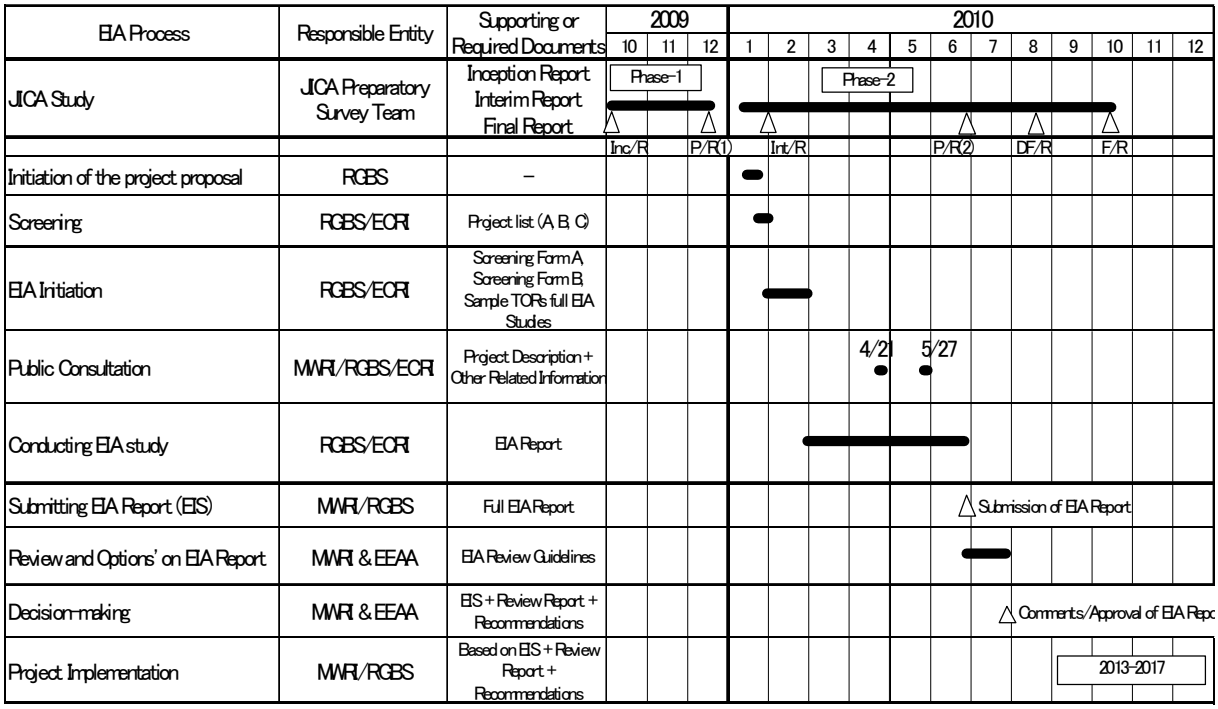


Figure 3.8.2 Schedule of EIA Procedure (Draft)

3.9 Constraints and Opportunities of the Development

3.9.1 Constraints of the Development

(1) Irrigation Water Shortage

The main issue of the Project is defined as securing a stable and sustainable irrigation water supply to the entire beneficiary area under Dirout Group of Regulators through its rehabilitation project. A stable and sustainable irrigation water supply is the most essential factor for the creation of agricultural production and productivity on the field in Egypt where there is no effective rainfall. According to the baseline survey, it was confirmed that the farmers in the beneficiary area have been suffering from irrigation water shortage to such a degree of sometimes affecting the crop yields.

To examine the situation of water shortage in the beneficiary area, an estimation of irrigation water balance in the beneficiary area was carried out based on the present cropping pattern of the beneficiary governorates and water supply to the main canals of Dirout Group of Regulators. Following are the assumptions for the examination, which will be further studied and verified in the course of the Study:

1. Total beneficiary area of the Project was set as the command area of the Dirout Group of Regulators, which is 1,565,100 feddan (657,342 ha). The Data was obtained from MWRI.

2. Table 3.9.1 shows the command areas by governorate. Because the jurisdiction of the irrigation directorate and governorate is not consistent, the command area of Beni Suef is over the cultivated area of the governorate. In any case, the total command area in the four (4) governorates excluding Assuit is 1,410, 560 feddan (592,435 ha), which is within the total cultivated area of the four (4) governorates. The difference of the total command area and the one in the four (4) governorates, namely 154,540 feddan (64,907 ha) is assumed as the command area in the Assuit governorate.

3. The cropped area in each crop season and governorate is based on the cropping intensity obtained from the agricultural statistical data from MALR. The total cropping intensity is estimated at 187%.

4. Based on the cropping pattern formulated in section 3.6 and the monthly water requirement by crop obtained from MWRI, the monthly crop water requirement was estimated.

5. Water supply is estimated as an average of monthly water discharges at Ibrahimia intake for 10 years.

6. Water demand is calculated considering the irrigation efficiency to the crop water requirement. Based on the “Feasibility Study for Rehabilitation and Improvement of Delivery Water System on Bahr Yusef Canal, 1992 (JICA),” present irrigation efficiency was assumed at 60.5%. With these assumptions, water balance at the present condition was examined.

7. Water balance was further examined with the cases of improving irrigation efficiencies at 65% and 75%. “Sustainable Agriculture Development Strategy 2030” by MALR targets to increase irrigation efficiency to 75% by 2017.

Table 3.9.1 Command Area of Dirout Group of Regulators and Cropped Area by Season

Governorate	Cultivated area (fed) (1)	Command Area (fed) (2)	Command Area (%)	Cropped Area (fed) Winter	Summer	Nile	S. berseem	Permanent	Total
Giza	203,358	149,600	98%	112,052	113,696	61,336	7,480	37,400	331,964
Beni Suef	291,386	333,700		270,297	177,195	90,099	26,696	63,069	627,356
Fayoum	422,304	401,900	95%	337,998	232,701	71,940	20,095	64,304	727,038
Minya	530,584	525,360	99%	415,560	393,495	31,522	5,254	110,325	956,156
Total 1	1,447,632	1,410,560	97%	1,135,907	917,087	254,897	59,525	275,098	2,642,514
Assiut	352,728	154,540	44%	122,241	115,750	9,272	1,545	32,454	281,262
Total 2	1,800,360	1,565,100	87%	1,258,148	1,032,837	264,169	61,070	307,552	2,923,776
		Cropping Intensity		80.4%	66.0%	16.9%	3.9%	19.7%	186.8%

(1) Data of cltivated area is for total governorate based on Agrculture Statistics from MALR
(2) Data of command area is from MWRI. Command area of Assiut is obtained as difference of total command are and the command area of other 4 governorates.

Table 3.9.2 and Figure 3.9.1 show the result of the water balance examination. The examination indicates that there is an overall water shortage with around 1 BCM per year and seasonally, there would be water shortage occurring from December to April and June to August. Most especially, the shortage in the summer season is observed to be more severe than in other seasons. As the examination suggests, improving irrigation efficiency will be the major direction to mitigate the overall water shortage.

Table 3.9.2 Estimation of Water Balance in the Command Area of Dirout Group of Regulators

Item		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Crop Water Requirement	MCM	392	466	673	720	512	855	894	832	507	358	322	372	6,904
Water Supply	MCM	281	676	831	849	917	1,148	1,214	1,209	927	827	741	588	10,208
Water demand (ie=0.605)	MCM	647	771	1,112	1,189	846	1,413	1,478	1,375	839	592	533	616	11,411
	Balance	-366	-95	-281	-340	71	-265	-264	-166	88	235	208	-28	-1,203
Water demand (ie=0.65)	MCM	602	717	1,035	1,107	788	1,315	1,376	1,280	781	551	496	573	10,621
	Balance	-321	-41	-204	-258	129	-167	-162	-71	146	276	245	15	-413
Water demand (ie=0.75)	MCM	522	622	897	960	683	1,140	1,193	1,109	676	477	430	497	9,205
	Balance	-241	54	-66	-111	234	8	21	100	251	350	311	91	1,003

ie = irrigation efficiency

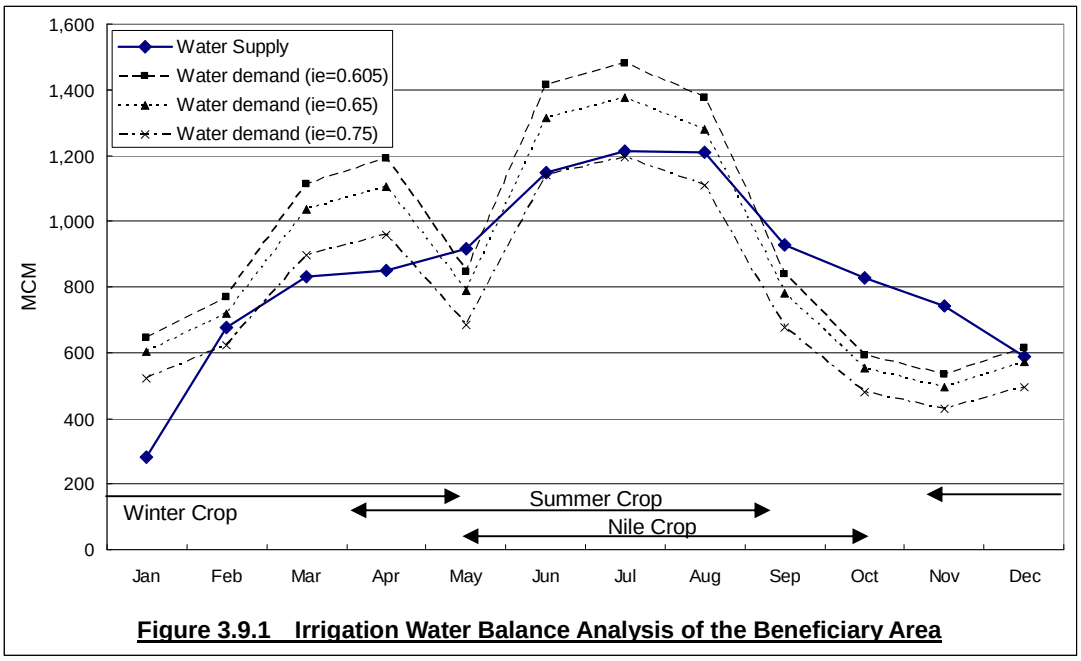


Figure 3.9.1 Irrigation Water Balance Analysis of the Beneficiary Area

Generally in the beneficiary area, the areas located in the upstream reaches are facing water shortage in the terminal area of the branch canals. In the lower part of the irrigation canals, it has been observed that because water does not reach to the terminal canals, farmers themselves dig shallow tube wells to use groundwater for irrigation. On the other hand, the downstream reaches, e.g. in the Fayum area,

receive relatively better delivery of irrigation water under the condition of the gravity irrigation method. The reasons can be pointed out based on various factors as discussed in the following (2) to (4).

Under the constraint of the limited surface water resources of 55.5 billion m^3, development of new surface water resources would not be possible. To make a new development plan of available water resources, the Integrated Water Resources Management (IWRM) approach is an essential concept for future horizontal and vertical expansion of the agricultural and irrigation sectors.

(2) Aged Major Infrastructures for Irrigation

Dirout Group of Regulators has an annual discharge volume of around 9.6 billion m^3 through the Ibrahimia Main Canal as mentioned earlier. Total cultivated areas in 2006 are measured at 8,410,986 feddan (3,532,600 ha). Available water volume is 17% of 55.5 billion m^3 which is fixed by International Agreement between Sudan, and the cultivated area is 17% of around 3,500,000 ha. From the viewpoint of distributing the 55.5BCM into allover the country, it indicates that the irrigation service area (17% of the total land) is equivalent to the available water supply (17% of total supply), hence the water shortage in Upper Egypt does not come from disproportion of water distribution at national level but from the limitation of available water resources of the whole country. Therefore, the realization of the integrated water resource management advocated by MWRI is considered as one of the most important issues.

To meet the requirement for the fields and supply volume through regulators and canals, major irrigation infrastructures should be improved to reply on just time and accuracy. According to the present situation between the project area and available irrigation water, it is necessary to make another horizontal expansion and vertical expansion which require much more additional irrigation water to fields for the increase of the agricultural production. It seems to be difficult based on the

present fixed condition. It is one of main issues to be solved in this preparatory survey study.

From the above-mentioned aspect, Dirout Group of Regulators which is beginning an entire irrigation system of the Project, has aged facilities, deteriorated structures and has no easy functioning equipment of the gates installed. This means that Dirout Group of Regulators cannot meet the requirement rationally and accurately from the seven canals which are located downstream from the regulators. Moreover, the control method of distribution of irrigation water through the gates of the regulators is done by the water level controlled method at downstream side (even though the aged structures have been rehabilitated, it is observed that the direct discharge control method has not been fully practiced but the indirect discharge control method with the water level at downstream side are still being practiced albeit the rehabilitated regulators have been equipped with the gates which can enable the direct discharge control method). To improve the traditional method to meet the latest requirements, not only Dirout Group of Regulators but also major infrastructures located along seven main canals are required to be rehabilitated and improved.

(3) Lack of Integrated Water Management System

Under limited available water resources, to meet the rational utilization of irrigation water, the following efforts shall be introduced for the project.

- To grasp the accurate water requirement volume on the basis of a real cropping pattern.
- To grasp the water demand on the basis of actual cultivated areas accurately.
- To supply irrigation water accurately in real time through the canal systems.
- To intake required irrigation water through minor structures.
- To establish the fair water distribution system under the sharing of the basic concept.
- To introduce the sharing of the limited water resources through collaboration.
- To introduce of latest water management system with new technology.

According to the result of hearing from decision-makers and planners, the annual water distribution plan is fixed for more than five years. Farmers are changing crops based on their own judgment sometimes. To meet the water supply with actual water demand on time, a flexible water distribution method shall be developed for the project which can be reflected by the present cultivated area and present cropping pattern.

The implementation plan of rehabilitation and improvement of major facilities is done steadily year by year. Minor structures are still left in a wide beneficiary area without rehabilitation. To realize the effectiveness of the rehabilitation project entirely through the area, not only rehabilitation of major facilities but also minor structures shall be maintained to meet original functions. At the same time, the latest water management system shall be developed

(4) Deterioration of Minor Structures

There are two thousand to three thousand numbers of minor structures in the beneficiary area of the Project, with the actual number of minor structures having never been surveyed. This is one of the constraints for the making of the rehabilitation plan of these structures. To assess the appropriateness of the selected priority minor structures, standardized criteria should be applied for the selection of priority minor structures. At the commencement of the field survey, a summarized table of selected minor structures was not made based on the same criteria for a field survey in the three Governorates. Lack of standardized criteria is also one of constraints.

Moreover, major irrigation facilities such as regulators and main canals are rehabilitated by the annual budget of the MWRI, but minor structures are rehabilitated by the annual budget of the regional directorates individually. Accordingly, the implementation plan of rehabilitation of minor structures is done within the limited amount of annual budgets. To make clear the effectiveness through the Project, under the above-mentioned constraints, giving priority on the plan, which will be expected to make contributions for the Project, is proper judgment. For implementation of the fair selection of the priority structures, reaching consensus with the related regional directorate office is based on the same criteria.

3.9.2 Opportunities of the Development

(1) Positive Policy of the Government of Egypt concerning Developing Upper Egypt

According to the Sixth Five-Year Plan, the Government of Egypt expressed to allocate 42% of its local public investments to fostering development in the Upper Egypt governorates as part of the national project for the region's development. It is a strong intention of the Government of Egypt to assist the activities done by regional governorates. For the reduction of regional disparity between urban areas and rural areas in the country, strong leadership of intentional execution of the policy of Government should be promoted. According to the 2008 EGYPT Human Development Report (UNDP), 762 villages of the poorest 1,000 are located in the Minya, Suhag,and Assuit Governorates whereas 59 villages out of the poorest 1,000 belong to Suhag alone.

To realize an increase of the living standard level in the Upper Egypt Region, the agricultural sector and the irrigation sector should be invested by a public fund, which is a major sector of the labor structure of 56% (except the Giza Governorate). Especially, for income creation, agricultural production should be created by an improved irrigation system with the latest water management system. Rehabilitation of existing irrigation facilities should be implemented with an intentional plan using an allocation of the budget. The policy of the Government of Egypt meets the above-mentioned requirement of the agricultural sector and irrigation sector.

(2) Steady Improvement of the Major Irrigation Infrastructures along the Main Canals

The Major Irrigation Infrastructures, which are located along seven parts of the main canal, have been rehabilitated based on the implementation plan made by the MWRI. Especially, four numbers of the Regulators located along the Bahr Yusef Irrigation Canal have been rehabilitated by a grant aid scheme of the Government of Japan individually since 1995 at Lahoun Regulator by request of the Government of Egypt. This effort has been continued until now by the Government, just as rehabilitation of regulators along the Ibrahimia irrigation canal, which were done by USAID. To follow the fundamental policy of the MWRI, mentioned in the National Water Resources Plan 2017, before everything else, Major Irrigation Infrastructures like Dirout Group of Regulators should be rehabilitated for rational utilization and distribution of limited water resources in the country.

From the above-mentioned aspect, in near future with respect to the project for rehabilitation of Dirout Group of Regulators, there are no obstructions to impede the decision for execution of an integrated rehabilitation project with implementation and technical cooperation. It would be expected to introduce the foreign assistance with funds similar to those used for the past projects of the Ethna Barrage and the Nagaa Hamady Barrage.

CHAPTER 4

PLAN FOR THE PROJECT

CHAPTER 4: PLAN FOR THE PROJECT

4.1 Goal of the Project and Basic Policies of Making the Implementation Plan

4.1.1 Goal of the Project

(1) Consistency with the upper level plan

While making the goal for the project, the pre-condition was defined as such that the goal should be kept consistent with the sixth national development plan as the upper level plan.

The government of Egypt has stated already in chapter one (1), as mentioned already in "2.2.3 National Sixth Five-Year Plan", the strategies and goals of the development as follows:

- Raising income and living standard
- Improving the quality of life
- Realizing a qualitative leap in education and providing a comprehensive health insurance coverage
- Developing abilities and productive capabilities, training and habilitation.
- Preserving the cultural identity and confirming the national belonging.

Especially, the aims of raising the income and living standard are situated as the most important goals of the national plan. The rehabilitation and improvement of the Dirout Group of Regulators (DGR) meet the strategy and goal of the government as above-mentioned. The project can be judged to contribute to the beneficiaries of the project directly by increasing the agricultural production and raising income through the rehabilitation of the DGR of basic irrigation infrastructure with a stable supply of the irrigation water to 1,565,100 feddan of the beneficiary area.

(2) Goal of the project

The goal of the project is defined as follows:

1. Restoration of the required function of irrigation water distribution by the rehabilitation of the DGR.

2. Establishment of the Integrated Water Management System on the seven (7) main canals and its major intake facilities. The system can be supported as a function of the rational water distribution of the DGR.

3. Making the judgment of appropriateness on implementing the project of the rehabilitation of the selected minor structures, through the analysis and assessment of the selected minor structures of 128, regarding the possibility of the contribution to the project of the rehabilitation and improvement of DGR, with creation of the benefit.

The first priority of the goal of the project is defined as the restoration of the required function of irrigation water distribution by the rehabilitation of the existing five (5) regulators which are aged at 140 years since being constructed and are marked as over-aged structures. The function of water distribution with high accuracy and fixed rate of distribution can be realized in the seven (7) main canals through five rehabilitated regulators restored to their required function. The improvement of the irrigation infrastructures on the entire beneficiary area of 600,000 ha with stable supply irrigation water through the year from the beginning point of DGR to the main canal, branch canals, minor structures, mesqas, etc. are realized by implementation of the project.

As a result of the project implementation, improvement of the farming activities, which were affected by unstable water distribution before, result in stable agricultural production and increased production. This means that the project contributes to raising income and living standard directly. Also it can contribute to reduction of the poverty ratio of the beneficiary areas where there exists one of the highest ratios of poverty in the country.

It goes without saying that creating the benefit of the project requires improvement of the irrigation infrastructures first. At the same time, the integrated water management system to control the entire major irrigation infrastructures, which consist of the intake facilities situated along main canals of seven (7), branch canals and major infrastructures situated along branch canals, is essential.

The present water management procedure is carried out at each regulator by control of the downstream water level individually with gate operation. For achievement of the goal of the project, establishment of the integrated water management system should be situated as a second priority subject, based on the understanding that the upstream water level control method is the essential method.

Furthermore, the presence of the minor structures, which are located in the beneficiary area and are left in the area without rehabilitation works, despite the necessity of the rehabilitation works, shall be considered as a possibility that those affect creation of the benefit through the project implementation of the rehabilitation of the DGR and the establishment of the integrated water management system. If it is clear that the minor structures affect the creation of the benefit of the project, the rehabilitation of the selected minor structures should be taken into the project components.

Through the implementation of the three project components mentioned above, high accuracy and stable irrigation water distribution shall be realized.

4.1.2 Basic Policy of Making the Project Implementation Plan

The preparatory survey for the rehabilitation and improvement of the DGR has the following objectives.

- To recover the original function of water distribution of the DGR.
- To realize supplying of stable and sustainable irrigation water to a magnificent beneficiary area of 1,500,000 feddan located along middle Nile Basin in the Upper Egypt Region.
- To make clear the process of creating the benefit through realizing more stability of agricultural activities by farmers can result in greater agricultural production and a raising of income.

Furthermore, the feasibility of the project implementation should be judged trough project evaluation by economic analysis.

Therefore, to make clear the mechanism of the creation of the project benefit, the following items should be considered, essential conditions to accelerate project implementation:

(a) The function of the water distribution is defined as first priority with sustainability of the structure. The alternative study regarding rehabilitation of the existing regulator and new construction of the regulators should be studied comprehensively based on the function, stability, economics and social environment for making the best solution of an appropriate plan.

(b) The appropriate plan of establishment of the Integrated Water Management System should be proposed to mitigate and dissolve the water shortage in the beneficiary area through the monitoring system of the water management regarding the major intake facilities located on the seven (7) main canals and 38 of the branch canals by introducing the supporting system of making a policy of the water distribution at the water management center (tentative name) to keep the expediency, quickness and high accuracy, adding the function of management and analysis to the varied information simultaneously.

(c) The preparatory survey team shall judge the possibility of the effectiveness of the rehabilitation of the minor structures of 128 which were selected by the MWRI, based on the ratio of the contribution to the creation of the project benefit. After judgment, the benefit created through the rehabilitation of the selected minor structures should be estimated. The suitability of the rehabilitation works should be judged based on the conclusion of the analysis of the contribution of the rehabilitation plan.

4-2 Formulation of Dirout Group Regulators (DGR)

4.2.1 Examination of the layout of the new DGR

Fig 4.2.1 Location of the DGR and main canal

The DGR has is made up of seven (7) canals that originate from the Ibrahimia canal and distribute the irrigation water to each canal. Therefore the location of the new DGR should be selected at a proper point to connect to the existing canal. If the new DGR is located away from the existing canal, new canals would be needed. Furthermore, the line of new canals would be shaped in a great curve in order to connect the existing canals. To buy up a grand area causes a loss in the hydrological energy. Therefore to construct the new DGR away from the existing canal is an unsuitableness alternative.

Accordingly, the suitable layout for the new DGR would be at same location as the existing DGR, or at upstream near the existing DGR, or at downstream near or far from the existing DGR.

On the condition of the above, additionally, the suitable layout of the new DGR will be examined, taking into consideration the detailed condition of the site surrounding the DGR and the ease of the distribution water. The examination will be done in two steps as follows, so that the process of the selection layout is clear.

1st step: Rough examination of the layout from the broader standpoint

2nd step: Detailed examination of the layout for the broader standpoint

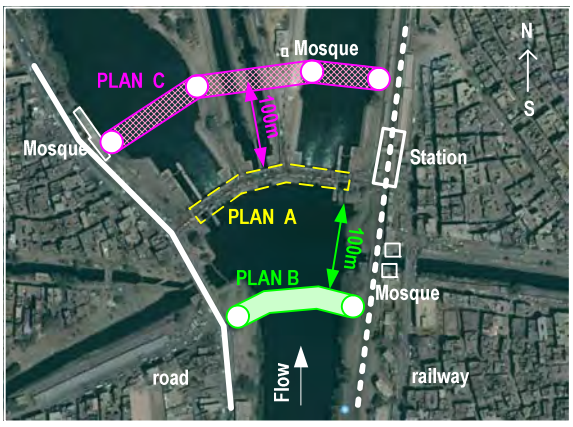


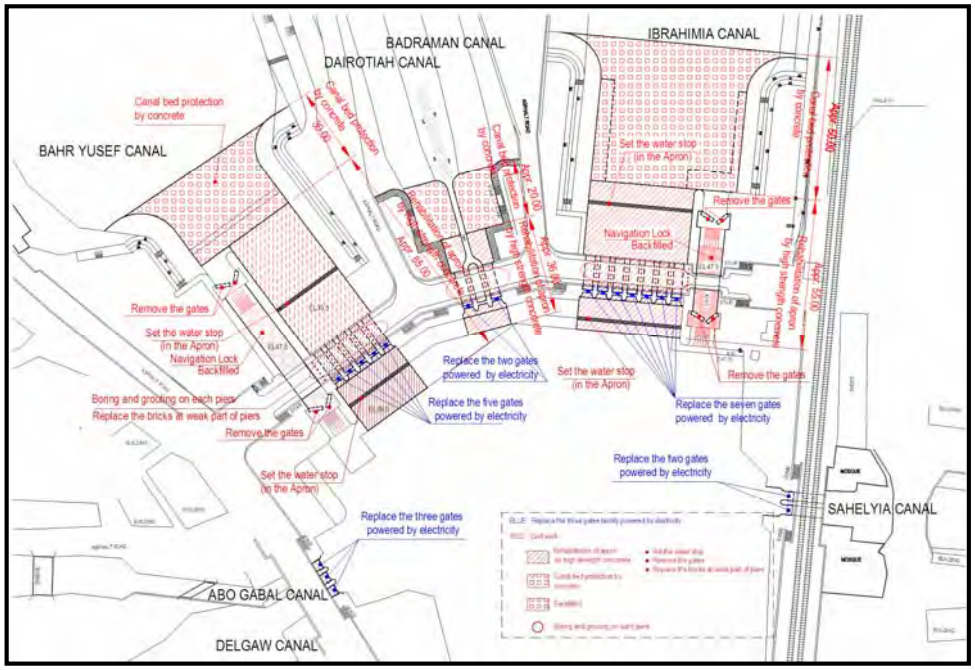
Fig 4.2.2 Shame of the layout DGR

(1) Rough examination of the layout from the broader standpoint—1st Step

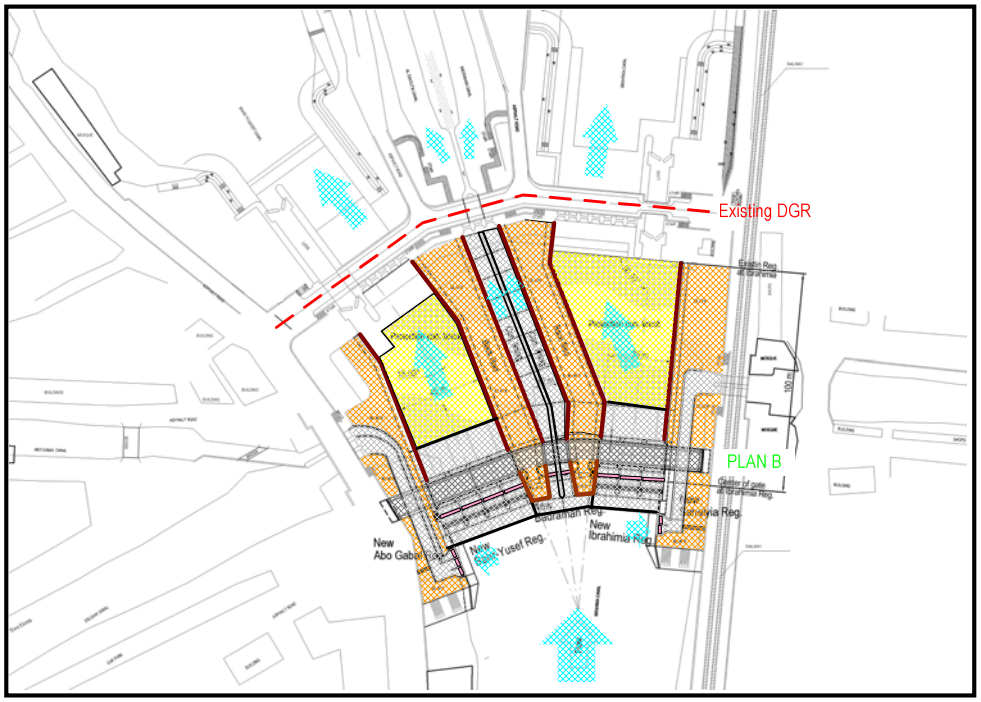
a) Selection of the scheme layout for the comparison

Herein, the examination will be from the broader standpoint and a decision will be made regarding the proper layout roughly, where three (3) alternative will be considered, at upstream, at downstream, or at the existing DGR. The advantages and disadvantages will be shown on the comparison table, and the proper scheme of the layout will be made clear.

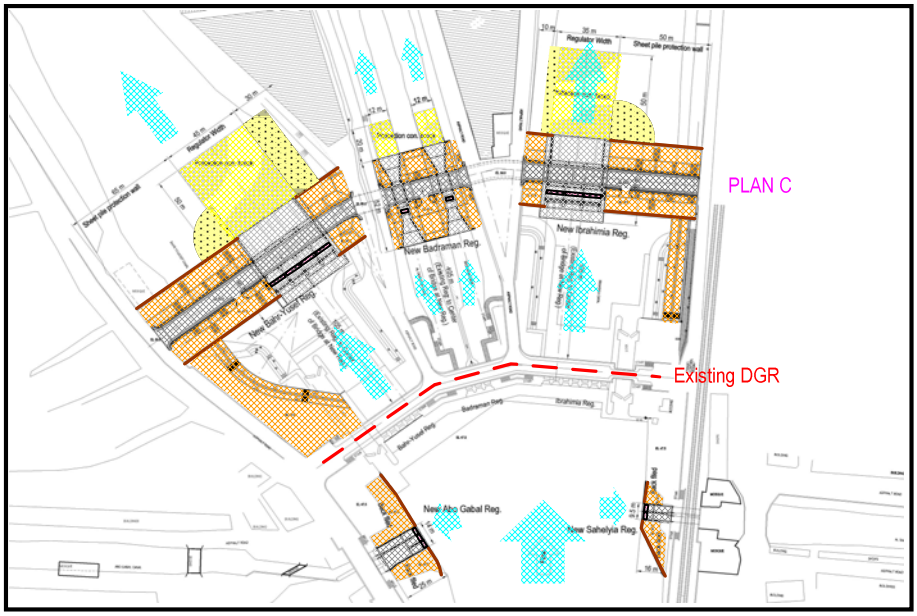
Plan A: Rehabilitation of the existing DGR



Plan B: Layout at upstream



Plan C: Layout at downstream



b) Conclusion of the rough examination of the layout

According to the comparison table shown as follow, the rough layout of the new DGR is selected downstream as "Plan C". Additionally, the policy of the new construction at downstream was accepted by the steering committee on 18 February 2010.

The outline of the outline of each layout will be shown as follows:

Plan A: Rehabilitation of the existing DGR

○ Even though the existing DGR will be rehabilitated, it would not be expected to reinforce the strength of the brick which would be getting weak, also it is difficult to manage the affected water operation. Therefore it cannot be used for the future.

Plan B: Layout at upstream

○ A temporary coffer dam in this plan would be taken into consideration to divert all water on the canal; also it would be detrimental to make the construction yard on the canal. Therefore the construction yard would be separated by a small area, which means the temporary coffer dam needs to be set up several times.

○ Additionally, even if the construction at upstream will be done, the existing DGR would be damaged by the high velocity flow, due to the existing DGR located at downstream of the new DGR. Therefore, the suitable condition for the preservation of the existing DGR as a historical monument will be taken into consideration.

Plan C: Layout at downstream (Adoption)

● This plan takes advantage of having a smaller effect to the existing DGR as well as having the benefit of easier construction, meaning that the temporary coffer dam would be planned on the condition of requiring a smaller volume of diverted water than Plan: B, and it would have enough space for the construction yard.

● After the construction at downstream, the existing DGR is located in the range of the pond area made by the new DGR. Therefore the existing DGR has few effects by the flow of water, and it is expected to improve the preservation of the existing DGR as a historical monument.

Advantages and Disadvantages of Scheme Layouts of DGR (1/3)

Item	PLAN: A	PLAN: B	PLAN: C
Outline	Plan A is to use the existing DGR by repairing the damaged part and defect of the facilities. Items of Repair are as follows: ・ Strengthening of foundation and regulator body by grouting. ・ Replacement of weakened bricks ・ Casting high strength concrete on the surface of the aprons of Bahr Yusef and Ibrahimia Regulators (preventing scouring) ・ Install water stop at the connection of the aprons (preventing uplift) ・ Canal bed protection: laying blocks on the canal bed right downstream side of the aprons (preventing scouring) ・ Electrification of all the gates	Plan B is to construct new regulators at around 100m on the upstream side of the existing DGR and all the regulators are put together. All the gates of the existing DGR are removed and water flow is regulated by the new regulators. The following is the outline of the new regulators: ・Bahr Yusef : gate width 8m ×4 gates ・Ibrahimia : gate width 8m ×3 gates ・Badraman : gate width 4m ×2 gates ・Abo Gabal : gate width 4m ×2 gates ・Sahelyia : gate width 4m ×1 gate	Plan C is to construct new regulators at around 105m on the downstream side of the existing DGR. Among the regulators, Abo Gabal at the left bank and Sahelyia at the right bank are constructed at the front side (inside the Ibrahimia canal) of the existing regulators in order to alleviate the sedimentation problem. ・Bahr Yusef : gate width 8m ×4 gates ・Ibrahimia : gate width 8m ×3 gates ・Badraman : gate width 4m ×2 gates ・Abo Gabal : gate width 4m ×2 gates ・Sahelyia : gate width 4m ×1 gate
Hydraulic performance	As the new canal bed protection enables adequate energy dissipation, scouring of canal bed will be alleviated. There is no efficiency improvement of water distribution because there is no change in the width and number of the gates. Therefore, Plan A cannot solve the issue of the imbalance situation, namely the number of gates in Bahr Yusef is less than Ibrahimia, although the discharge of Bahr Yusef is larger than Ibrahimia. **Point : 1**	The width and number of gates in each regulator are designed according to the required hydraulic capacity for each canal, i.e. the size of each regulator is balanced with the required hydraulic capacity of each canal. With this plan, the imbalance of the structure size and discharge between Ibrahimia and Bahr Yusef will be solved. Shifting the location of Abo Gabal and Sahelyia to the upstream side will alleviate the sedimentation. However, since the new regulators are constructed right at the upstream side of the existing DGR, there is a concern about the effects of discharge from the new regulators to the existing DGR. **Point : 2**	The width and number of gates in each regulator are designed according to the required hydraulic capacity for each canal, i.e. the size of each regulator is balanced with the required hydraulic capacity of each canal. With this plan, the imbalance of the structure size and discharge between Ibrahimia and Bahr Yusef will be solved. Shifting the location of Abo Gabal and Sahelyia to the front will alleviate the sedimentation. **Point : 3**

Advantage and Disadvantage of Scheme Layouts of DGR (2/3)

Item	PLAN: A	PLAN: B	PLAN: C
Stability of Structure	It is estimated that the remaining duration of the existing DGR will be 30 to 35 years based on the analysis on the degradation of the strength of bricks of DGR. Although reinforcement by grouting is planned, it would be difficult to perfectly recover the strength of the structures due to uncertainty on the degree of filling grouting material. Furthermore, because the foundations of the Bahr Yusef, Ibrahimia and Badraman regulators are permeable, there is a fear that the grouting material could be washed out. Therefore, it is difficult to improve the existing foundation to be a permanent bearing ground. **Point : 1**	Since it is a new construction, there will be no problem in the stability of the structures. Also because all the gates in the existing DGR are removed, effects such as uplift caused by the existing gates will disappear. Therefore the adverse environment of the new location will be alleviated. **Point : 3**	Same as Plan B **Point : 3**
Ease of Construction	To secure the space for construction, water flow with 7m-depth has to be stopped. It is difficult to install sheet piles on the existing aprons for dry-work. Therefore, the canal has to be completely cut off during the construction. Necessary duration of the cut-off would be around 3 months. **Point : 1**	Since the new regulators are constructed at the upstream side of the existing DGR, feeder canals from new regulators to the existing DGR are required. To construct feeder canals, complicated temporary diversion will be required. **Point : 1**	There will be sufficient construction space. Therefore, the construction will be easily worked out by closing half of the canal, and the flow can be kept even during the construction period. **Point : 3**
Operation and maintenance	Transferring the manual operation of the gates to electrified operation reduces labor force. However, the existing three-leaf gate makes the operation complicated. Therefore, it is difficult to realize the appropriate water distribution. In case of applying a remote operation system in future, it is difficult to control 19 gates by remote. **Point : 1**	Since the facility is modernized and electrified, the operation of the gates will be upgraded, so that the appropriate water distribution can be easily accomplished. **Point : 3**	Same as Plan B **Point : 3**

Advantages and Disadvantages of Scheme Layouts of DGR (3/3)

Item	PLAN: A	PLAN: B	PLAN: C
Heritage and view	In case of electrifying the existing gates, installation of switching devices on the existing structures will damage the landscape of DGR. **Point : + 1**	It will not change the structure (appearance) of DGR. However, because the new regulators are constructed at the upstream side and feeder canals are constructed from the new regulators to the existing DGR, the landscape of the upstream side of DGR will drastically change. Also the discharge from the new regulators to the existing DGR might affect the stability of the existing DGR. **Point : + 1**	It will not change the structure (appearance) of DGR. However, because the new regulators are constructed at the downstream side, the view of the downstream side of the existing DGR will change. There will be no hydraulic effects to the existing DGR. **Point : + 2**
Environment	There will be no land acquisition or removal of housing. **Point : + 3**	There will be no land acquisition or removal of housing. Also, the hydro-power plant and navigation lock set on the regulators might require land acquisition **Point : + 2**	There is a mosque at the left bank of Bahr Yusef. This mosque will need to be moved during construction work. **Point : + 1**
Comprehen-sive Evaluation	**Total Point : 8** **Not Good** It is difficult to realize appropriate water distribution with the existing DGR. It is judged that the functional capability of the existing DGR is not sufficient considering the future use. Also the reinforcement and repair of the existing DGR is not easy and its effects are uncertain.	**Total Point : 12** **Not Good** Appropriate water distribution will be realized with this plan and the working life of the new regulators would be around 100 years. However, temporary diversion work would be complicated and the landscape of the upstream side of the existing DGR will drastically change due to construction of the new regulators and feeder canals.	**Total Point : 15** **Very Good** Appropriate water distribution will be realized with this plan and the working life of the new regulators would be around 100 years. Construction work will also be easier than other alternatives. (Adoption)

Option

Item	PLAN: A	PLAN: B	PLAN: C
Navigation lock	Existing navigation locks can be used, but the gates have to be renewed. **Point : + 3**	It may require expanding the width of the canal towards the main roads on both banks and the railway on the right bank in order to acquire the space for navigation. **Point : + 1**	It needs to construct new navigation locks but without land acquisition. **Point : + 2**

(2) Detailed examination of the layout for the broader standpoint — 2nd Step

a) Selection the scheme layout for comparison

In a detailed examination, the scheme layouts will be selected, taking into consideration the following:

- To secure enough space for the construction yard with attention to the condition of site
- To ensure easy maintenance and the possibility of working effectively as a water distribution facility
- To have few effects to the existing DGR by the construction of new DGR
- To select locations for the Sahelyia and Abo Gabal regulators so that the issue of the sedimentation can be solved

b) Measures for the sedimentation on Sahelyia and Abo Gabal regulators

As for the Sahelyia and Abo Gabal regulators, the new location of these regulators should be located in front of their respective existing regulators so as to avoid the effect of sedimentation. It is reasonable enough to make the decision of locating them in front of each of the existing regulators based on the following:

- As for the reason of the sedimentation around these regulators, the current location is at a corner from the main flow.
- To solve this issue, the location of these regulators should be closed to the main flow. This means that they should be relocated to the front of the each existing regulator.
- Additionally, the place of relocation is not designated as a strict area
- By contrast, even though the relocation is behind the existing regulators, the issue of sedimentation cannot be solved.

Therefore the new layout of the Sahelyia and Abo Gabal regulators are the same layout in comparison with each scheme.

Accordingly, with considering the above mentioned, the comparison will be examined among three (3) schemes as follows:

Plan C-1: This layout is at approximately 100m downstream from the existing DGR, provided that the new layout of Sahelyia and Abo Gabal is in front of each existing regulators

Plan C-2: This layout is at approximately 140m downstream from the existing DGR, provided that the new layout of Sahelyia and Abo Gabal is in front of each existing regulators

Plan C-3: The new layouts of the Bahr Yusef and Badraman regulators are at approximately 600m downstream from the existing DGR. And the new layout of the Ibrahimia regulator is at approximately 1,000m, provided that the new layouts of Sahelyia and Abo Gabal are in front of each existing regulator.

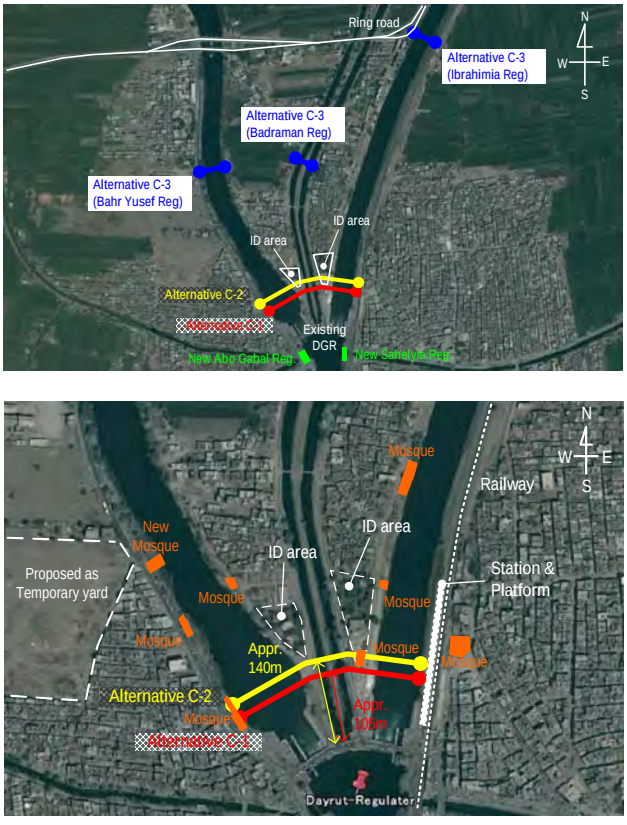


Fig 4.2.3 Scheme detail layout of the DGR

b) Conclusion of the detailed examination of the layout

According to the comparison table shown as follows, the detailed layout of the new DGR is selected at approximately 140m downstream from the existing DGR "Plan C-2". Additionally, the policy of the new construction at 140m downstream for the existing DGR was accepted by the technical committee on 30 March 2010.

The outline of each layout will be shown as follows:

Plan C-1: at Appr.100m downstream from the existing DGR

- ● This plan has an advantage of proper distribution function as integrated regulator as well as stability of the structure and the ease of the construction.
- ○ However the temporary coffer dam touches the existing DGR, so the apron and navigation lock on the existing DGR need to be partially demolished.

Plan C-2: at Appr.140m downstream from the existing DGR (Adoption)

- ● This plan has an advantage of the same items listed in Plan: C-1
- ● Additionally, in this plan the temporary coffer dam does not touch the existing DGR, which means that it follows the intention of preserving the existing DGR as a historical monument.

Plan C-3: Layout at downstream

- ● Further from the 140m at downstream, the suitable place is at 600m ~1,000m downstream for the existing DGR so as to avoid the densely populated area
- ○ The maintenance bridge on each regulator is not continuous. Therefore it takes extra time to reach each regulator, so it is difficult to do the maintenance.
- ○ The operating of each gate could be a cause of instability in operating the water level, because the effects of the gates' operation where the gates are located apart from each other individually will cause the gates to interfere with each other, resulting in a time-lag.
- ○ Additionally, there is the geographic feature which is the low elevation ahead of 140m downstream. Therefore it needs the embankment from the new location of the DGR to the existing DGR against the raising of the water level, due to the expansion of the range of the pond area. This would cost much and would greatly affect the area surrounding the site.

Advantages and Disadvantages of Scheme Layouts Downstream of DGR (1/2)

Item	PLAN: C-1	PLAN: C-2	PLAN: C-3
Outline	Plan C-1 is to construct new regulators at around 100m on the downstream side of the existing DGR, provided Abo Gabal and Sahelyia are constructed at the front side of the existing regulators in order to alleviate a sedimentation problem. The following is an outline of the new regulators: ・Bahr Yusef : gate width 8m ×4 gates ・Ibrahimia : gate width 8m ×3 gates ・Badraman : gate width 4m ×2 gates ・Abo Gabal : gate width 4m ×2 gates ・Sahelyia : gate width 4m ×1 gate	Plan C-2 is to construct new regulators at around 140m on the downstream side of the existing DGR, provided Abo Gabal and Sahelyia are constructed on the front side of the existing regulators in order to alleviate the sedimentation problem. The following is an outline of the new regulators: ・Bahr Yusef : gate width 8m ×4 gates ・Ibrahimia : gate width 8m ×3 gates ・Badraman : gate width 4m ×2 gates ・Abo Gabal : gate width 4m ×2 gates ・Sahelyia : gate width 4m ×1 gate	Plan C-3 is to construct new regulators downstream, thus apart from the existing DGR, provided Abo Gabal and Sahelyia are constructed at the front side of the existing regulators in order to alleviate the sedimentation problem. The following is an outline of the new regulators: ・Bahr Yusef : gate width 8m ×4 gates ・Ibrahimia : gate width 8m ×3 gates ・Badraman : gate width 4m ×2 gates ・Abo Gabal : gate width 4m ×2 gates ・Sahelyia : gate width 4m ×1 gate
Hydraulic performance	The width and number of gates in each regulator are designed according to the required hydraulic capacity for each canal, and the size of each regulator is balanced with the required hydraulic capacity of each canal. With this plan, the imbalance of the structure size and discharge between Ibrahimia and Bahr Yusef will be solved. Shifting the location of Abo Gabal and Sahelyia to the front will alleviate the sedimentation. **Point : +3**	Same as Plan: C-1 **Point : +3**	Same as Plan: C-1 **Point : +3**
Stability of Structure	Since it is a new construction, there will be no problem in the stability of the structures. **Point : +3**	Same as Plan: C-1 **Point : +3**	Same as PlanC-1 **Point : +3**
Ease of Construction	The construction works is on the condition of the heavy traffic although it is possible to plan the suitable temporary coffer dam by using the double-sheet pile or single-sheet pile method. Since the construction site is well-organized, it is easy to transport the materials and machinery onto the site. Therefore it can be an effective plan. **Point : +3**	Same as Plan: C-1 **Point : +3**	The construction works are not under strict conditions. However, since the sites of construction are apart from each other, it is difficult to transport the materials effectively. It need several stock yards. **Point : +1**

Advantages and Disadvantages of Scheme Layouts of DGR (2/2)

Item	PLAN: C-1	PLAN : C-2	PLAN : C-3
Operation and maintenance	Since the maintenance bridge on each regulator is continuous, it is easy to move from the Bahr Yusef to the Ibrahimia regulator. The location of the new DGR gates are close to each other, so the effects of the gates' operation do not interfere with each other. **Point : +3**	Same as Plan: C-1 **Point : +3**	The maintenance bridge on each regulator is not continuous. Therefore, it takes extra time to reach each regulator, so it is difficult to do the maintenance. The locations of the new DGR gates are apart from each other, so the effects of the gates' operation do not interfere with each other to cause a time-lag. **Point : +1**
Heritage and view	Since the new DGR is constructed downstream, it will change the view from downstream. Additionally, the temporary coffer dam is close to the existing DGR, so it needs to be partially demolished. **Point : + 1**	Since the new DGR is constructed downstream, it will change the view from downstream. The temporary coffer dam does not touch the existing DGR, so it does not need to be demolished. **Point : + 2**	Since the new DGR is constructed far downstream, the view of the existing DGR will not be affected. **Point : + 3**
Environment & Social	There will be no land acquisition. The mosque located downstream on Bahr Yusef needs to be relocated, and it would be possible for the relocation. (RGBS has experienced the relocation of the mosque on another project). **Point : + 3**	Same as Plan: C-1 **Point : + 3**	There is the geographic feature requiring the lowering of the elevation ahead of 140m downstream. Therefore, it needs the embankment from the new location of the DGR to the existing DGR against the rising of the water level. It might require land acquisition or transfer of residence. **Point : + 1**
Construction Cost	Since the structure and size of the regulator is the same as Plan:C-2, the construction cost is almost the same. However this plan requires the partial demolition at the existing DGR, but it does not require significant cost, so this work does not need to be evaluated. **Point : + 3**	Since the structure and size of the regulator is the same as Plan:C-1, the construction cost is almost the same. **Point : + 3**	The structure and size of the regulator is the same as Plan:C-1 and C-2 although the location of each regulator is at a different place. Therefore, the construction work is not effective. Additionally, this plan needs the embankment along the canal due to the effect of the rising water level. Accordingly, the construction cost is costly compared with the schemes. **Point : + 1**
Comprehensive Evaluation	**Total Point : 19** **Good** This plan can be expected to provide proper distribution which is a required function of the new DGR, and the maintenance is easy. However in the construction, it needs to be partially demolished, so it difficult to preserve the existing DGR as a historical monument. Furthermore it requires the relocation of the mosque.	**Total Point : 20** **Very Good** This plan can be expected to provide proper distribution which is a required function of the new DGR, and the maintenance is easy. It requires the relocation of the mosque. (Adoption)	**Total Point : 13** **Not Good** Since the sites of construction are apart from each other, the effects of the gates' operation do not interfere with each other to result in a time-lag. It needs the embankment from the new location of DGR to the existing DGR against the raising up of the water level. It might require land acquisition or transfer of residence.

4.2.2 Plan of New Construction of Dirout Group of Regulators

(1) Basic Design Policy

The Dirout Group of Regulators is a large-scale diversion regulator consisting of five (5) sub-regulators and seven (7) canals. The diversion regulator should enable appropriate distribution of water into each canal. The ability of the regulator is greatly affected by the function of gates installed at each intake of the canal and their operation, i.e. selection of appropriate gate type, is an essential element to realize the full function of the regulator.

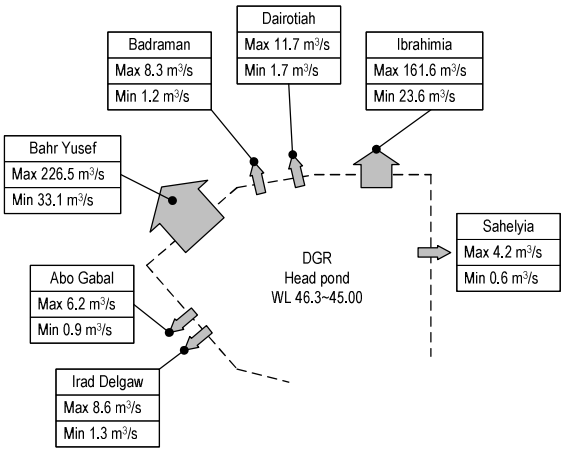


Figure 4.2.4 Diversion of DGR (Layout)

In general the diversion regulator is operated to maintain the water level on the upper side of the gates by subtle control of the gate, so as to enable appropriate diversion of water. The existing DGR is operated based on such a general concept. Moreover, the DGR has a duty to distribute different discharges into seven (7) canals. Therefore, it is recommended for the new DGR to select an over-flow type of gate, which makes it possible to control minuscule discharge without affecting the discharges to the seven (7) canals from one to another. An over-flow type gate means to make water discharge over the gate.

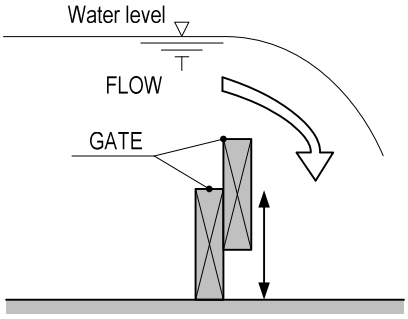


Figure 4.2.5 Discharge by Over-flow Type Gate

Because there is no need to consider the effects of flooding in Egypt, it is possible to design the cross-sectional area of flow on the condition that the discharge should be controlled by over-flow throughout the year, unlike the case in Japan, in which the cross-sectional area of flow is designed with the gates fully opened in order to safely discharge the maximum flow during the flood period.

For the proposed new DGR, it is possible to introduce a mechanical gate with a longer width considering the facility modernization and intending to save the cost of earth work. In this case, discharge per gate will increase. The proposed gate ought to function making full use of the merits of a longer-width-gate in order to very accurately control a large amount of discharge. Furthermore, the canal beds at the location of the new DGR are formed from fine sand and silt and therefore, it is required to design the gate type so as to avoid high velocity discharge, occurring when the water level is low at the downstream side of the gate, to prevent the canal beds from scouring on the spot.

It is expected that the over-flow type of gate is suitable to mitigate the above issues: because the discharge per degree of gate openness is so moderate that it is easy to adjust the amount of discharge to the planned discharge, and the over-flow type makes the flow as a waterfall so that it can reduce the velocity. In conclusion, it is proposed for the new DGR to introduce an over-flow type gate to control all the discharge by the over-flow method. However, it is proposed that the over-flow type gate is to be introduced only to the Bahr Yusef and Ibrahimia canals. Because their discharges occupy 90% of the total discharge of the all seven (7) canals, the stability of the reservoir of the DGR can be sufficiently secured with such a design.

The following table shows the basic design conditions of the new DGR. For the present situation, there is no plan to revise or increase the discharge into the DGR or into each canal, and the objective of the Project is to recover the function of the facility and improve the present water management. Therefore, the basic conditions are followed in the existing DGR.

Table 4.2.1 Basic Design Conditions of the New DGR

Name of Regulator		Max. W.L. Upstream	Min. W.L. Downstream	Max. Discharge	Min. Discharge
Bahr Yusef		EL46.30m	EL43.00m	226.5 m^3/s	33.1 m^3/s
Ibrahimia		EL46.30m	EL43.00m	161.6 m^3/s	23.6 m^3/s
Badraman	Badraman side	EL46.30m	Same as canal elevation	8.3 m^3/s	1.2 m^3/s
	Dirotiah side	EL46.30m	Same as canal elevation	11.7 m^3/s	1.7 m^3/s
Abo Gabal	Abo Gabal side	EL46.30m	Same as canal elevation	6.2 m^3/s	0.9 m^3/s
	Irad Delgaw side	EL46.30m	Same as canal elevation	8.6 m^3/s	1.3 m^3/s
Sahelyia		EL46.30m	Same as canal elevation	4.2 m^3/s	0.6 m^3/s

Note 1) Max W/L/ is taken from the modified drawing of the existing DGR on confirmation with RGBS (refer to Appendix)
Note 2) Min. W.L. is taken from the record of the water management and data on safe side was employed. (refer to 3.4.3 Present Situation of Water Level and Discharge)
Note 3) Max and min discharge is based on the arrangement of water distribution in 2001 (3.4.4 Present Situation and Problems of Water Management)

(2) Plan of Gate Installation

a) Selection of Gate Type

For the selection of an over-flow type gate, two types are compared, namely the Double-leaf gate and the Radial-gate with a flap, both of which have recently been introduced in Egypt. As for selecting the existing gate types in Egypt, it is expected that the actual situation of the structure and operation of the gates can be confirmed and these existing types can easily fit into the current water management in Egypt.

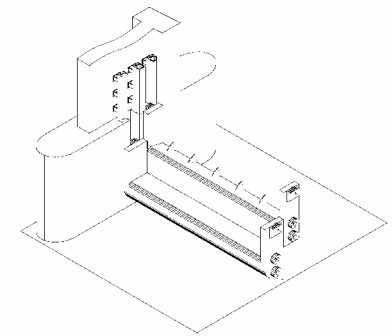
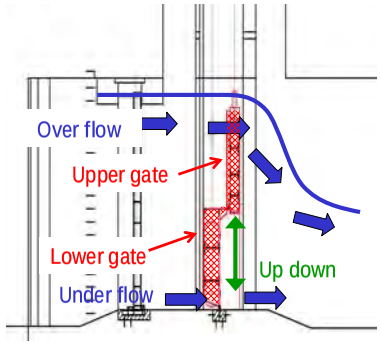
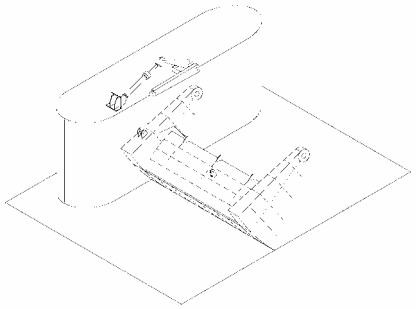
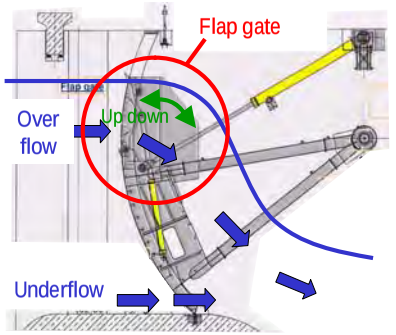
The Double-leaf gate has been introduced at the Rahoon (constructed in 1997), Mazoura (2002), Sakhola (2006) and Monshat EL Dahab regulators (2010) in the Bahr Yusef canal by Japan's Gant aid. The Radial-gate with a flap has been introduced at the Ensa barrage (1994) and the Naga Hammady barrage (2008) in the Nile River. The barrages in the Nile have been constructed by RGBS with the assistance of donor countries. The following table summarizes the comparison of the two gate types with their features and adaptability to the DGR from the viewpoints of hydrology, structure, operation and maintenance, and cost. As a result, the Double-leaf gate is recommended.

From the cost point of view, the cost of the Double-leaf gate is more expensive than the Radial-gate with a flap. But as for the cost including earth work, the Double-leaf gate is cheaper than the Radial-gate with a flap. Also for the amount of discharge per gate in case of controlling all the discharge by over-flow, the Double-leaf gate can control double the amount that the Radial-gate with a flap can. It is therefore evaluated that the discharge control of the Double-leaf gate is superior to the Radial-gate with a flap.

- Over-flow discharge control per meter by Double-leaf gate : Max. approx. 9$m^3/s/m$
- Over-flow discharge control per meter by Radial-gate with flap : Max. approx. 4$m^3/s/m$

According to the hearing from RGBS, the Radial-gate with a flap introduced to the Naga Hammady barrage, which is operated with an oil hydraulic cylinder, requires a highly sophisticated technique for operation and maintenance. On the other hand, the double-leaf gates, which have been introduced to the Bahr Yusef canal, have been operated and maintained by ordinary irrigation technicians. It is, therefore, evaluated that the Double-leaf gate is a suitable type to introduce to the middle and small-scale canals because of its easy O&M.

Comparison Table of the Over-flow Type Gate with Double-leaf gate and Radial gate with Flap (1/2)

Items		Double Leaf-gate (Over flow control of the discharge)	Radial gate with flap (Over flow control of the discharge)
Figure of gate		 (View of the Gate)  (General section of the gate)	 (View of the Gate)  (General section of the gate)
General information	Structure	- The structure of the gate consists of skin plates which are supported by steel beams in back to resist the water pressure. The structural feature of the gate is having two gates in the facility, a lower gate and an upper gate. - Generally, the upper gate's water pressure is smaller than the lower gate; therefore the thickness of the upper gate is thinner than that of the lower gate. - A High accuracy of the gate operation by over-flow type discharge can be done with the upper gate. - The height of the upper gate can be designed within a half of water head of design.	- A feature form of the gate is a skin plate by circular arc which is supported by a steel beam from behind to resist the water pressure. Additionally, the main two arms are supporting the gates and are set in a radial form to resist the water pressure. - The form of the skin plate by circular arc can disperse the water pressure; therefore this type of gate is adopted on the condition of high water pressure. - Especially, in this gate, the flap gate on the main gate can operate by an over-flow type of discharge with high accuracy - The height of the flap gate can be designed within one-third of the water head of design.
	Hoisting	- The force of the hoist is transmitted to the gate by wire rope and winch method. The driving power of hoist is generally sourced with an electric motor. - In this gate type two hoists are required for the upper gate and lower gate. - The hoist machine should be located at the upper part of the weir pier. Generally, the located level of hoist is as high as "approx. 1.5m x the designed water depth" from the top of the pier.	- The hoisting of the gate is operated in rotary motion. - The force of hoist is transmitted by the hydraulic power using the telescopic arm, generally. Especially in this gate type, it is required to have two hydraulic hoists for the flap gate and lower gate (radial gate). - The located level of hoist is as high as the top of the pier level.

Comparison Table of the Over-flow Type Gate with Double-leaf gate and Radial gate with Flap (2/2)

Items	Double Leaf-gate (Over flow control of the discharge)	Radial gate with flap (Over flow control of the discharge)
Structural feature	- The gate can keep its strength with many steel parts; therefore the weight of the gate might be heavy compared with the Radial gate type. Additionally, since the setting of the hoist level is located at a high place, the view of the landscape might be affected by the high structure. Point: 1	- As a feature of this gate type, it has the structural advantage of strength for the high water pressure. Therefore the weight of the gate might be light compared with the Double-leaf gate type. - The size of the hydraulic hoist machine is smaller than the hoist of the Double-leaf gate type. - The setting of the hoist level is located as high as the top of the pier; therefore the view of the landscape might not be affected by the structure. - The radial gate is longer toward downstream than the case of the Double-leaf gate. Therefore the pier and apron length are about 1.5 times as long as the case of the Double-leaf gate. Also, the cost of civil works is about 1.5 times as much as the case of the Double-leaf gate. Point: 1
Hydraulic feature	- It is controlled by a high accuracy over-flow. And the discharge volume by over-flow control is available at a range of half of the designed water head. The volume controlled by over-flow is larger than that of the Radial gate type. - On the condition of the DGR, the maximum discharge volume by over-flow is approx 9 $m^3/s/m$ and that volume is 2 times as much as the Radial gate type. Therefore the number of vents of Double-leaf gate is less than that of the Radial gate type. Point: 2	- It is controlled by high accuracy over-flow. And the discharge volume by over-flow control is available at a range of one-third of the designed water head. The volume controlled by over-flow is smaller than that of the Double-leaf gate type. - On the condition of the DGR, the maximum discharge volume by over-flow with flap is approx. 4 $m^3/s/m$ and that volume is half as much as the Double-leaf gate type. Therefore the number of vents of the Radial gate is more than that of the Double-leaf gate type. Point: 1
Maintenance	- Main subjects of maintenance are painting and inspection for the gate and guide and painting the grease on the wire rope. - Those maintenance procedures can be done by general knowledge of machinery. Therefore it is easy to find the failing parts. - The daily maintenance works are easier than those for the Radial gate type. Point: 2	- Main subjects of maintenance are painting and inspection for the gate and guide, and inspection for hydraulic facility. Especially, the maintenance of the hydraulic facility should be inspected by the expert engineer, because it is difficult to find the failing parts of the hydraulic facility. - Need for remarkable operation considering the dusty and sandy condition, because it is a cause of damage to the hydraulic cylinder that makes trouble with the reduction of oil pressure as well as a problem of water pollution. Especially the reduction of oil pressure would lead to the uncontrolled gate. - If the raw material of oil is combustible, care should be taken to prevent a fire in case of increasing the temperature of oil. Point: 1
Economic	ratio 1.00 Manufacturers (1 gate) LE. 9.02 million Civil works (1 vent) LE. 6.83 million (1LE=16.40yen) Total LE.15.85 million (0.26billi. yen) Point: 2	ratio 1.07 Manufacturers (1 gate) LE. 6.71 million Civil works (1 vent) LE. 10.24 million (1LE=16.40yen) Total LE.16.95 million (0.27billi. yen) Point: 1
Comprehensive Evaluation	**Total point : 7** **Very Good** - The cost of the Double-leaf gate per one is costlier than that of the Radial gate type per one, however the cost including the civil works per one vent is lower than that of the Radial gate type. Additionally the maintenance is easy. - It is recommended to adopt the Double-leaf gate in DGR (Adoption)	**Total point : 4** **Fairly Good** - The cost of the Radial gate per one is lower than that of the Double-leaf gate type per one, however the cost including the civil works per one vent is costlier than that of the Double-leaf gate type. Additionally the maintenance is very difficult.

b) The examination for the required width of the vents

The required width of vents and number of vents shall be determined based on the required discharge control volume.

b-1) Required width of the vents for Bahr Yusef and Ibrahima Regulators

Bahr Yusef and Ibrahima as the main canals at the DGR have much effect to a distributional function in the DGR, because both canals control the discharge by more than 90% of the total discharge. Therefore the dimensions of vent on both Bahr Yusef and Ibrahima canals shall be designed on the condition of over-flow controlling all discharge, so that the distributional function is steady and proper. The following examination shows that the total width of the vent for the Bahr Yusef regulator is more than 25.17m and more than 17.96m for the Ibrahimia regulator.

Table 4.2.2 The examination of the required total vents' widths (Bahr-Yusef and Ibrahimia reg.)

Items	Bahr Yusef reg.	Ibrahimia reg.
Maximum discharge : (A)	226.5 m^3/s	161.6 m^3/s
Discharge per meter by over-flow (Double-leaf gate) : (B)	9 $m^3/s/m$	9 $m^3/s/m$
Required liner width of the gate : (A) / (B)	More than 25.17m	More than 17.96 m

b-2) Required widths of the vents for Abo Gabal, Sahelyia, and Badraman Regulators

Abo Gabal, Sahelyia, and Badraman regulators control the discharge at approximately 10% (approx. 40m^3/s total) in the DGR, and these controlled volumes are extremely small compared with Bahr Yusef and Ibrahimia. Therefore, since the steady and proper distributional function will be expected enough by the over-flow of the Bahr Yusef and Ibrahimia regulators, the required widths of the vents Abo Gabal and Sahelyia will be examined by the under-flow as well as the existing regulator. Provided the affect of sedimentation is to be considered, the new Abo Gabal and Sahelyia regulators shall be designed.

● Abo Gabal and Sahelyia regulators

Abo Gabal and Sahelyia Regulators are located upstream of the existing DGR. These regulators will be designed by the Japanese standard design criteria (Design standard for "Head Works" Ministry of Agriculture and Fishery) in order to avoid the affect of the sedimentation. According to these design criteria, the velocity of in-flow at the intake should be 0.6m/s ~1.0 m/s and the intake level should be higher than one (1) meter than the canal bed level, for the purpose of preventing sand and grown water weeds in the intake. Accordingly the required width of vents shall be examined so that within the velocity above mentioned, it is shown as follows:

Table 4.2.3 **The examination of the required widths of the vents (Abo Gabal and Sahelyia reg.)**

Items	Abo Gabal reg.		Sahelyia reg.
	Abo Gabal side	Irad Delgaw side	
Required maximum discharge : (A)	6.2m^3/s	8.6m^3/s	4.2m^3/s
Design water depth : (B)	2.3m	2.3m	2.3m
Design velocity : (C)	1.0m/s~0.6m/s	1.0m/s~0.6m/s	1.0m/s~0.6m/s
Required liner width of the gate : (D)=(A) / (B) / (C)	2.69m~4.49m	3.74m~6.23m	1.83m~3.04m

Note) Design water depth is the deference between design water level 46.3m and bottom of intake canal level 44.0m. The design gate bed elevation is at a level that is more than one (1) meter higher than the existing canal bed level, so as to prevent sand and grown water weeds in the intake.

● Badraman Regulator

The Badraman regulator is not affected by sedimentation, because it is located at the middle of the

Bahr-Yusef and Ibrahima Regulators. Therefore, the vent width will be designed for the purpose of preventing canal scouring by the discharge. On the condition of this, the design velocity of the discharge needs to be less than 1.2 m/s, which is shown on the Japanese standard design criteria for "Canal works," published also as "Head Works". According to this design criteria, a clay layer including sand, which corresponds with this site feature, shall reduce the velocity of discharge to less than approximately 1.2 m/s for the purpose of preventing canal scouring by the discharge.

Table 4.2.4 The examination of the required width of vents (Badraman reg.)

Items	Badraman Regulator	
	Badraman side	Dairotiah side
Required maximum discharge : (A)	8.3m^3/s	11.7m^3/s
Design water depth : (B)	2.8m	2.8m
Design velocity : (C)	less than 1.2m/s	less than 1.2m/s
Required liner width of the gate : (D)=(A) / (B) / (C)	more than 2.47m	more than 3.48m

Note) Design water depth is the difference between design water level 46.3m and bottom of intake canal level 43.5m. The design gate bed elevation level is more than 0.5 meter higher than the existing canal bed level, so that prevent the sedimentation.

c) The examination for the actual vent and gate width

c-1) The examination for the actual vent and gate widths on Bahr Yusef and Ibrahima regulators

The actual vent and gate widths should be designed to secure the required widths, and then proper widths will be examined in comparison with economical advantage, provided that each width of examination should be the same width in the regulator. This means that it has the purpose of giving the feature of the symmetric structure and hydraulic performance; moreover the effect of saving costs for the design and manufacture will be expected. Additionally, the examination will be taken into consideration of diverting the stop logs. It is as follows:

- Consideration of the stop logs width is 8m in order to divert the gate installed by the Japanese grant aid project.
- Consideration of the stop logs width is 5m in order to divert the gate that has been installed at the Assuit barrage. Since the existing Assuit barrage will be reconstructed in the near future, the existing stop log would be expired, which is informed by the Egyptian side.
- Consideration of the stop logs width is 4m, because the 8m width gate can be separated to the 4m size.
- Consideration of the stop logs width is 10m, because the 5m width gate can be set side by side.

Table 4.2.5 The actual vent and gate No. and width on Bahr Yusef and Ibrahimia reg.

	Bahr Yusef regulator				Ibrahimia regulator			
Vent length / one vent	4 m	5 m	8 m	10 m	4 m	5 m	8 m	10 m
Guide plate width of D.L gate / one vent	1.0 m	1.0 m	1.5 m	2.0 m	1.0 m	1.0 m	1.5 m	2.0 m
Actual width by Over-flow / one vent (A)	3.0 m	4.0 m	6.5 m	8.0 m	3.0 m	4.0 m	6.5 m	8.0 m
Necessity of entire vent width (B)	25.17 m	25.17 m	25.17 m	25.17 m	17.96 m	17.96 m	17.96 m	17.96 m
(B) / (A)	8.39	6.29	3.87	3.15	5.99	4.49	2.76	2.25
Necessity of entire vent number	9 vent	7 vent	4 vent	4 vent	6 vent	5 vent	3 vent	3 vent
Actual entire width of vents	36.0 m	35.0 m	32.0 m	40.0 m	24.0 m	25.0 m	24.0 m	30.0 m

Remarks : The gide wall of the D.L gate should be changed by gate size.

: The "D.L gate" is the "Double-leaf gate"

Table 4.2.6 Cost comparison of each case of no. and widths of gate and vent at Bahr Yusef and Ibrahima reg.

(LE)

Item	Bahr Yusef regulator				Ibrahimia regulator			
Vent length / one vent	4 m	5 m	8 m	10 m	4 m	5 m	8 m	10 m
Actual entire width of vents	36.0 m	35.0 m	32.0 m	40.0 m	24.0 m	25.0 m	24.0 m	30.0 m
Regulator civil works	2,918,000	3,067,000	2,671,000	3,247,000	1,945,000	2,190,000	2,003,000	2,435,000
Canal prorection and bank protection by sheet pile	15,263,000	15,681,000	12,873,000	15,529,000	10,175,000	11,201,000	9,655,000	11,647,000
Other works	876,000	910,000	789,000	950,000	584,000	650,000	592,000	712,000
Gate manufacturer	58,341,000	51,171,000	40,732,000	45,317,000	40,195,000	37,707,000	31,707,000	35,220,000
Temporary works	25,679,000	24,966,000	22,826,000	28,533,000	17,583,000	18,316,000	17,583,000	21,979,000
Sum	103,077,000	95,795,000	79,891,000	93,576,000	70,482,000	70,064,000	61,540,000	71,993,000
Ratio	1.29	1.20	1.00	1.17	1.15	1.14	1.00	1.17

As a result of the examination, the most proper gate width shall be 8m on both regulators and the number of gates and vents is shown in the following table.

Table 4.2.7 Number of proper sets at Bahr-Yusef and Ibrahima reg.

Items	Bahr-Yusef Regulator	Ibrahimia Regulator
Gate span	8m	8m
Number of gate sets	4 sets	3 sets

C-2) Examination for the actual vent and gate widths on Abo Gabal, Sahelyia and Badraman regulators

The actual gate and vent width for each regulator shall be examined based on the required width of each gate. According to the following table, the proper width is shown as 4m which corresponds most with the condition of the required width and whole plan of the gate width. However, the gate width of the Sahelyia regulator is a little larger than the appropriate width; it can control discharge by gate operation. Additionally, since these regulators can control a small discharge, it is enough to discharge and control by the one (1) gate or vent.

Furthermore, it can be expected that adopting the 4m width would divert the stop log gate, which will be installed on the Bahr Yusef and Ibrahimia regulator, which means a savings in the cost of manufacturing the stop log gates could be expected.

Table 4.2.8 The selection of gate span for the Abo Gabal and Badraman regulators

Regulator or canal		Appropriate width to gate and vent	Proposed span			
			2m (one set)	3m (one set)	4m (one set)	5m (one set)
Abo Gabal Reg.	Abo Gabal side	2.69m~4.49m	***	OK	OK	***
	Irad Dergaw isde	3.74m~6.23m	***	***	OK	OK
Saheryia Regulator		1.83m~3.04m	OK	OK	***	***
Badraman Reg.	Badraman side	More than 2.47m	***	OK	OK	OK
	Dairotiah side	More than 3.48m	***	***	OK	OK
Evaluation			Point 1	Point 3	Point 4 (adoption)	Point 3

(3) The layout of the regulator body

The layout of the regulator body will be designed with reference to the Japanese standard "Head Works". The major elevations of the regulator are shown on following table:

Incidentally the proposed water levels and discharges are shown in the "Table 4.2.1 Basic Design Conditions of the New DGR" .

Table 4.2.9 Proposed main elevations of the New DGR

Regulators	Top of pier	Bed level of gate	Maintenance bridge
Bahr Yusef	EL47.5 (same as existing)	EL40.0 (0.5m higher than the existing bed)	EL50.0 (same as existing)
Ibrahimia	EL47.5 (same as existing)	EL40.0 (0.5m higher than the existing bed)	EL50.0 (same as existing)
Badraman	EL47.5 (same as existing)	EL43.5 ((0.5m higher than the existing bed)	EL50.0 (same as existing)
Abo Gabal	EL47.5 (same as existing)	EL44.0 (0.5m higher than the existing bed)	EL50.0 (same as existing)
Sahelyia	EL47.5 (same as existing)	EL44.0 (0.5m higher than the existing bed)	EL50.0 (same as existing)

The main dimensions of the new DGR are shown on the following table. Incidentally, according to the geographic survey, the team found that a fine and proper foundation layer is located around an elevation of 32.3m which is approximately 10m deeper than the gate bed level. Therefore the team proposes the pile foundation method preferring the direct foundation method with concrete. Since in Egypt the type of the pile by reinforced concrete (RC pile) is marketable and easy to procure, it will be designed with RC pile.

Table 4.2.10 Proposed main dimensions on the New DGR

Regulators	Pile length	Length of cutoff Sheet piling	Thickness of apron	Length of apron	Length of bed protection
Bahr-Yusef	Prefabricate con. pile(■500mm) L=7m/pcs.	L=14.5m/pcs.(U.S) L=13.0m/pcs.(M.D) L= 2.0m/pcs.(D.S)	Max 2.5m Min 0.6m	L= 6.0m(U.S) L=17.5m(M.D) L=24.0m(D.S)	L=50.0m
Ibrahimia	Prefabricate con. pile (■500mm) L=7m/pcs.	L=14.5m/pcs.(U.S) L=13.0m/pcs.(M.D) L= 2.0m/pcs.(D.S)	Max 2.5m Min 0.6m	L= 6.0m(U.S) L=17.5m(M.D) L=24.0m(D.S)	L=50.0m
Badraman	Prefabricate con. pile (■500mm) L=11m/pcs.	L=10.5m/pcs.(U.S) L= 9.0m/pcs.(M.D) L= 2.0m/pcs.(D.S)	Max 2.5m Min 0.6m	L= 4.5m(U.S) L=15.2m(M.D) L=16.0m(D.S)	L=20.0m
AboGabal	Prefabricate con. pile (■500mm) L=11m/pcs.	L= 2.0m/pcs.(M.D)	Max 2.7m Min 0.7m	L= 9.0m L=15.0m	Riprap stone works
Sahelyia	Prefabricate con. pile (■500mm) L=11m/pcs.	L= 2.0m/pcs.(M.D)	Max 2.7m Min 0.7m	L=9.0m L=7.0m	Riprap stone works

Incidentally, in the design of the new Abo Gabal and Sahelyia regulators, preventing sedimentation with reference to the Japanese standard "Head Works" is to be considered. It is mentioned as follows:

- The intake bed level shall be located one (1) meter higher (or 60% of total water depth) than original canal bed.
- The width of intake shall be designed within 1.0m/s~0.6m/s so that the velocity of in-flow at the intake will be 0.6m/s ~1.0 m/s.

(4) Maintenance Bridge

When the DGR is used as a bridge, it is necessary to connect the maintenance bridge on the left bank side of the Bahr Yusef canal and the right bank side of the Ibrahimia canal with an existing road respectively. However, according to the location of the platform for railroads, or the situation of a residence, on the right bank side of Ibrahimia canal, it is difficult for a maintenance bridge of the new DGR to connect with an existing road directly. In other words, even if a maintenance bridge is constructed, convenience on the right bank cannot be found. Therefore, it is judged that the installation of a bridge for vehicles to pass is very difficult.

As mentioned above, in the new DGR, it is judged that installation of the maintenance bridge for the purpose of operation and maintenance is appropriate. The road width of the maintenance bridge is planned as 6m, referring to standard road width of a maintenance bridge for a regulator shown in the Egyptian Code Regulators and Gates/P-5-11. In addition, the Working Group with RGBS of holding agreed on 31 May 2010 to design a 6m wide road, the road width of a maintenance bridge, for the purpose of operation and maintenance.

(5) Navigation lock

There are navigation locks on the existing Bahr Yusef and Ibrahimia regulators near each other. In the Bahr-Yusef regulator, the Egyptian side has expressed the lack of need for the navigation lock. It is found clearly by showing the new Dahab, Sakoula, Mazoura, and Lahoum regulators on the Bahr Yusef canal, which has been expired, the function of the navigation lock. By contrast, as for the Ibrahimia canal, the Egyptian side has shown the necessity of the navigation lock, so it needs to design the navigation lock on new Ibrahimia regulator, provided that the width of the new navigation lock will be 8.8m as is the existing navigation lock.

(6) Plan of construction works

a) Method of the temporary coffer dam

Surrounding the site, there are residences, the main roads and the railway which are close to the construction site. Additionally this construction work should divert the canal water in order to keep flow downstream all year. Therefore, in a condition such as this case, using the sheet piles will be the most proper method for the coffer dam in order to optimize the strict construction area. Since the feature of the sheet pile method enables construction of a thin coffer dam with the strength of the sheet, the construction yard will be secured within a minimum range and will enable work without stopping the canal flow during the construction period.

The team will propose the two (2) types as the sheet pile method, the double-sheet pile and the single sheet pile, which is considered to be the proper method for this site. (Refer to the right fig.) This method has been adopted for the improvement works of the regulators on the Bahr Yusef canal which has been carried out by the Japanese grant aid project,

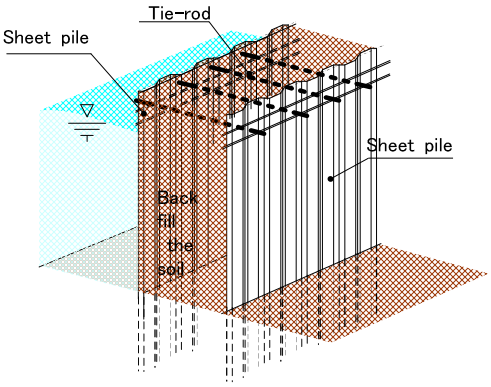


Fig. 4.2.6 Double-sheet pile

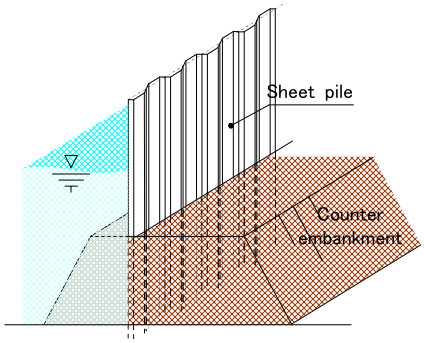


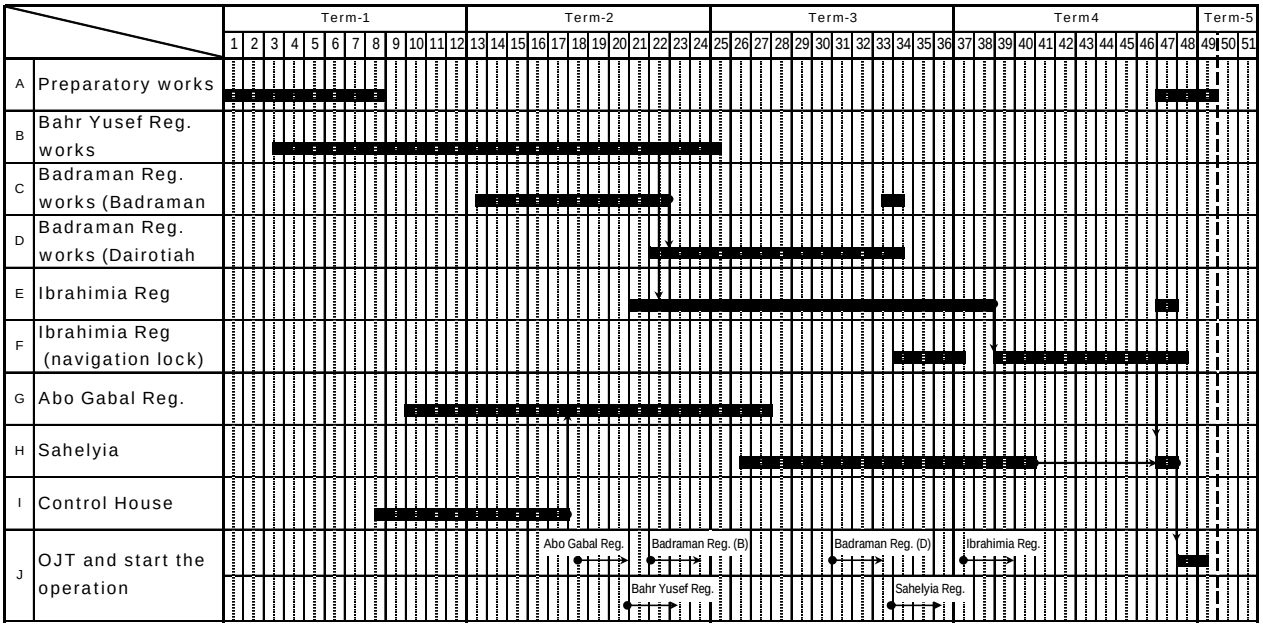
Fig. 4.2.7 Single-sheet pile

so this method has proven the high conformity and safety for the construction.

b) Plan of the construction works

The construction periods of the new DGR will be planned for approximately four (4) years (49 months) by taken into consideration each of the works and the range of works. It is shown as follows:

Table 4.2.11 The construction plan for the New DGR



4.2.3 The policy for rehabilitation and improvement of the existing DGR

The policy of the existing DGR after constructing a new DGR will be used continually, such as the bridge for the people to remain as it is and to remain as a historical monument. However, the existing DGR has been in place for 138 years, and it has been ascertained that there is much deterioration and lack of brick, and it needs rehabilitation and improvement; also, the existing gate needs to be removed because it has expired its irrigation function as part of the DGR.

Accordingly, considering the function of the existing DGR, the team proposes the following plan for the rehabilitation and improvement as a reference, provided that the technical advice and case-example for the rehabilitation and improvement of the old structure in Egypt should be received, and then the plan could be formulated again.

- The gate should be removed, provided that the navigation lock at the Ibrahimia regulator would remain because of its operational function.
- Erosion at the apron of the Bahr Yusef and Ibrahimia regulators should be rehabilitated. The range of rehabilitation is for the surface of the apron downstream of the gate. Furthermore, high-strength concrete should be used for the rehabilitation since it would then be more than 50cm thick. In case the fragile concrete remains at the apron, it should be removed completely, and then fresh concrete should be poured on the apron.

  Additionally, the Badram regulator, between Bahr Yusef and Ibrahimia, has the high strength concrete, as well as the Bahr Yusef and Ibrahimia regulators.

●For the parts of the body which have been scoured and whose bricks have been lost, it is suggested to replace all the bricks of the damaged parts. At the area in which mortar has been lost, mortar should be re-filled. This repair is based on the understanding that the existing DGR is a historical monument, so the same materials with the existing one should be preferentially used for repair. It should be noted that the same scouring may occur in the future.

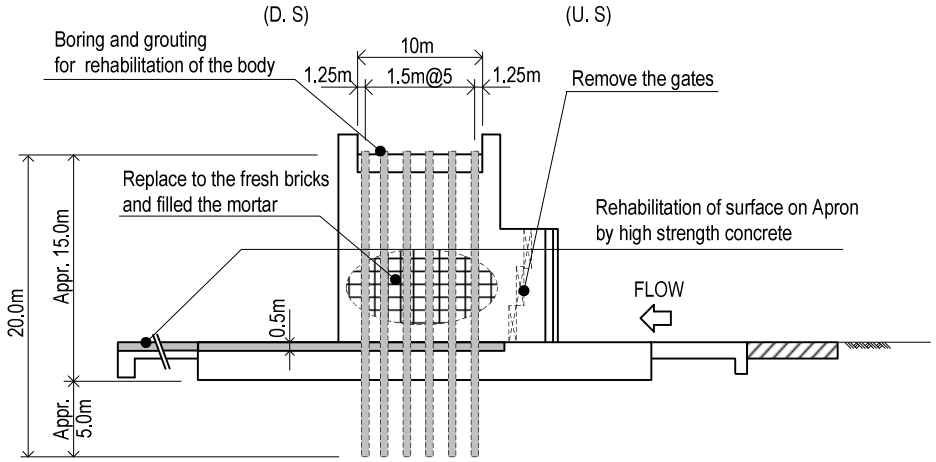


Fig 4.2.8 Example for the rehabilitation of the existing DGR

4.2.4 The study of possibility of the Hydropower generation plan at the DGR

(1) Limitations of design conditions

The hydraulic data about the Bahr Yusef and Ibrahimia main canals are arranged on ten year's discharges and water levels between the years 1999 and 2008. The average of water level and discharges were tabulated in the table below, and characteristics of the data will be as follows:

a) Averages of the discharge of the two main canals have a sufficient discharge of more than 120m^3/sec. and

b) Averages of water head between upstream and downstream are 0.9m (1.3m) on Bahr-Yusef and 1.3m (1.7m) on Ibrahimia, and both will never exceed 2.0m of water head.

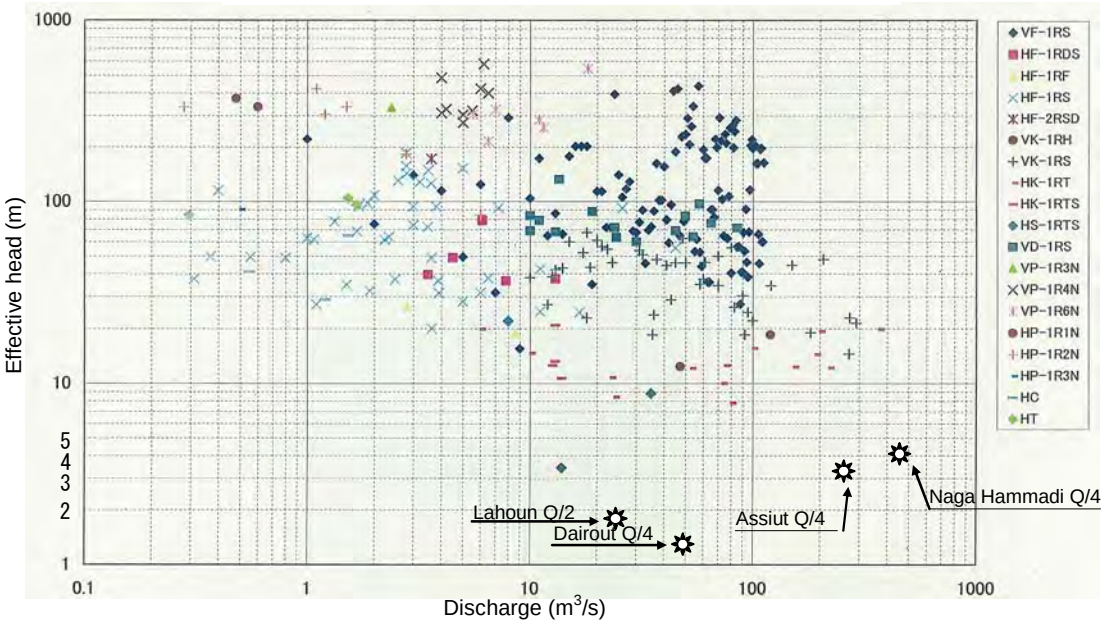
Table 4.2.12 Flow discharge and water head differences between upstream and downstream

Condition (Seasonal discharge)	Bahr Yusef		Ibrahimia	
	Monthly average discharge (m^3/s)	Water head (m)	Monthly average discharge (m^3/s)	Water head (m)
Four months (Feb. to May)	154	1.0 (1.4)	129	1.4 (1.8)
Three months (Jun. to Aug.)	207	0.3 (0.7)	173	0.8 (1.2)
Four months (Sep. to Dec.)	138	1.3 (1.7)	124	1.6 (2.0)

1) January includes water closure and data will be neglected because of extremely small discharge in January
2) "() " are shown in case upstream water level rises to 46.30m as maximum design water level, existing maintained water level at upstream is between 45.8 and 46.0m.

Effective head for hydraulic generation will be given minus certain losses from the water head of the above table, and generally, in case of more than two (2) meters of effective head, the design of adequate turbine for hydraulic generation shall be given with some of the possibility. But in the case of the DGR effective head being less than two (2) meters, and the discharges were certainly large, it shall be treated as a greater runner diameter of turbine with more of a general case, and also it will result in low economy.

Fig 4.2.9 Empirical results of turbine types in Japan



Source "Hydraulic turbine Japan industrial publications"

Note; The design conditions of the lahoun, DGR, Assuit and Naga Hammadi were shown together with the Figure. But the four cases were plotted as per one unit of design dimension.

(2) Economical evaluation method on the hydropower generation plan

As the empirical case at the Lahoun generation plant in Egypt, almost 1.8m of effective head, it was implemented by the Hydro Power Plant Executive Authority (Ministry of Electricity and Energy), and we tried to study a possibility and beneficial break-even point to be referring the case of Lahoun.

1) The study condition based on the data by the Lahoun case

a. Discharge and water head

Discharge and water head based on the ten years investigation data of both Bahr Yusef and Ibrahimia main canals are used, and one unit of generation plant may be 50m^3/sec. and case studies shall be one (1) to three (3) units of generation plant. Effective water head will be estimated in relation with the Lahoun experience.

b. Integrated generation efficiency: Assumption the Lahoun experience

c. Type of hydraulic turbine: Caplan type turbine (S shape tubular hydraulic turbine)

d. One unit of generating discharge

Maximum generating discharge will be 150m3/s, then the divided three units of maximum generating discharge will be given as 50m3/s of one unit discharge and three of the units will be given the maximum unit at each of the main canals.

e. Construction cost

Construction cost for civil works will be estimated by the layout design of the generator turbine and mainly constructed by the Egyptian side, and electro-mechanical for generation equipments will be manufactured, transported and installed by the Japanese foreign side and the cost for these will be estimated based on the "Medium to small scale generation guide book" [Ministry of Economic and Industrials in Japan, Agency of Natural Resources and Energy (a foundation of new energy)].

f. Finance: After 10 year's deferment and 30 year's repayment with interest 0.3% (Foreign Portion)

g. Price increase interest: 8 %

h. Price of electricity: 15 Pt/kwh

i. Annual operation and maintenance costs: around 0.4 % of initial construction cost

j. Integrated life time: between 30 to 50 years.

Data b. c. d. e. g. are referenced by the Hydro Power Plant Executive Authority (Ministry of Electricity and Energy)

2) Evaluation method (development effect)

In Japan, the evaluation method for a small scale of a hydropower generation project will be appraised using a unit construction price method, which is useful and effective worldwide, not only in Japan, and C/V (cost/value method), which is internationally and generally applied, but the DGR case is a much smaller case compared to the large scale of generation cost of thermal oil and gas plants. Then "The cash flow method" shall be applied because of its simple logic, easy understanding and clear result, that is referred to in the "Guidebook for Hydro-valley planning" [Ministry of Economic and Industrials in Japan, Agency of Natural Resources and Energy (a foundation of new energy)]

(3) Evaluation of Conclusion

1) Case study

According to the above conditions, the table below shows the DGR case that the output of hydropower generation will be estimated based on some assumptions of a number of turbine and discharge, and integrated efficiency of hydropower generation and loss of water head may be referred with the Lahoun case.

The annual O&M cost is supposed to estimate the cost for personnel, repairs, exchanges of the electro-mechanical equipments and assemblies and others.

Case 2-2 is the most effective case because plant cost/annual output is the minimum.

Table 4.2.13 Case study

Case[1]		Upstream water level[2]	Output (kw)	Annual output (kwh)	Plant cost[3] (1,000LE)	Plant cost/ annual output ratio
1-1	2×3 units	Existing WL	1,960	9,100,000	480,300	52.8 LE (6)
1-2	2×2 units	〃	1,798	8,400,000	320,200	38.1LE (4)
1-3	2×1 unit	〃	787	3.,300,000	160,100	48.5 LE (5)
2-1	2×3 units	Raise WL	2,431	13,600,000	480,300	35.3LE (3)
2-2	**2×2 units**	**〃**	**2,174**	**11,000,000**	**320,200**	**29.1LE (1)**
2-3	2×1 unit	〃	1,081	5,200,000	160,100	29.1 LE (2)

Notes ; 1) Same number of units for each at Bahr-Yusef and Ibrahimia
2) Existing WL:45.8～45.9m, Raise WL: 46.3m
3) Plant cost may approximately be proportional to a set of generation plant units and estimated in Japan.

2) Result of the cash flow estimation

The effective case 2-2 and case 1-2 has been tried using cash flow estimation. The result of this was shown that the income from electricity sold to consumers has never turned to a beneficial/positive side during a period of 50 years.

3) Comparison with other projects for reference

For both projects, which for Naga Hammadi has already been implemented and for Assiut has been on-going, the generation project will be tried to evaluate by unit price method for comparison with the DGR, and the unit construction cost of the DGR case is significantly high compared with the Naga Hammadi and the Assiut cases. The result of this is clearly a low economical index for the DGR case.

Table 4.2.14 Unit Cost method for each Project (for reference)

Projects	Construction Cost/kW (LE)			Construction Cost/kWh (LE)		
DGR	147,000	(10.5)	(5.7)	29.1	(15.3)	(8.3)
Assiut	26,000	(1.8)	(1.0)	3.5	(1.8)	(1.0)
Naga Hammadi	14,000	(1.0)		1.9	(1.0)	

4) The conclusion

The DGR shall be concluded by no means of the possibility to propose a hydropower generation under the conditions of the above.

Furthermore, besides high technology in the level of the laboratory or university, there is no possibility to propose a hydropower generation program in the DGR project.

4.3 Improving Water Distribution System Plan

4.3.1 Basic concept

As a main characteristic of the water management of the project area, there are the following advantage points.

- In the main facilities in each canal, the water level has been observed and recorded continuously.
- The water management system has been specialized like the gate operator of the regulator, the decision maker of a canal's discharge, and the inspector of a canal water level.
- The water management system has controlled the downstream water level of the regulator by both experience and custom rules.

Such an existing water management system has supported the water distribution of the Project site with the area of about 1,565,100 feddan over many years.

In general, there are the following three points in the role of the water control system.

- Equality
- Reliability
- Flexibility

Here, equality refers to the role of the water management facilities which can distribute the limited amount of water appropriately according to the quota of each governorate. Reliability refers to the performance of an apparatus in which water management can be used continuously, and the role which can perform decision-making about water distribution is transparent. Flexibility corresponds to the role to distribute water flexibly as the change of the volume of water is matched to demand.

In the project, to achieve the above-mentioned role, the following three basic functions are established.

Table 4.3.1 Three basic functions in the Project

Item	Contents
Real-time Water management	Real-time monitoring of water supply situation in DGR, discharge situation of each regulator in canal, and the main branch canal intake.
Water Balance Management	The discharge of regulators and branch canal intake is monitored unitarily, and the water balance of the whole project area is integrated and grasped.
PDCA Cyclic management	An improving water distribution system cycle consisting of a Plan, Do, Check, and Act is established, and proper water distribution and the quick improvement of an evaluation result can be performed based on real time discharge data.

At the management level of the water control system, three levels can be defined. The first is a method

of transmitting the water level by telephone. The second is a method of the observation of the water level with electric equipment, and transmission to the distance place through the telecommunication system. The third is the method of controlling water management equipment from a distant place.

Although the existing water management method is respected, the newly planned water management system reduces a water distribution administrator's daily routine work, and introduces the system which can support the policy towards more advanced water supplies. The water management system which supports a policy is technically reliable in Egypt, and it is preferable that operation and maintenance are easy. In recent years, the technology for supervising two or more water level data at the distant place is spreading using the circuit of a cellular phone company. Moreover, the engineers in the telemetry use these technologies and two or more projects are being are carried out.

On the other hand, flow quantity to flow through the project district is a big flow quantity of nearly $200m^3/s$ at the maximum level. However, a prompt gate operation corresponding to the flood each time is unnecessary in the project district. The operator operates the gate on the site and therefore, the water management is possible enough.

If such a point is taken into consideration in a project area, a function which operates water management apparatus from a distant place, or is automated, operation is unnecessary. In order to improve the existing water management system, the water level and discharge data at a distant place "are supervised", and data "is transmitted" to a central control house using a telecommunications system. In a control center, data "is processed" and it is reflected in the next directions. Thus, the Study team thinks that a plan to add the function which supports decision-making of the engineer of a water distribution office is appropriate. It is thought that the plan with an easy maintenance check of the water management equipment is appropriate at the level by which a present water control system is improved.

An improving water distribution system is introduced, two or more water management institutions are managed at one place, and the following results can be expected.

Table 4.3.2 Outcome of the Improving Water DIstribution System

Item	Outcome
Equality	・ Achievement of impartial water management within the range of quantity supplied.
Reliability	・ Achievement of efficient water management that reflects canal arrival time ・ Achievement of pre-meditated crop based on irrigation schedule ・ Achievement of efficient water management by a decrease in management loss etc.
Flexibility	・ Achievement of practical water management matched at crop’s cultivation time

4.3.2 Design of the system

(1) The outline of a plan

The following facilities are selected in order to build an improving water distribution system. In addition, training of the engineer who can manage an improving water distribution system is essential to keep sustained outcome after the introduction of the improving water distribution system.

The facilities for introduction of an improving water distribution system are shown in Figure 4.3.1.

- Dirout Group of Regulators
- Regulators along the main canal
- Main branch canal intake
- Water level of Quarun lake
- Central operation and maintenance facilities which supervise two or more data at the distant place
- Training support of the engineer who can operate improving water distribution system

1) Dirout Group of Regulators

DGR has a role which carries out distribution of the water for irrigation proper to seven canals. This is the center facilities in the project area and facilities where premeditated operation of the irrigation water is supported. Therefore, this is taken as the object of an improving water distribution system.

In a present plan, the basis of each gate is operation from the control house by the operator. However, it will prepare for the possibility of the plan to control the operation of two or more gates by the automatic operation in the future, and the computer system with an advanced calculation function is introduced. A remote control panel and the computer equipment at each gate are set up in the newly constructed control house. The main function of the DGR control house is as follows.

(a) On-site remote control operation of gate

- A gate is considered as operation by an operator from a control house. However, the future change to automatic control management of a gate is also considered, and it is considered as the system which can operate by remote control.

(b) Collection of data

- The water level, discharge, the state at the gate, and the monitored data of the breakdown, etc. are collected from each gate.

(c) Information processing

- Operation processing, the detection of the abnormal value, the detection of the trouble of the equipment.

(d) Indication of the information

- Collected information and processed information are visually displayed, and a prompt judgment is supported.
- Warning alarm rings when abnormality and breakdown occur.

- Detailed information, including the amount of water supply to a water level required for the determination of water distribution, discharge, and a gate state etc., is displayed on a monitoring screen

(e)Record

- Daily report record, monthly report record, operation record, and alarm recording

(f) Data storage

- The collection and the processed data are preserved in the recording equipment.

2) Regulators along the main canal

The function of the regulator in the main canal is to keep the upstream water level of the canal as constant as possible and to distribute water to the branch canal intake on the upstream side of the regulator stably. In the Bahr Yusef canal, two leaf gates and a control house are installed in all the regulators. Radial gates and F.H. gates are installed in the Ibrahimia canal, thus the level of the maintenance of the regulator is different in each canal. (Refer to English appendix)

However, each regulator has two roles "Stabilization of the upstream water level of the regulator" and "discharge monitoring". Therefore, appropriate operation in each regulator that corresponded to the quantity supplied is necessary in cooperation with the DGR located in the uppermost stream of the project area. These regulators are made the object of the improving water distribution system.

3) Branch canal intake along the main canal

In order to distribute water appropriately, it is important to grasp the discharge which is distributing water to a branch canal from the main canal in real time and to always analyze the water income-and-outgo balance in a project area. About 40 branch canal intakes are located in the Bahr Yusef canal and about 120 branch canal intakes are located in the Ibrahimia canal. About 160 branch canal intakes are located in total in the project area. However, it is difficult to make all of these intakes the object of centralized control from the respect of the economy. Usually, in the case of a large scale irrigation project, about 80% of the whole area is designated as the target of centralized water management.

The branch intakes where the telemetry is set up is selected based on the command area list and the water flow diagram chart of each branch canal collected from MWRI and the Central directorate. The object facilities of the improving water distribution system are chosen from the point where the command area of the branch canal intake is large as the total of the branch canal intake where the telemetry is set up covers about 80% of the irrigation area of the whole project area. As a result of the examination, six sites along the Bahr Yusef canal and thirty-four sites along the Ibrahimia canal are planned as object facilities of the improving water distribution system.

4) Water level of Quarun Lake

In 2009, the MWRI reduced the amount of water supply from the Bahr Yusef canal to the Fayoum area

in order to prevent the rise of the water level of Quarun Lake. Moreover, there is also a background of having forbidden rice crop farming in the Fayoum area since 2009, and the amount of water supply to the Fayoum area is reduced compared with 2008 and before. Water levels are lower than the same time last year as of May 2010. The rise of the water level of Quarun Lake can be presumed to be caused by having a part of the water supplied from the Bahr Yusef canal to the Fayoum area as invalid discharge.

Thus, it is indispensable information for not only the effect of controlling the inundation damage but also the establishment of an improving water distribution system and the establishment of a proper water distribution in the Bahr Yusef canal, etc. to observe the water level of Quarun Lake. Therefore, the water level data of Quarun Lake is designated for the object facilities of the improving water distribution system.

The amount of evaporation from Quarun Lake is important information, and the installation of the evaporation meter and the transmission of data are requested. However, the same maintenance degree of the level as the telemetry of the branch canal intake is summed up from influence of having it on the project expense to a small degree presently.

5) Central control house

The water distribution of the project district is controlled based on the instruction from the water distribution in Assiut. However, there is the skeptical opinion that equality water distribution is not applied because each irrigation district office acts independently, whether water distribution was performed according to the instructions or not.

Then, the organization that manages the amount of the distributed water along the canal in four directorates is newly set up in this project. This new organization performs fair water distribution and evaluation independently of each directorate as the water distribution office in direct control of the water distribution in Assiut. To support this management, a real-time improving water distribution system for the monitor and the evaluation of the distributed water situation is established.

Although a series of flows called PDCA cyclic water management of two or more regulators, monitoring, and evaluation are carried out in fairness and real time, it becomes possible by this office being founded. The MWRI thinks about the surrounding of Beni Suef as a candidate site in a new central control office. The main function of a central management facilities are as follows.

(a) Collection of data

- The water level, discharge, the state at the gate, and the monitored data of the breakdown, etc. are collected from each telemetry station.

(b) Information processing

- Operation processing, the detection of the abnormal value, the detection of the trouble of the equipment.

(c) Indication of the information

- Collected information and processed information are visually displayed, and a prompt judgment is supported.
- Warning alarm rings when abnormality or breakdown occurs.

- Detailed information, including the amount of water supply to a water level required for the determination of water distribution, discharge, a gate state, and a branch canal intake etc., is displayed on a monitoring screen

(d) Record

- Daily report record, monthly report record, operation record, and alarm recording

(e) Data storage

- The collection and the processed data are preserved in the recording equipment.

(f) Data distribution

- The system that can access improving water distribution information is constructed via the Internet so that a related organization may confirm a real-time water distribution situation.

As for the equipment composition of the improving water distribution system, the SCADA system is general. However, there is no introduction example of the SCADA system that handles the irrigation water management in the large area in Egypt. Therefore, the construction of a system is planned referring to integrated water management systems in which the introduction results exist in Japan. The progress of the IT equipment greatly influences the SCADA system. Therefore, it is necessary to decide on a detailed design period based on the introduction results and the use results of the manufacturer. With careful attention to experience of the development technology of the program for processing a contractor's reliability and wide area water management data on the occasion of construction of the improving water distribution system in a detail design etc., it is necessary to design a water management system.

(2) Examination of transmission line

The telemetry department of the MWRI uses telecommunication line (GMS, GPRS) of the mobile phone carrier, and there are results to transfer various pieces of information related to water management. Moreover, there is an engineer in the telemetry department to handle these transmission techniques and for the handling of data. Therefore, the transmission line to the central control house uses the telecommunication line of the mobile phone carrier.

(3)Summary table

Table.4.3.3 and Table 4.3.4 shows the facilities for the management and control item of the improving water distribution system. Figure 4.3.2 shows the water management system configuration chart. Figure 4.3.3, Figure 4.3.4, Figure 4.3.5 shows the image of the improving water distribution system.

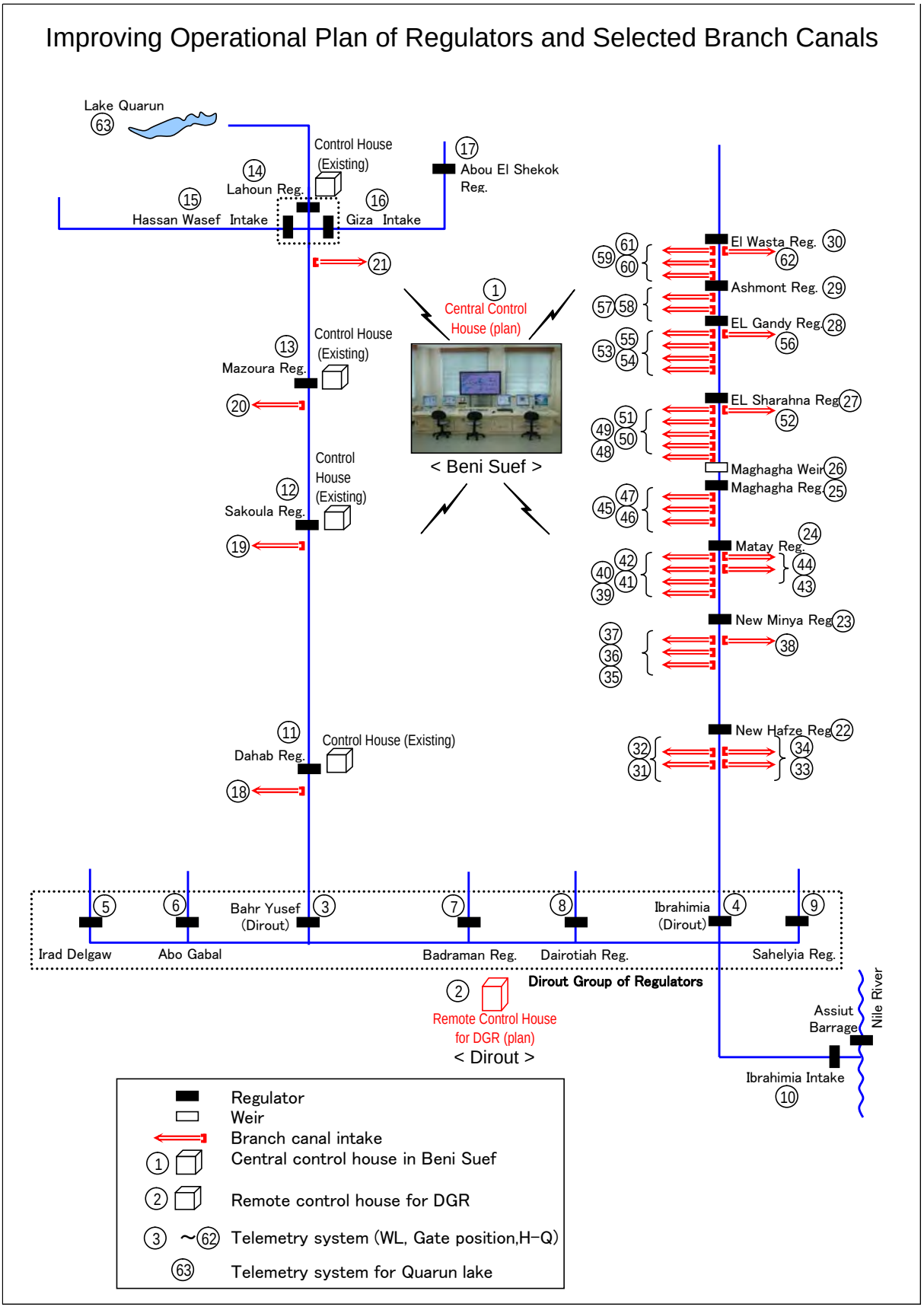


Figure 4.3.1 Improving Water Distribution System

Table 4.3.3 Target of the facilities for the water management

Facilities	Items	Management level		Number of sites
		monitoring	control	
Dirout Group of Regulators (DGR)	Upstream WL	✓		Seven (7) sites
	Downstream WL	✓		
	Gate	✓		
	Discharge	✓		
Regulators along the Bahr Yusef canal	Upstream WL	✓		Five (5) sites
	Downstream WL	✓		
	Gate	✓		
	Discharge	✓		
Regulators along the Ibrahimia canal	Upstream WL	✓		Eight (8) sites
	Downstream WL	✓		
	Gate	✓		
	Discharge (H-Q Rating curve)	✓		
Branch canal intake along the Bahr Yusef canal	WL (main canal)	✓		Seven (7) sites
	WL (Branch canal)	✓		
	Canal Intake	✓		
	Discharge (H-Q Rating curve)	✓		
Branch canal intake along the Ibrahimia canal	WL (main canal)	✓		Thirty four (34) sites
	WL (Branch canal)	✓		
	Canal Intake	✓		
	Discharge (H-Q Rating curve)	✓		
Ibrahimia canal intake	WL (main canal)	✓		One (1) site
	WL (Branch canal)	✓		
	Canal Intake	✓		
	Discharge (H-Q Rating curve)	✓		
Quarun Lake	WL	✓		One (1) site
	Evaporation	✓		

Table 4.3.4 Name of the Target Facilities

Irrigation facilities		Name of the Target facilities		No.
Dirout Group of Regulators		Bahr Yusef regulator Ibrahimia regulator Irad Delgaw regulator Abo Gabal regulator	Badraman regulator Dairotiah regulator Sahelyia regulator	7
Regulator	Bahr Yusef canal	Dahab regulator Sakoula regulator Mazoura regulator	Lahoun regulator (Hassan Wasef Intake, Giza Intake) Abo El Shekok regulator	5
	Ibrahimia canal	New Hafze regulator New Minya regulator Matay regulator Maghagha regulator	El Sharahna regulator El Gandy regulator Ashmont regulator El Wasta regulator	8
Branch canal intake	Bahr Yusef canal	Manshat EL-Dahab EL-Hareka and Sabaa Main Mazora canal Old P.S. Bhbashen	Hassan Wasef EL-giza canal Lahoun Reg.	7
	Ibrahimia canal	Sahelia Abo korkas Serry East hafez West hafez South EL-hoaslia El-dosot Damareas Safsafa canal Samalot canal Abo esa Adkak South Daroush Matay canal Abo haseba EL-gharabawy West aba EL-gendia	EL-fant Saedaia EL-fashnea Main Abo shosha Absog EL-soultane South Ahmad bsha Tansa Ahnasya canal EL-Azhare EL-sahara Bosh EL-mansour South kashesha Middle kashesha Medom canal Atoab canal El-Giza Canal	34
Ibrahimia main canal		Ibrahimia Intake		1
Lake		Quarun Lake		1

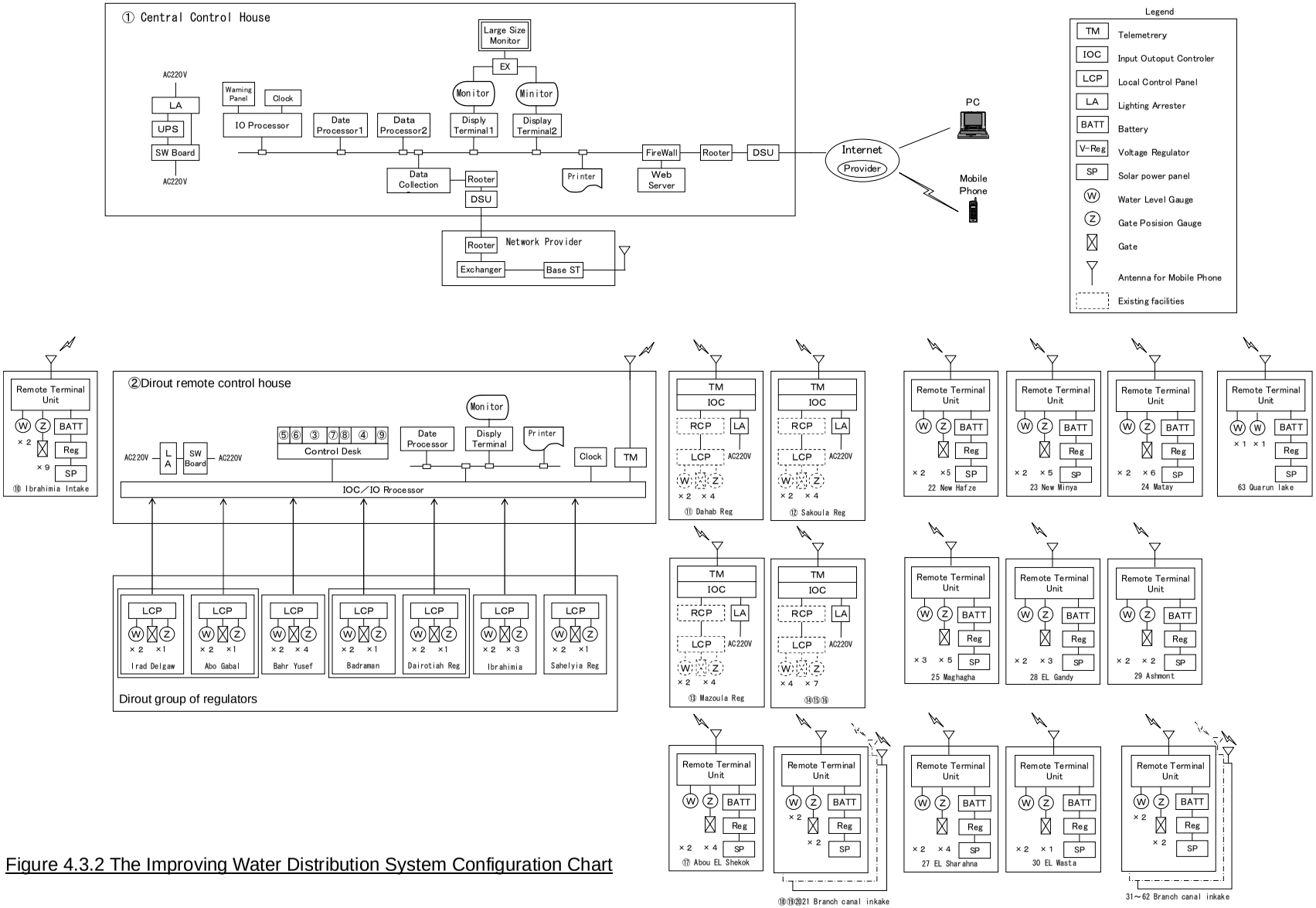


Figure 4.3.2 The Improving Water Distribution System Configuration Chart

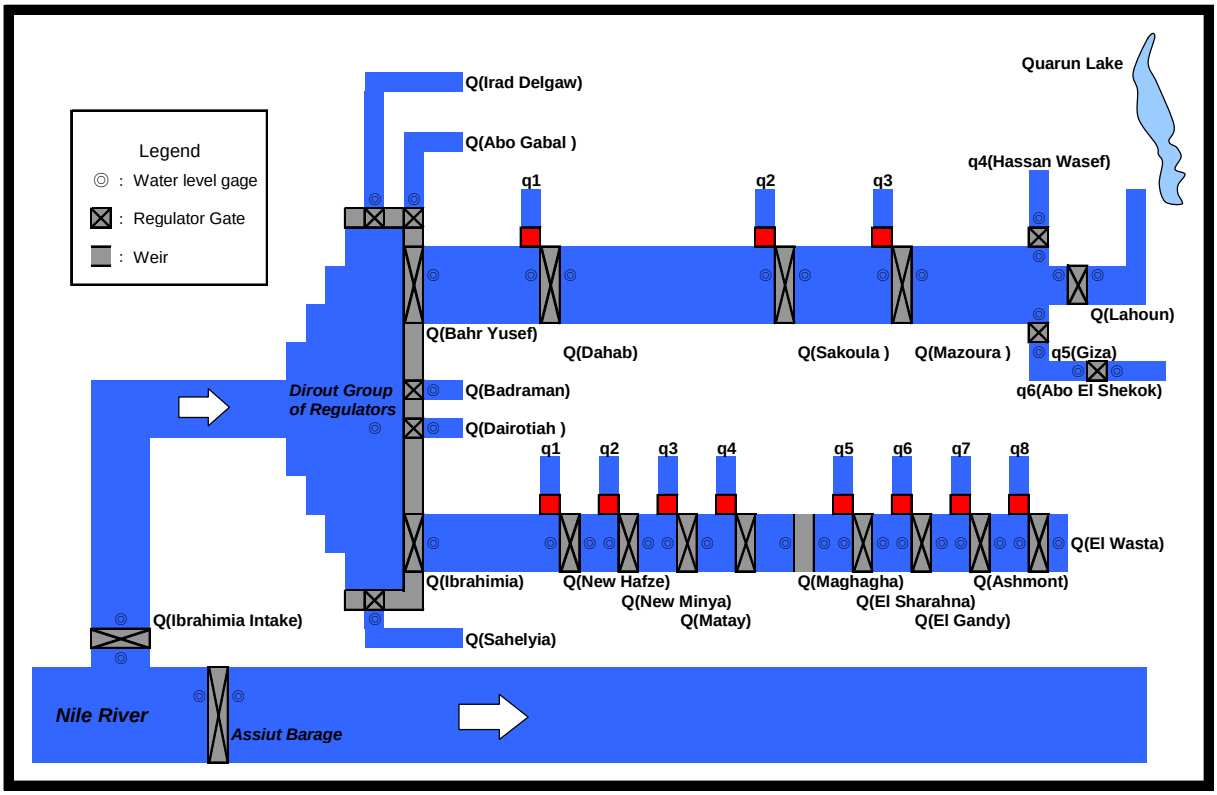


Figure 4.3.3 Image of Water Balance Management

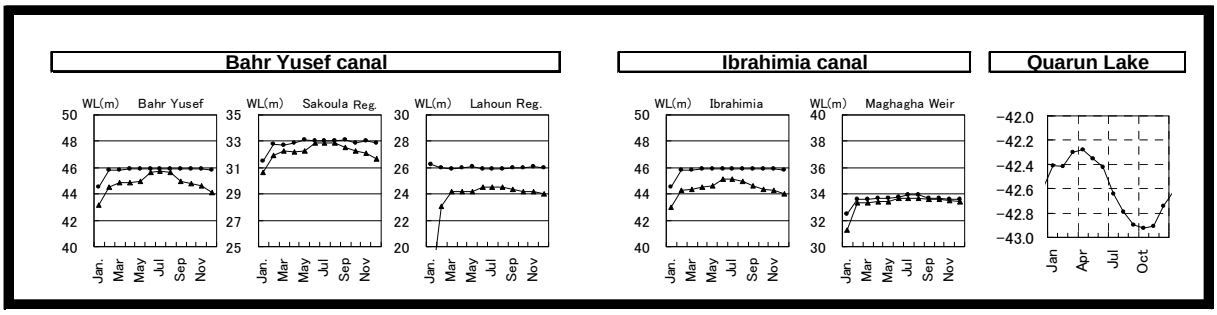


Figure 4.3.4 Image of Real-time Monitoring of Water Level

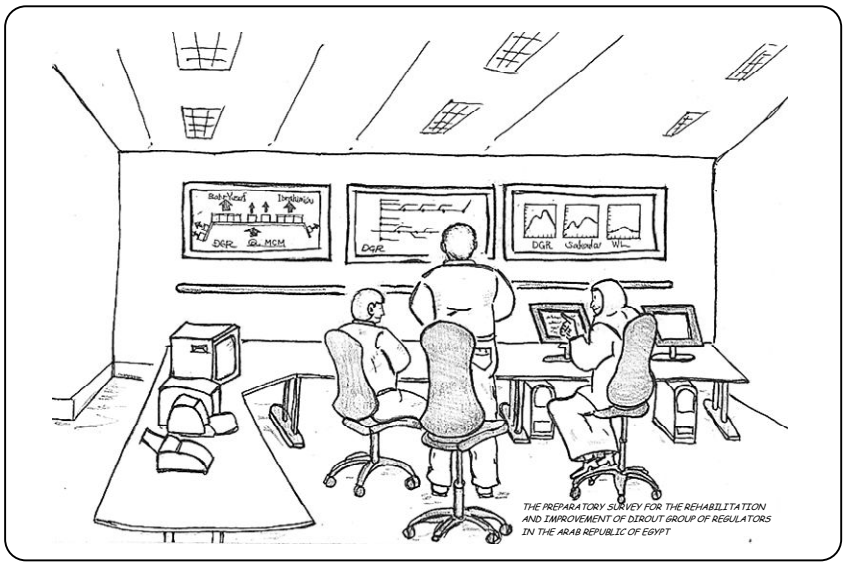


Figure 4.3.5 Image of Improving Water Distribution Operation System

4.4 The Project plan for the Infrastructures of the Minor Structures

4.4.1 Evaluation of the Priority for the Selected Minor Structures

The number of the selected minor structures counted at 128 finally, including original selected minor structure of 125 by the Egyptian side and an additional three (3) as damaged structures by the JICA Study Team during field survey periods, will be assessed. An additional three (3) minor structures are situated in the Giza directorate as one (1) regulator, one (1) pump station and one (1) regulator in the Beni Suef directorate.

Table 4.4.1 Number of selected Minor structures

	Giza	Fayoum	Beni-Suef	Minya	Total
Intake	2	2	11	31	46
Regulator	4	2	1	14	21
Tail escape	0	0	9	5	14
Culvert	0	1	1	0	2
Siphon	0	0	5	1	6
Aqueduct	0	0	3	0	3
Bridge	0	1	2	6	9
Weir	0	19	1	0	20
Pipe line	0	0	3	0	3
Pump station	0	0	1	3	4
Total	6	25	37	60	128

The priority minor structures have been selected to be located in the beneficiary area of the DGR and should be built depending on the requests and opinions of the people who are users or farmers in the local area, as even the scale of minor structures and the beneficiary area are different. Therefore, priority classification should be decided for the time of suitable implementation works, such as within 5 yrs, within 10 yrs, or within in 20 yrs. A fair evaluation method on the minor structures located in the whole beneficiary area under the DGR is expected.

The result of assessment of the priority for the time of implementation work, as to within 5 years, within 10 years and within 20 years, are shown in the following table. Eighty percent (80%) of the minor structures' appropriate implementation works should be required within five (5) years. The total cost for the implementation works is estimated at LE 61,817,000 (¥ 1.1 Billion Yen). The total cost for the implementation works within five (5) years is estimated at LE 59,140,700 (0.97 Billion Yen), sharing 95% of the total cost.

Table 4.4.2 The priority of the selected Minor structure

	Giza	Fayoum	Beni-Suef	Minya	Total
Within 5yrs	4	19	26	54	103
Within 10yrs	1	4	6	4	15
Within 20yrs	1	2	5	2	10
Total	6	25	37	60	128

Table 4.4.3 Cost estimation of the Minor Structure (LE)

	Giza	Fayoum	Beni-Suef	Minya	Total
Within 5yrs	13,860,000	20,788,000	9,147,000	15,345,700	59,140,700
Within 10yrs	105,000	1,470,000	192,000	283,000	2,050,000
Within 20yrs	53,000	206,000	368,000	0	627,000
Total	14,018,000	22,464,000	9,707,000	15,628,700	61,817,700

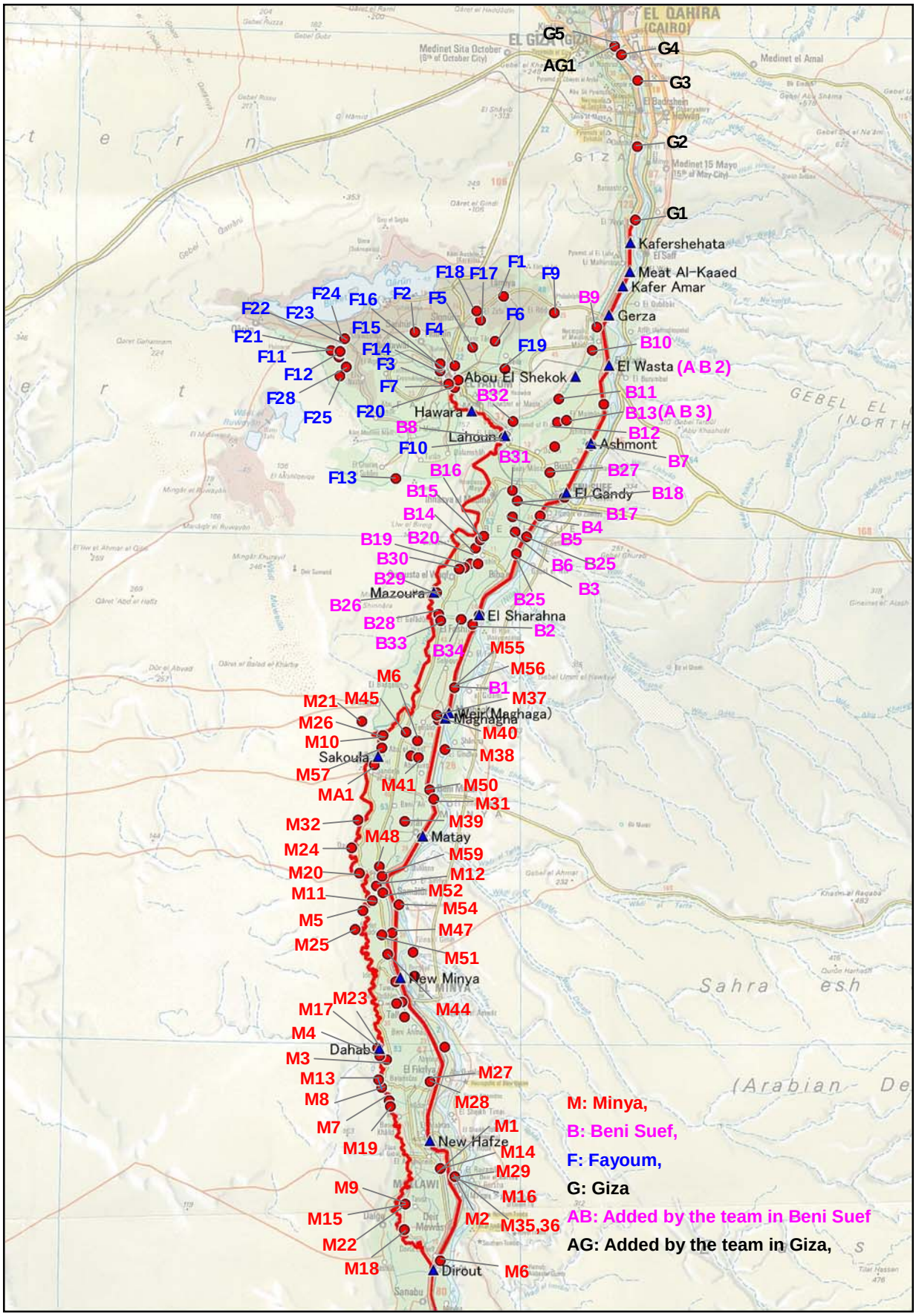


Fig 4.4.1 Location map of the selected Minor Structures

4.4.2 Subjects to be solved for the selected minor structures

The subjects to be solved on the function of each structure are listed on the evaluation sheets. The recommendations are mentioned for the important notes about operation and maintenance by making clear the subjects on the structures.

Weathering, cracks and frictional abrasion are remarkable subjects in each directorate. They are considered to be causes of interference with appropriate water distribution.

The team sees many troubles caused by the trash and garbage in the Giza, Beni Suef and Minya directorates. Some parts of those directorates are facing the problem of fair water supply. This is caused by the garbage stuck in front of the gates, and moreover, that garbage is involved in moving the gate, thereby making trouble and damage for the machine. By contrast in Fayoum, the team can see few troubles concerning the stuck garbage in front of the gate because the geographic feature of different elevation is quite clear; therefore the gravity irrigation method without gates is applied in this area.

Table 4.4.4 Summary table of the problem on the Minor structure (site No.)

	Giza	Fayoum	Beni-Suef	Minya	Total
Water Level shortage	0	0	2	3	5
Water Discharge small	0	19	12	34	65
Sedimentation	0	0	6	9	15
Garbage around the structure	4	0	13	20	37
Weathering Structure	2	20	27	46	95
Crack or Scouring of Structure	2	18	15	31	66
Settling of struc. or facili.	0	1	0	0	1
Damage on the machine	4	1	14	31	50

According to the result of the survey, the minor structures have been in place for more than 50 to 100 years since they were constructed, so the bricks were already aged and the gate machinery was deteriorated. The possibility of repairing these structures is small by the rehabilitation works. Therefore the team recommends that almost all the selected minor structures should be reconstructed or replaced as well as the machineries, even considering the past period since it has been constructed. Accordingly, the structures which have been found lacking in their original function or have diminished in their level of performance should be improved or reconstructed as a first priority. Moreover, it is important that the structures with machineries have maintenance carried out regularly. The team recommends that daily maintenance should be made for the items listed in the table and the engineers should be reminded of it.

According to the information of existing minor structures of 3,000 to 4,000 in the command area, the minor structures requiring the rehabilitation or improvement works might be assumed to be several thousand based on the tendency as to result of this study. Therefore, the deterioration of existing irrigation facilities which have the principal duty for the central irrigation system would be heavily damaged within the basic infrastructures for the agricultural production system in Egypt, assumed from the result of this study. It seems that the deterioration of those facilities and lack of functions should be considered for a further stage.

4.5 Agriculture Plan

4.5.1 Basic Policy of Agriculture Plan in this Survey

The Project is planned in order to improve appropriate and equitable water distribution within the command area as well as to improve irrigation efficiency but subject to the current regulated supply of water by the MWRI. The Project is, therefore, planned to deal with the rehabilitation of the major structure on the main canal, namely the DGR, among the required improvement from the man canal to terminal irrigation facilities, which are under charge of MWRI, except for improving some minor structures.

Therefore other components concerned with agriculture development such as strengthening extension services etc., which are necessary for associating with the external agencies such as the Ministry of Agriculture and Land Reclamation (MALR), are not planned in this Project. Based on this policy, the agriculture plan in this Project concentrates on identifying the increase of productivity with the project that would improve the situation of irrigation water distribution into the command area of DGR.

4.5.2 Proposed Cropping Pattern

On agriculture in the command area of the DGR, maize in the summer season and wheat and berseem in the winter occupy the greater part of the cultivated area. These crops are the major staple grains and fodder (also important for maintaining soil fertility) in Egypt, and they would be cultivated to the same extent as the present as the important crops in the future. There are tendencies of increasing the cultivated area of sugar beet or decreasing the cultivated area of cotton. However, the share of these crops in the command area of the DGR is little, and therefore the effects of increase or decrease of cultivated areas of these crops to the water requirement of the whole command area are not considerable.

There would also be a possibility of changing the cultivated area of vegetables due to the change of market environment, but the water requirement for vegetables are not much different from maize and wheat, and therefore the effects of the proposed Project in this Study are mainly considered from the increase of productivity with the appropriate irrigation water distribution or decrease of productivity in case the Project is not implemented, leaving the deteriorating irrigation facilities.

In summary, the improvement of productivity will be focused on the agriculture plan of this Project and also the plan is preconditioned with no change of water supply currently operated by MWRI. Based on these conditions, the cropping pattern and cropping intensity for the Project is proposed to follow the present cropping pattern and intensity consolidated from the agriculture statistics. Increase of cropping intensity could be considered with the Project situation, but since the present cropping intensity is already as high as 187%, increase of cropping intensity is not considered in the future plan.

Table 4.5.1 shows the command area and cropping intensity by governorate. Table 4.5.2 and Figures 4.5.1 to 4.5.5 show the proposed cropping pattern by governorate. Among the five governorates of the command area of DGR, the command area in the Assuit governorate is around 40% of the total cultivated area in Assuit, while the command areas of the other governorates cover more than 95% of the cultivated area of each governorate. Also the command area in Assuit is located north, attached to the boundary of the Minya governorate. Therefore, the proposed cropping pattern in Minya is applied to the one in Assuit.

Table 4.5.1 Command Area (Beneficiary Area) of DGR

Governorate	Cultivated Area of Governorate(fed)	Command Area of DGR (fed)	Winter Crop		Short Berseem		Summer Crop		Nile Crop		Perenial Crop		Total	
			Area (fed)	(%)	Area (fed)	(%)	Area (fed)	(%)	Area (fed)	(%)	Area (fed)	(%)	Area (fed)	(%)
Giza	203,358	149,600	112,052	74.9%	7,480	5.0%	113,696	76.0%	61,336	41.0%	37,400	25.0%	331,964	221.9%
Beni Suef	291,386	333,700	270,297	81.0%	26,696	8.0%	177,194	53.1%	90,100	27.0%	63,069	18.9%	627,356	188.0%
Fayoum	422,304	401,900	337,998	84.1%	20,095	5.0%	232,701	57.9%	71,940	17.9%	64,304	16.0%	727,038	180.9%
Minya	530,584	525,360	415,560	79.1%	5,254	1.0%	393,495	74.9%	31,522	6.0%	110,325	21.0%	956,156	182.0%
Sub-total	1,447,632	1,410,560	1,135,907	80.5%	59,525	4.2%	917,086	65.0%	254,898	18.1%	275,098	19.5%	2,642,514	187.3%
Assuit	352,728	154,540	122,240	79.1%	1,545	1.0%	115,751	74.9%	9,272	6.0%	32,454	21.0%	281,262	182.0%
Total	1,800,360	1,565,100	1,258,147	80.4%	61,070	3.9%	1,032,837	66.0%	264,170	16.9%	307,552	19.7%	2,923,776	186.8%
Governorate	Cultivated Area of Governorate(ha)	Command Area of DGR (ha)	Winter Crop		Short Berseem		Summer Crop		Nile Crop		Perenial Crop		Total	
			Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Giza	85,410	62,832	47,062	74.9%	3,142	5.0%	47,752	76.0%	25,761	41.0%	15,708	25.0%	139,425	221.9%
Beni Suef	122,382	140,154	113,525	81.0%	11,212	8.0%	74,421	53.1%	37,842	27.0%	26,489	18.9%	263,490	188.0%
Fayoum	177,368	168,798	141,959	84.1%	8,440	5.0%	97,734	57.9%	30,215	17.9%	27,008	16.0%	305,356	180.9%
Minya	222,845	220,651	174,535	79.1%	2,207	1.0%	165,268	74.9%	13,239	6.0%	46,337	21.0%	401,586	182.0%
Sub-total	608,005	592,435	477,081	80.5%	25,001	4.2%	385,176	65.0%	107,057	18.1%	115,541	19.5%	1,109,856	187.3%
Assuit	148,146	64,907	51,341	79.1%	649	1.0%	48,615	74.9%	3,894	6.0%	13,631	21.0%	118,130	182.0%
Total	756,151	657,342	528,422	80.4%	25,649	3.9%	433,792	66.0%	110,951	16.9%	129,172	19.7%	1,227,986	186.8%

Source: Cultivated Area of Governorate: Agriculture Directorates in Minia, Beni Suef, Fayoum and Giza, MALR; Commad Area: MWRI
(Because the jurisdiction of Irrigation Directorates and Governorates are different, cultivated area of Beni Suef is smaller than command area (part of the command area of Beni suef belongs to Giza))

Table 4.5.2 Proposed Cropping Intensity by Crop

Season	Crop	Giza		Beni Suef		Fayoum		Minia		Assuit		Total	
		Area (fed)	(%)	Area (fed)	(%)	Area (fed)	(%)	Area (fed)	(%)	Area (fed)	(%)	Area (fed)	(%)
Winter	Wheat	27,227	8.2%	150,499	24.0%	157,545	21.7%	214,872	22.5%	63,207	22.5%	613,350	21.0%
	L. Berseem	36,054	10.9%	53,726	8.6%	105,298	14.5%	118,731	12.4%	34,926	12.4%	348,735	11.9%
	Sugar beet	449	0.1%	12,013	1.9%	13,263	1.8%	7,880	0.8%	2,318	0.8%	35,923	1.2%
	Legums	150	0.0%	667	0.1%	2,813	0.4%	5,254	0.5%	1,545	0.5%	10,429	0.4%
	Vegetables	45,030	13.6%	40,378	6.4%	34,563	4.8%	37,301	3.9%	10,972	3.9%	168,244	5.8%
	Other crops	3,142	0.9%	13,014	2.1%	24,516	3.4%	31,522	3.3%	9,272	3.3%	81,466	2.8%
	S. Berseem	7,480	2.3%	26,696	4.3%	20,095	2.8%	5,254	0.5%	1,545	0.5%	61,070	2.1%
Summer	Rice	0	0.0%	667	0.1%	20,497	2.8%	0	0.0%	0	0.0%	21,164	0.7%
	Maize	21,692	6.5%	129,142	20.6%	48,228	6.6%	273,187	28.6%	80,361	28.6%	552,610	18.9%
	Sorghum	299	0.1%	1,001	0.2%	68,323	9.4%	8,931	0.9%	2,627	0.9%	81,181	2.8%
	Oil Crops	3,441	1.0%	5,673	0.9%	10,048	1.4%	36,775	3.8%	10,818	3.8%	66,755	2.3%
	Vegetables	67,021	20.2%	35,372	5.6%	29,339	4.0%	70,924	7.4%	20,863	7.4%	223,519	7.6%
	Other Crops	21,243	6.4%	5,339	0.9%	56,266	7.7%	3,678	0.4%	1,082	0.4%	87,608	3.0%
Nile	Maize	22,440	6.8%	73,748	11.8%	31,348	4.3%	0	0.0%	0	0.0%	127,536	4.4%
	Sorghum	299	0.1%	6,007	1.0%	2,411	0.3%	0	0.0%	0	0.0%	8,717	0.3%
	Vegetables	24,385	7.3%	7,675	1.2%	20,497	2.8%	31,522	3.3%	9,272	3.3%	93,351	3.2%
	Other Crops	14,212	4.3%	2,670	0.4%	17,684	2.4%	0	0.0%	0	0.0%	34,566	1.2%
	Sugar cane	1,945	0.6%	1,001	0.2%	402	0.1%	41,503	4.3%	12,209	4.3%	57,060	2.0%
	Cotton	0	0.0%	45,383	7.2%	28,535	3.9%	36,775	3.8%	10,818	3.8%	121,511	4.2%
	Fruit trees	35,455	10.7%	16,685	2.7%	35,367	4.9%	32,047	3.4%	9,427	3.4%	128,981	4.4%
Total		331,964	100.0%	627,356	100.0%	727,038	100.0%	956,156	100.0%	281,262	100.0%	2,923,776	100.0%
Cultivated Area (fed)		149,600		333,700		401,900		525,360		154,540		1,565,100	
Cropping Intensity (%)		221.9%		188.0%		180.9%		182.0%		182.0%		186.8%	

Giza

Season	Crop	Cropped Area (fed)	Share (%)	Cropped Area by month (fed) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter	Wheat	27,227	8.2%												
	L. Berseem	36,054	10.9%												
	Sugar beet	449	0.1%												
	Legums (Broad Bean)	150	0.0%												
	Vegetables (Tomato)	45,030	13.6%												
	Other crops (Marjoram)	3,142	0.9%												
	S. Berseem	7,480	2.3%												
Summer	Maize	21,692	6.5%												
	Sorghum	299	0.1%												
	Oil Crops (Sun flower)	3,441	1.0%												
	Vegetables (Tomato)	67,021	20.2%												
	Other Crops (Basil)	21,243	6.4%												
Nile	Maize	22,440	6.8%												
	Sorghum	299	0.1%												
	Vegetables (Tomato)	24,385	7.3%												
	Other Crops (Basil)	14,212	4.3%												
	Sugar cane	1,945	0.6%												
Permanent	Fruit trees (Citrus)	35,455	10.7%												
	Total	331,964													

Figure 4.5.1 Proposed Cropping Pattern (Giza)

Beni Suef

Season	Crop	Cropped Area (fed)	Share (%)	Cropped Area by month (fed) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter	Wheat	150,499	24.0%												
	L. Berseem	53,726	8.6%												
	Sugar beet	12,013	1.9%												
	Legums (Broad Bean)	867	0.1%												
	Vegetables (Onion)	40,378	6.4%												
	Other crops (Marjoram)	13,014	2.1%												
	S. Berseem	26,696	4.3%												
	Rice	867	0.1%												
Summer	Maize	129,142	20.6%												
	Sorghum	1,001	0.2%												
	Oil Crops (Sun flower)	5,673	0.9%												
	Vegetables (Cucumber)	35,372	5.6%												
	Other Crops (Basil)	5,339	0.9%												
Nile	Maize	73,748	11.8%												
	Sorghum	6,007	1.0%												
	Vegetables (Cucumber)	7,675	1.2%												
	Other Crops (Basil)	2,670	0.4%												
	Sugar cane	1,000	0.2%												
Permanent	Cotton	45,383	7.2%												
	Fruit trees (Citrus)	16,685	2.7%												
	Total	627,356													

Figure 4.5.2 Proposed Cropping Pattern (Beni Suef)

Fayoum

Season	Crop	Cropped Area (fed)	Share (%)	Cropped Area by month (fed) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter	Wheat	157,545	21.7%												
	L. Berseem	105,298	14.5%												
	Sugar beet	13,263	1.8%												
	Legums (Broad bean)	7,812	0.8%												
	Vegetables (Tomato)	34,563	4.8%												
	Other crops (Marjoram)	24,516	3.4%												
	S. Berseem	20,095	2.8%												
Summer	Rice	20,497	2.8%												
	Maize	48,228	6.6%												
	Sorghum	68,323	9.4%												
	Oil Crops (Sun flower)	10,048	1.4%												
	Vegetables (Melon)	29,339	4.0%												
	Other Crops (Basil)	56,266	7.7%												
Nile	Maize	31,348	4.3%												
	Sorghum	2,411	0.3%												
	Vegetables (Melon)	20,497	2.8%												
	Other Crops (Basil)	17,684	2.4%												
Permanent	Sugar cane	402	0.1%												
	Cotton	28,535	3.9%												
	Fruit trees (Olive)	35,367	4.9%												
	Total	727,038													

Figure 4.5.3 Proposed Cropping Pattern (Fayoum)

Minia

Season	Crop	Cropped Area (fed)	Share (%)	Cropped Area by month (fed) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter	Wheat	214,872	22.5%												
	L. Berseem	118,731	12.4%												
	Sugar beet	7,860	0.8%												
	Legums (Broad bean)	5,254	0.5%												
	Vegetables (Tomato)	37,301	3.9%												
	Other crops (Majoram)	31,522	3.3%												
	S. Berseem	5,254	0.5%												
Summer	Maize	273,187	28.6%												
	Sorghum	8,931	0.9%												
	Oil Crops (Sun flower)	36,775	3.8%												
	Vegetables (Tomato)	70,924	7.4%												
	Other Crops (Basil)	3,678	0.4%												
Nile	Vegetables (Tomato)	31,522	3.3%												
Permanent	Sugar cane	41,503	4.3%												
	Cotton	36,775	3.8%												
	Fruit trees (Grape)	32,047	3.4%												
	Total	956,136													

Figure 4.5.4 Proposed Cropping Pattern (Minya)

Assiut

Season	Crop	Cropped Area (fed)	Share (%)	Cropped Area by month (fed) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter	Wheat	63,207	22.5%												
	L. Berseem	34,926	12.4%												
	Sugar beet	2,308	0.8%												
	Leguns (Broad bean)	1,545	0.5%												
	Vegetables (Tomato)	10,972	3.9%												
	Other crops (Majoram)	9,272	3.3%												
	S. Berseem	1,545	0.5%												
Summer	Maize	80,361	28.6%												
	Sorghum	2,627	0.9%												
	Oil Crops (Sun flower)	10,818	3.8%												
	Vegetables (Tomato)	20,863	7.4%												
	Other Crops (Basil)	1,082	0.4%												
Nile	Vegetables (Tomato)	9,272	3.3%												
Permanent	Sugar cane	12,209	4.3%												
	Cotton	10,818	3.8%												
	Fruit trees (Grape)	9,427	3.4%												
	Total	281,262													

Figure 4.5.5 Proposed Cropping Pattern (Assuit)

4.5.3 Proposed Incremental Ratio of Crop Yield

The expected increase of productivity, namely the increase of unit yield of crops with the Project, is examined based on the result of the baseline survey carried out in this Survey. The baseline survey was carried out in the area where farmers are suffering from water shortage, and in the survey the farmers were asked about the degree of water shortage. The proposed incremental ratio of yield by improving water distribution was examined based on the analysis of correlation between the level of unit yield and the degree of water shortage.

As shown in Table 4.5.3, Figure 4.5.6 and Figure 4.5.7, the fairly strong correlation was observed between the degrees of water shortage rated by five levels and the level of yields for maize (representing summer crops) and wheat (representing winter crops). Based on this analysis, the incremental ratio of unit yield by improving water distribution by one degree in five ranks is proposed at 9% for maize (summer crop) and 4% for wheat (winter crop). Comparing to the incremental ratios applied in other project and the standard applied in the land

Table 4.5.3 Baseline Survey Result (Water Shortage and Yield

Degree of Water Shortage	Ave. Yield (t/fed)		No. of Valid Sample	
	Maize	wheat	Maize	wheat
1	2.495	2.191	37	49
2	2.345	2.501	19	25
3	2.531	2.511	27	23
4	2.741	2.483	21	36
5	3.449	2.685	5	11
Statistics	3.330	2.800		

Degree:

1 Water shortage frequently occurs and gives considerable damage to crops.
2 Water shortage frequently occurs and gives little damage to crops.
3 Water shortage often occurs but does not affect crop growth.
4 Water shortage occurs only on a few occasions.
5 Water shortage does not occur at all.

(Source: JICA Study Team)

improvement project in Japan, these incremental ratios are considered appropriate to be the basis of estimating the benefit of the Project.[1]

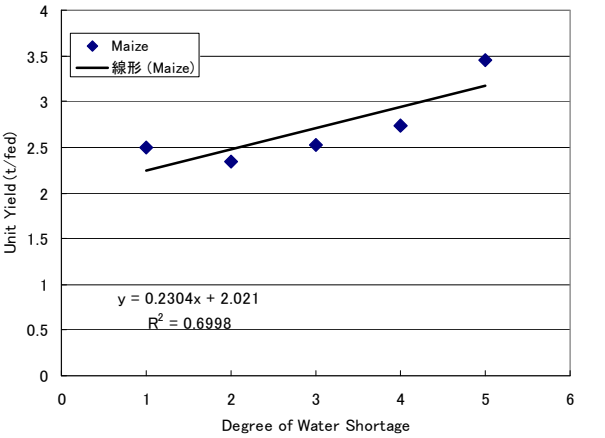


図 4.5.6　Yield and Degree of Water Shortage (maize)

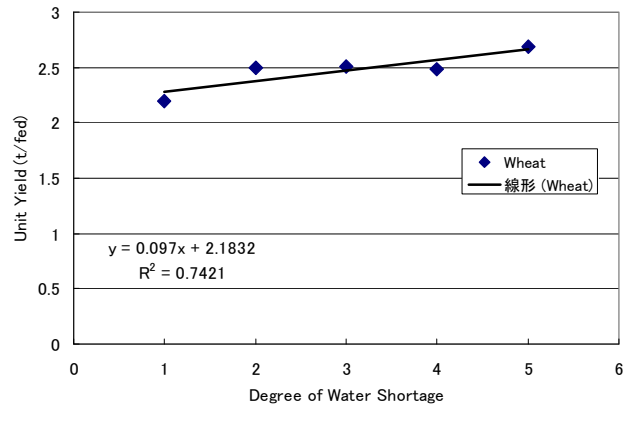


図 4.5.7　Yield and Degree of Water Shortage (wheat)

Table 4.5.4　Proposed Incremental Ratio with Project

Maize (to represent Summer / Nile crop)				Wheat (Winter / Perenial crop)			
Degree	Yield (t/fed)	Increment		Degree	Yield (t/fed)	Increment	
		per rank	cumlative.			per rank	cumlative.
1	2.25			1	2.28		
2	2.48	10.2%	10.2%	2	2.38	4.4%	4.4%
3	2.71	9.3%	20.4%	3	2.47	3.8%	8.3%
4	2.94	8.5%	30.7%	4	2.57	4.0%	12.7%
5	3.17	7.8%	40.9%	5	2.67	3.9%	17.1%
	Ave.	9.0%			Ave.	4.0%	
Y = 0.2304X + 2.021				Y = 0.097X + 2.1832			

[1] IIIMP project funded by the World Bank, which includes the improvement of terminal irrigation system, sets the incremental ratios of maize and wheat at 21% and 8% respectively in the new unimproved area, and 11% and 4% respectively in previously improved area. Also the land improvement project in Japan sets the standard of incremental ratios for irrigation improvement from 5% to 30% according to crops.

CHAPTER 5

IMPLEMENTATION PLAN OF THE PROJECT

CHAPTER 5: IMPLEMENTATION PLAN OF THE PROJECT

5.1 The Project Plan

5.1.1 The Project Plan of the Infrastructures

(1) Contents of the Plan of the Infrastructures

The Project consists of the following three (3) components for the rehabilitation and improvement of the Dirout Group of Regulators (DGR):

(a) New construction of the regulators as the DGR at 140 m downstream from existing DGR
(b)Establishment of the Improving Water Distribution System by the communication equipment
(c)Rehabilitation of the minor structures selected by the MWRI

The components of (a) and (b) are inseparably linked to each other for restoring the original function of the existing DGR with the rehabilitation of the DGR and the establishment of the Improving Water Distribution System for supporting the daily decision-making procedure of the water management policy. The Project is planned for understanding the above-mentioned.

The components of (c) are defined as restoration of the function of the irrigation on the terminal farm of 600,000 ha by restoration of the function of the water distribution at DGR. The rehabilitation plan of the selected minor structures is defined as a key project for creating the benefit of the Project.

The responsible agencies of the sub-projects are divided into two, shown as follows:

- The responsible agency of the sub-projects of (a) and (b) is RGBS.
- The responsible agencies of the sub-project (c) are the Directorate offices under the Irrigation Sector, located in the five Governorates of Assuit, Minya, Fayum, Beni Suef and Giza.

(2) Project Description of the Infrastructures

Three (3) sub projects consist of following works.

Table 5.1.1 Main project

(a) New construction of Dirout Group of Regulators	
(i) New construction of regulators	Construction works of five regulators
(ii) Installation of the gates	W8.0m×H6.3m ; 7vents W4.0m×H2.3 and 2.8m ; 5vents
(iii) Peripherals improvement of facilities	Construction of maintenance bridge Improvement of existing Mosque
(iv) Coffer dam works	Single & Double Coffer dams by Steel Sheet-pile
(b) Improving Water Distribution System	
(i) Monitoring system for IWMS of Regulators along Main canals	Installation of the monitoring equipment
(ii) Monitoring system for IWMS of Intakes along branch canals	Installation of the monitoring equipment
(iii) Construction of the building for IWMS Center	Construction of the building for IWMS Center
(c) Rehabilitation of Priority Minor Structures	
(i) First Priority Structures	Implementation within five (5) years
(ii) Second Priority Structures	Implementation within 10 years
(iii) Third Priority Structures	Implementation within 20 years

5.1.2 The Project Plan of the Technical Cooperation

The gate operation of the regulator in Egypt has been carried out by the Downstream Water Level Control Method for the Water Management. Therefore, to introduce the new Water Management Method by keeping the stable water level of upstream and the stable water distribution with an over-flow type gate, a trial period and technical cooperation for the gate operation shall be needed.

For the past grant aid projects by Japan's Government for the regulators located along the Bahr Yusef Irrigation Canal, the technical transfer regarding operation and maintenance of the gate and instruction of console panel as On the Job Training (OJT) has been executed on the basics of hardware. But, technical transfer for the latest water management technology by keeping the stable water level of upstream and importance of water distribution has not been carried out continuously, with the exception of only two times of the dispatching of the short-term expert of the water management in 2003 and 2006. Therefore, to introduce the over-flow type gate and to realize the appropriate water distribution into the seven (7) main canals, the technical cooperation of software technology for learning of the gate operation should be done.

To realize the integrated management and control for the entire gate systems of the DGR, appropriate evaluation and quick judgment on the collected data should be required based on using the IT equipment like Personal Computers (PCs). The soft technology for supporting the integrated water distribution method on the wide area is also an essential component to realize the Improving Water Distribution System, including the multi-data handling technology.

For maximizing the effectiveness through the project, the technical cooperation activities shall be proposed as shown below based on above-mentioned. The technical cooperation activity is assumed to be six Japanese long-term specialists, five Japanese short-term specialists, and four Egyptian engineers' training in Japan. The cost of technical cooperation is estimated to be about 40 million LE.

Table 5.1.2 Technical Cooperation

Items	Contents
Technical Cooperation	・Operation/Maintenance (O/M) of the DGR. ・O/M of the Bahr Yusef Main Canal with O/M for Regulators along main canal and O/M for Intake along branch canal. ・O/M of the Ibrahimia Main Canal with O/M for Regulators along main canal and O/M for Intake along branch canal. ・O/M of the Improving Water Distribution System
	・Short Term Training in Japan of Egyptian engineers for the Improving Water Distribution System.

Table 5.1.3 Dart scheme of the Technical Cooperation

Required Expert and Year	1st	2nd	3rd
<Long-term expert>			
(1) Team leader (Water resources planning)	▬ ▬ ▬	▬ ▬ ▬	▬ ▬ ▬
(2) Irrigation Eng. (Water management)	▬ ▬ ▬	▬ ▬ ▬	▬ ▬ ▬
(3) System Eng. (Data management)	▬ ▬ ▬	▬ ▬ ▬	▬ ▬ ▬
(4) Hydraulic Eng. (Field monitoring)	▬ ▬ ▬	▬ ▬ ▬	▬ ▬ ▬
(5) Irrigation Eng. (On-farm water management)	▬ ▬ ▬	▬ ▬ ▬	▬ ▬ ▬
(6) Training programer	▬ ▬ ▬	▬ ▬ ▬	▬ ▬ ▬
<Short-term expert>			
Hydraulic Eng (Filed monitoring)	▬	▬	▬
Water management Eng. (O/M)	▬	▬	▬
Computer programmer	▬	▬	▬
Telecommunication facilities Eng.	▬	▬	▬
Specialist (as required)	▬	▬	▬

5.2 Implementation Schedule

The Loan Agreement (L/A) between the Government of Egypt and the Government of Japan is concluded after the conclusion of the Exchange of Note (E/N) on the grant of the Japanese Yen Loan. The Project can proceed to the next stage as the Implementation after the E/N. The Implementation Schedule is planned into two (2) stages as follows:

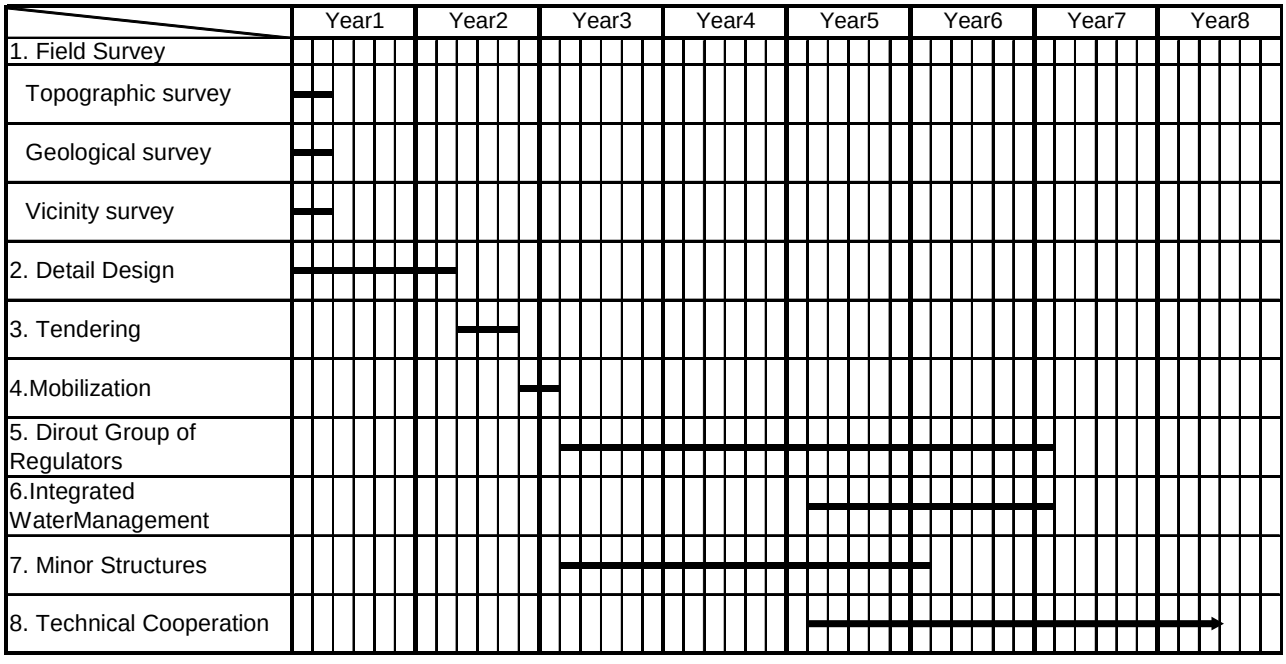
Stage 1: Detailed Design, including design and tendering of documents, management of the International Competitive Bidding, (ICB) and the Consulting Services to assist the execution of the Japanese Yen Loan Project.

Stage 2: Implementation of the Project (Construction Works, Procurement and Supervision)

After execution of the required Detail Field Survey, Detail Design and Cost Estimation and Project Evaluation shall be executed based on the result of the Feasibility Study, the Tendered Document shall be prepared, and services will be consulted for the supporting of the Executive Agency of the Japanese Yen Loan for the smooth implementation of the Project. The periods of the Stage 1 are considered of two (2) years.

During the Stage 2 periods, the procurement and construction works are executed. The periods of Stage 2 are expected to take four (4) years.

Table 5.1.4 Entire schedule of the project



5.3 Project Cost

(1) Cost

The project cost consists of the direct cost, the engineering services, the physical contingency and price contingency. The project cost was estimated as indicated below.

Table 5.1.5 Project Cost

Items	Project Cost(1,000LE)		Total (1,000LE)	Exchange to "YEN" (Mil. YEN)
	Foreign Currency	Local Currency		
Dirout Group of Regulators	324,044	139,773	463,817	7,699
Improving Water Distribution System	37,110	4,123	41,233	685
Sub Total	**361,154**	**143,896**	**505,050**	**8,384**
Priority Minor Structures	60,712	26,019	86,731	1,440
Entire total	**421,866**	**169,915**	**591,781**	**9,824**

Rate : 1 LE = 16.6 YEN (Reference: 1 US$ = 91.7 YEN)

The each items of project approximate cost is estimated indicated below.

Table 5.1.6 Cost of New DGR

ITEM	Unit		Local C. (LE)	Foreign C. US$	Foreign C. (YEN)	Exchange to "Yen"
Cost of civil works						
Excavation	m^3	69,600	1,452,000	0	0	
Embankment(include by bull and by man)	m^3	48,700	3,575,000	0	0	
Demolition work	m^3	450	80,309	0	0	
Sheet pile protection (include all works)	m	415	5,199,000	0	188,842,000	
Rip rap bank protection	m^2	10,550	3,162,000	0	659,000	
Canal bed protection	m^2	9,380	4,559,000	0	9,720,000	
Concrete works for regulator	m^3	18,390	24,790,000	0	10,335,000	
Foundation works for regulator (pile)	pc	1,305	12,162,000	0	0	
Road work (include the guard pipe)	m	200	2,312,000	0	321,000	
Control house (2 stories)	m^2	300	2,604,000	0	1,288,000	
Electric works (Generator, light, etc.)	Unit	1	3,920,000	0	0	
Gate manufacturers and works	Unit	1	0	0	1,276,000,000	
Expense of the machine and facility	Unit	1	9,464,000	0	122,380,000	
Sub total : A			73,279,309	0	1,609,545,000	
Cost of temporary works						
Double sheet pile	m	540	4,865,000	0	43,730,000	
Single sheet pile	m	1,020	5,307,000	0	86,619,000	
Temporary bridge	m^2	1,180	1,273,000	0	19,733,000	
Deep well	m^2	23,330	8,996,000	0	0	
Temporary road and water stop works	Unit	1	5,412,000	0	11,101,000	
Preparatory works (5% of above works)	%	5	1,293,000	0	8,059,000	
Transportation / Shipment	Unit	1	10,090,000	4,884,000	316,720,000	
Sub total :B			37,236,000	4,884,000	485,962,000	
Direct cost : C (A+B)	Unit	1	110,515,309	4,884,000	2,095,507,000	4,377,923,929
Indirect cost (for the direct cost) : D	%	35			1,532,273,000	1,532,273,000
Construction cost of the DGR : E (C+D)	Unit	1	110,515,309	4,884,000	3,627,780,000	5,910,196,929
Consultant service : F (for the construction cost : E)	%	10			591,020,000	591,020,000
Adimi. cost for RGBS (for the direct cost totally : C)	%	5	13,200,000			219,120,000
Tax for the LC : G (for the direct cost LC : C)	%	10	11,052,000			183,463,200
Base cost of the DGR : H	Unit	1	134,767,309	4,884,000	4,218,800,000	6,903,800,129
Physical contingency : I (for the base cost :H)	%	5	6,738,000	244,000	210,940,000	345,165,600
Price contingency for LC : J (for the base cost :H)	%	14.5	19,541,000			324,380,600
Price contingency for FC : K (for the base cost :H)	%	2.7		132,000	113,908,000	126,012,400
Total cost of the DGR (H+I+J+K)	Unit	1	161,046,309	5,260,000	4,543,648,000	7,699,358,729

Exchange the total cost of the DGR to "LE" → **463,817,000**

Remarks : To keep the existing DGR as historical monument according to the recommendation from the Steering committee, the preservation work will be required and the cost will be estimated in further study of detail design .

Table 5.1.7 Cost of Improving Water Distribution System

Item	Unit Cost (LE)	Quantity	Amount (LE)
Central Control House	11,330,000	1	11,330,000
Dirout Control House	8,271,000	1	8,271,000
Main Canal Regulator telemetry station			
Bahr Yusef Canal			
Telemetry Type-1	480,000	4	1,920,000
Telemetry Type-2	310,000	1	310,000
Ibrahimia Canal			
Telemetry Type-4	410,000	1	410,000
Telemetry Type-2	310,000	5	1,550,000
Telemetry Type-3	230,000	3	690,000
sub total			4,880,000
Branch Canal Intake telemetry station			
Bahr Yusef Canal	200,000	4	800,000
Ibrahimia Canal	200,000	34	6,800,000
Quarun lake	200,000	1	200,000
sub total			7,800,000
Enhancement of O/M	2,000,000	1	2,000,000
TOTAL			34,281,000
			34,000,000(LE)

Item	Local C. (LE)	Foreing C. (LE)	Total (LE)	Exchange to "YEN"
(1) Construction cost	3,400,000	30,600,000	34,000,000	564,400,000
(2) Engineering service(10% of (1))	340,000	3,060,000	3,400,000	56,440,000
(3) Sub Total	3,740,000	33,660,000	37,400,000	620,840,000
(4) Physical contengency(5% of (3))	187,000	1,683,000	1,870,000	31,042,000
(5) Price contengency(5% of (3) and (4))	196,350	1,767,150	1,963,500	32,594,100
Total Cost	4,123,350	37,110,150	41,233,500	684,476,100

Table 5.1.8 Cost of Priority Minor Structure

Item	Unit		Giza Pre.	Fayoum Pre.	Beni-Suef Pre.	Minya Pre.	Total (LE)	Exchange to "YEN"
A : Cost of the direct								
Category "Within 5yrs"			10,266,667	15,398,519	6,775,555	11,367,185		
Category "Within 10yrs"			77,778	1,088,889	142,222	209,630		
Category "Within 20yrs"			39,259	152,593	272,593	0		
Sub-total of the direct cost	Unit	1	10,383,704	16,640,001	7,190,370	11,576,815		
B : Cost of the indirect								
Category "Within 5yrs"	%	35	3,593,333	5,389,481	2,371,444	3,978,514		
Category "Within 10yrs"	%	35	27,222	381,111	49,778	73,371		
Category "Within 20yrs"	%	35	13,741	53,407	95,408	0		
Sub-total of the indirect cost	Unit	1	3,634,296	5,823,999	2,516,630	4,051,885		
C=A+B : Cost of the direct and indirect								
Category "Within 5yrs"	Unit	1	13,860,000	20,788,000	9,147,000	15,345,700	59,140,700	981,735,620
Category "Within 10yrs"	Unit	1	105,000	1,470,000	192,000	283,000	2,050,000	34,030,000
Category "Within 20yrs"	Unit	1	53,000	206,000	368,000	0	627,000	10,408,200
Sub-total of the direct and indirect cost	Unit	1	14,018,000	22,464,000	9,707,000	15,628,700	61,817,700	1,026,173,820
D : Consultant service (for the construction cost : C)								
Category "Within 5yrs"	%	10	1,386,000	2,078,800	914,700	1,534,570	5,914,070	98,173,562
Category "Within 10yrs"	%	10	10,500	147,000	19,200	28,300	205,000	3,403,000
Category "Within 20yrs"	%	10	5,300	20,600	36,800	0	62,700	1,040,820
Sub-total of the Consultant service	Unit	1	1,401,800	2,246,400	970,700	1,562,870	6,181,770	102,617,382
E : Tax for the LC (for the direct cost : A)								
Category "Within 5yrs"	%	10	1,026,667	1,539,852	677,556	1,136,719	4,380,794	72,721,180
Category "Within 10yrs"	%	10	7,778	108,889	14,222	20,963	151,852	2,520,743
Category "Within 20yrs"	%	10	3,925	15,259	27,259	0	46,443	770,954
Sub-total of the Tax	Unit	1	1,038,370	1,664,000	719,037	1,157,682	4,579,089	76,012,877
F=C+D+E : Base cost of the Minor structure								
Category "Within 5yrs"	Unit	1	16,272,667	24,406,652	10,739,256	18,016,989	69,435,564	1,152,630,362
Category "Within 10yrs"	Unit	1	123,278	1,725,889	225,422	332,263	2,406,852	39,953,743
Category "Within 20yrs"	Unit	1	62,225	241,859	432,059	0	736,143	12,219,974
Sub-total of the base cost	Unit	1	16,458,170	26,374,400	11,396,737	18,349,252	72,578,559	1,204,804,079
G : Physical contingency (for the base cost : F)								
Category "Within 5yrs"	%	5	813,633	1,220,333	536,963	900,850	3,471,779	57,631,531
Category "Within 10yrs"	%	5	6,164	86,294	11,271	16,613	120,342	1,997,677
Category "Within 20yrs"	%	5	3,112	12,093	21,603	0	36,808	611,013
Sub-total of the physical contingency	Unit	1	822,909	1,318,720	569,837	917,463	3,628,929	60,240,221
H : Price contingency during 5 yrs (for the base cost : F)								
Category "Within 5yrs"	%	14.5	2,359,537	3,538,965	1,557,192	2,612,463	10,068,157	167,131,406
Category "Within 10yrs"	%	14.5	17,875	250,254	32,686	48,178	348,993	5,793,284
Category "Within 20yrs"	%	14.5	9,023	35,070	62,649	0	106,742	1,771,917
Sub-total of the price contingency	Unit	1	2,386,435	3,824,289	1,652,527	2,660,641	10,523,892	174,696,607
Project Cost of the Minor structure (F+G+H)								
Category "Within 5yrs"	Unit	1	19,445,837	29,165,950	12,833,411	21,530,302	82,975,500	1,377,393,300
Category "Within 10yrs"	Unit	1	147,317	2,062,437	269,379	397,054	2,876,187	47,744,704
Category "Within 20yrs"	Unit	1	74,360	289,022	516,311	0	879,693	14,602,904
Total cost	Unit	1	19,667,514	31,517,409	13,619,101	21,927,356	86,731,380	1,439,740,908

(2) The condition of cost estimation

● **Rate**

Foreign currency (FC) of the rate: YEN/$ US$1 = 91.7YEN

Local currency (LC) of the rate : YEN/LE LE1 = 16.6YEN (LE : Egyptian pound)

(Reference)

Local currency (LC) of the rate: YEN/EUR EUR1 = 114 YEN

The rate of foreign currency is calculated by the published value from the Bank of Japan (BOJ), and the rate of local currency is calculated by converting the LC for US$ to YEN, which is sourced by the Central Bank of Egypt. (Original source from JICA)

● **Price escalation**

The annual average price escalation for the LC and FC are calculated by the price escalation from 2005 to 2009 and the currency exchange rate. (Original source from JICA)

for Foreign currency (FC): 1.8 % (the annual average rate of price escalation)

for Local currency (LC) : 9.2 % (the annual average rate of price escalation)

As mentioned above, as a basic condition, the rate of price escalation and project cost is calculated for each year in the four (4) years of the construction term of the new DGR, and these are averaged and weighted in four (4) years. This is the rate of price escalation for the project.

for Foreign currency (FC): 2.7 % (the average rate of price escalation for the project)

for Local currency (LC) : 14.5 % (the average rate of price escalation for the project)

Table 5.1.9 Examination of the Price escalation

Price escalation for four years

	for FC	for LC	for FC	for LC
BASE Rate =	9.200	1.800		
Term	(1+a)xB=			
1	1.000	1.000		
2	1.092	1.018	0.092	0.018
3	1.192	1.036	0.192	0.036
4	1.302	1.055	0.302	0.055

Rate after 1 yr = (1+a) x B

a=9.2 or 1.8

B=rate of previous year

Price Contingency Rate

	Term-1	Term-2	Term-3	Term-4	SUM	Weighted average rate
Disbursement	15 %	35 %	35 %	15 %	(Base cost)	
Prce rate %	0.000	0.092	0.192	0.302		
Cost every Term	20,215,096	47,168,558	47,168,558	20,215,096	134,767,309	LE
LC (LE)	0	4,339,507	9,056,363	6,104,959	19,500,829	0.145
Prce rate %	0.000	0.018	0.036	0.055		
Cost every Term	732,600	1,709,400	1,709,400	732,600	4,884,000	US$
FC (US$)	0	30769.2	61538.4	40293	132,601	0.027
Cost every Term	632,820,000	1,476,580,000	1,476,580,000	632,820,000	4,218,800,000	YEN
FC (YEN)	0	26,578,440	53,156,880	34,805,100	114,540,420	0.027

● Physical contingency

According to the appraisal manual (Sep. 2008) by JBIC, it is shown at 5 %. This is adopted as the rate of physical contingency for the project.

● Undirected cost

According to the actual construction records in Egypt and other investigations, 35 % for the directed cost is adopted.

● Consultant service

According to the case-example of other projects, such as F/S study, 10% is assumed for the construction cost.

● Total cost of the labor, material and equipment

The basic total cost of the labor, material and special equipment such as gate facility are ascertained after the requests for quotations. Then, the total price of sheet pile and other special equipment will be determined by referring to the other projects in Egypt, such as regulator works.

5.4 Project Implementation Structure

5.4.1 Implementation Agency

(1) Name of the agency

It is proposed that The Reservoirs and Grand Barrages Sector (RGBS) under The Ministry of Water Resources and Irrigation will be the main executing and implementation agency for the investment of the proposed project for the rehabilitation and improvement of the Dirout Group of Regulators (DGR). The Project will be implemented as a single purpose project of the stabilization of the irrigation water distribution which is one of the main duties of the Ministry of Water Resources and Irrigation.

(2) Operation structure of the project and capacity of the agency

The responsible agency of the project is the Ministry of Water Resources and Irrigation (MWRI). The structure of MWRI is shown below. The executing agency of the Project is RGBS, which belongs to the Irrigation Authority.

Structures of Ministry of Water Resources and Irrigation

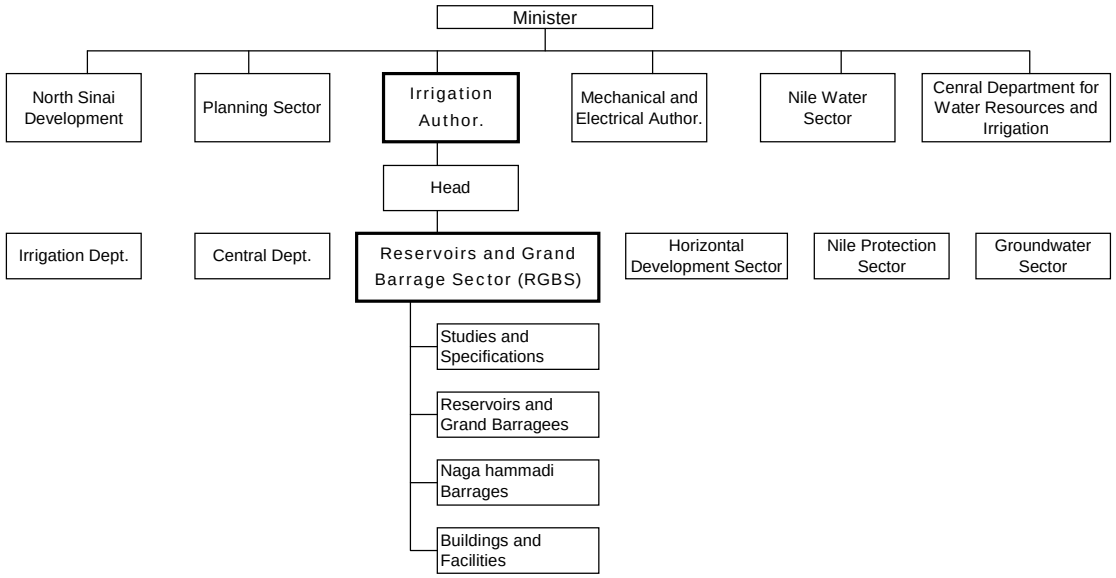


Fig 5.1.1 Organization chart of the Ministry of MWRI

The number of permanent personnel under the MWRI and the RGBS are summarized as follows:

	Ministry	RGBS
Engineers	4,068	287
Staff members	109,018	514
Total	113,086	801

The RGBS, which is the responsible agency of the Project, have the following duties defined by the regulations of the MWRI.

- Monitoring of the safety of the main hydraulic structures over the country.
- Carrying out the stability studies of the hydraulic structures.
- Designing of the hydraulic structures, revising the tendered designs of the projects and rechecking Stability.
- Carrying out studies, assessment, planning relating to the barrage safety and risks management.

The MWRI have much experience for introducing the large scale loan project as shown below, and the RGBS have been the executive agency for all projects. (Refer to 2.3 Activities of Other Donors)

The MWRI have implemented three (3) barrages (the Esna, the Naga Hammadi and the Asuit) from the High Aswan Dam by the loan project from some of the foreign assistance. The tender bidding is coming within this year (2010) for the Asuit Barrage, which was done with a detailed design and the tendering of documents was done under the assistance of the KfW (Germany), after finishing the pre-qualification procedure.

The MWRI have many implemented irrigation projects under financial cooperation by ODA as the large scale project of the barrages along the River Nile. The amount of the funds financed for these projects are bigger than the assumed budget of the project cost of the DGR.

Therefore, the MWRI has enough abilities with the technology and organizing and managing the project, so there are not any kinds of anxiety for the execution of the DGR Project.

In addition, the MWRI have experiences of the Japan's Grant Aid Project of the Lahoun Regulator (1997), the Mazoura Reg. (2002), the Sakoula Reg. (2006) and the Dahab (2010) along the Bahr Yusef Irrigation Canal. It can be judged that the MWRI has enough knowledge on the Japan's Yen Loan Scheme, even though there is a difference between the Grant Aid scheme and Yen Loan scheme.

(3) Proposal of the establishment of the TASKFORCE

The Project will be asked to join the sub-project of the rehabilitation of the minor structures, based on the large scale project of the rehabilitation of the DGR, for the realization of the supply irrigation water until there is a terminal beneficiary area based on stable water distribution. In this occasion, if the implementation organization has been established by the RGBS only, it will be worried concern that the operation organization will be relatively oriented to the large scale structures.

To realize the systematic and mobilized organization for smooth operation of the project, the TASKFORCE should be proposed by the entire organization of the MWRI.

5.4.2 Financing Plan

The financing plan of the Project shall be made as Japan's Yen Loan Scheme by Japan's Government.

The yearly financing plan shall be made based on the budget allocation plan and implementation plan of the Project. The uncovered budget by Japan's Yen Loan Scheme shall be taken care of by the budget of the MWRI.

Table 5.1.10 Disbursement of the project (1,000 LE)

Items	Consulting service		Implementation						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
1.Dirout Group of Regulators			69,573	162,336	162,336	69,572	0	0	463,817
2.Integrated Water Management System			0	0	20,617	20,616	0	0	41,233
3.Priority Minor Structures			18,177	18,177	18,177	17,620	10,824	3,756	86,731
TOTAL			87,750	180,513	201,130	107,809	10,824	3,756	591,781

5.4.3 Procurement of the material and equipment

In Egypt, they have performed and experienced large-scale construction works such as roads, bridges and the Naga Hammadi Barrage; therefore, it is possible to procure the basic materials and equipment such as cement, reinforced-bar, backhoes, and dump trucks. However, in this project, construction of the new DGR, which has a condition of being on a middle or small size canal and additionally would be close to the main road, railway or residence. In a condition such as this case, it is very important to plan to optimize a strict construction area, and also it is necessary to successfully procure huge sheet piles and H beams in order to perform safe and smooth construction. Incidentally, in this project the

double-leaf gate will be installe.

Considering the above-mentioned, the procurement condition of the main materials and equipment is shown as follows.

(1) Concrete, reinforced-bar, and general materials

The materials and equipment such as cement, reinforced-bar, timber, light-steel goods, fitting goods and appliances will be procured in Egypt, and it is best to procure them in Cairo in order to procure them certainly. The reinforce-bar will be procured directly from a manufacturer in Alexandria because in Egypt it is produced in Alexandria only.

(2) Banking materials, aggregates, and stones

The banking materials, aggregates and stones will be procured from quarries near the site, Minya or Assiut.

(3) Sheet piles, H beams and steel materials

The H beams which are up to 250mm in size will be procured in Egypt; however, a size of more than 250mm should be imported, as well as sheet piles of all sizes. These steel materials should be ordered from the agency or producing country because they are not produced in Egypt, then these materials will be procured properly and in a timely manner under the construction terms.

(4) Gate facility

In this stage, the JICA study team was not provided the sufficient technical information about manufacturing of the double-leaf gate in the local market or the third country. However there are some examples in Japan only for the installation of the double-leaf gate in order to control the discharge in high accuracy. Therefore, in this project, the double-leaf gate on the new DGR will be suggested procured from Japan as follow reasons;

In the third country (In here the third country means other developed country), they have little experience to manufacture it. Therefore, they need the supervisors from a Japanese manufacturer in order to secure the quality and observe the due date. However, in case of dispatching the supervisors, there needs to be a of guarantee mutual benefit to both the manufacturer dispatching the supervisors and the manufacturer accepting them. Therefore, generally, the team formation seems to be difficult, unless there is a business relationship, such as an affiliation or capital investment from both of them. On this point, the company that has such a relationship will not be in Egypt, Africa, Europe or the Middle East but will be a few in the Asian area. Furthermore recently, the companies which have branch office in abroad with business relationship are retreating from there caused by economic recession. Thus, the dispatching of supervisors from the third country is concluded to be unrealistic.

Accordingly, the team considers that it is best to procure the double-leaf gate from Japan. Furthermore, procuring it from Japan ensures the quality and high reliability which has been proven by past Japanese grant aid projects in Egypt.

(5) Equipment for the construction

In Egypt, they have performed and experienced large scale construction works and have many large contractors. Therefore, basic equipment such as backhoes, dump trucks and cranes will be procured in Egypt. However, the sheet pile driver might not be accustomed to the type of sheet piles to be

used. Therefore, the procuring of this machine should be taken into consideration for proper application. And then the suppliers can be enabled from Egypt, although the suppliers possess few sheet pile drivers in Egypt. Therefore, considering the timely and proper procurement of this machine, matching with the type of sheet piles, the suppliers of it will be subject to the third company or Japan.

5.4.4 Procurement of the Consulting Services

The consultant will be procured for the smooth execution as the Project of the Japanese ODA loan, to be prepared and executed effectively after conclusion of the ODA Loan Agreement. The consultant will engage the engineering design, tender documents, manage the documents, and manage the supervision and capacity building for the executive agency.

(1) Terms of Reference of the consulting services

The consulting services consist of the following items:

(a) Topographic survey and geological survey.

(b) Detailed design, including design, drawing, making a construction plan, making a bill of quantities and construction cost estimation.

(c) Tendering documents.

(d) Management of the documents, including the pre-qualification (P/Q), evaluation of the tender and supporting of the contract.

(e) Supervision of the construction works.

(f) Supporting services for the capacity building of the executive agency.

(a) Topographic survey and geological survey

Plane table survey, profile leveling and cross-leveling for the main canals

Borehole drilling along the proposed axis on the right bank, left bank and river bed portions with 50 m (±) depth

Standard penetration test, permeability test and horizontal loading test by using the drilled holes

(b) Detailed Design

The detailed design regarding five (5) regulators and establishment of the improving water distribution system will be carried out for the proceeding to the construction stage with high accuracy drawings. Before the preparation of the drawings, the hydraulic analysis and structural analysis will be done. Furthermore, the required fundamental function of the Dirout Group of Regulators which is defined as stable water distribution shall be verified on the upstream pond of the group of regulators from the viewpoint of hydraulics by a mathematic model using a computer system. Finally, the construction plan shall be made and the construction cost shall be estimated.

(c) Tendered documents

The tendering should be done based on the rule of the International Competitive Bidding (ICB). The consultant shall prepare the required tendered documents for the ICB.

(d) Management of the tendered documents

The consultant shall manage the pre-qualification (P/Q) in advance tendering the documents. Also, the consultant shall manage the tendering and the evaluation of the results of the bidding to support the activities of the executive agency by preparing the required documents and supporting the bidding. The consultant shall support the contract between the executive agency and the contractors.

(e) Supervision of the construction works

The consultant shall manage all activities under the executive agency, which consist of the detailed design works, modifying the specifications, modifying the bill of quantities, management of the purchasing of the materials and equipment and supervision of the construction works, in place of the executive agency.

(f) Supporting services for the capacity building of the executive agency

The consultant shall give support to the executive agency for the consolidation of the capacities of the organization of the executive agency to manage the project in progress, operation and maintenance of the post-implementation of the project. The consultant shall make the programs for the above-mentioned subjects and join the team for the activities.

5.5 Operation and Maintenance Plan

5.5.1 Subjects and Level of Operation and Maintenance

(1) Dirout Group of the Regulators

The New DGR consists of five regulators and seven main canals and gates installed at each regulator to control the discharge volume and water level, planning 12 vents in number. The mechanical equipment should be maintained by daily operation and maintenance activities to perform well the functioning and to bring the result of long life of the entire system. The over-flow type gates with double leaf gates are installed to realize the high accuracy water distribution on the Bahr Yusef Main Canal and the Ibrahimia Main Canal. The operation and maintenance technology for the gate operation should be skillfully learned.

To realize the function of the large scale regulators through the accurate operation of the gates and preparation of the linkage with the Integrated Water Management System in the future, daily inspection of the equipment and detailed inspection items will be executed every year and known by related managers and engineers.

(2) Improving Water Distribution System.

There are about 50 stations to be monitored in the Project area, including the Integrated Water Management Center, the DGR, the regulators located on the main canals and the intakes located on the branch canals. The monitoring systems are installed at each station monitored, and the system will be operated and maintained by the engineers belonging to the Telemetry Department under the Irrigation Sector of the MWRI. The system can be operated and maintained by the engineers related to the Telemetry Department.

The Integrated Water Management Center has to play the important duty to collect the data through the telemetry system and to make decisions on the water distribution plan. Since the latest water management equipment is installed in the center, the skilful engineers, who have enough knowledge

about the Water Management and Tele-Control System, should be assigned.

(3) Selected Minor Structures

According to the result of the field survey on the selected minor structures, almost all structures are deteriorated due to lack of enough maintenance. The rehabilitation and reconstruction works shall be needed and daily maintenance-oriented technology should be learned by the related engineers. The engineers who have enough knowledge of the water management should be assigned based on the understanding of the future plan of linkage with the Improving Water Distribution System.

(4) Technical Support for Irrigation Agriculture

This project aims at a proper distribution of the limited water resource by recovering the water distribution function of the existing DRG and introducing the improving water distribution system., and it has aimed at contributing to crop production increase. In general, there are various farming support processes like the reduction of the production loss after harvest, improvement of farming materials, and improvement of the cultivation method.

The method of using machine parts with high irrigation efficiency such as efficient promotion at the field level for the improvement of the irrigation efficiency for the water supply, the integrated use for mesqa, the sprinkler irrigation, and the drip irrigation, etc. are important to increase the crop production through this project.

Therefore, to assume the improvement of the irrigation efficiency to be the main purpose, and to combine with the activity of the technical co-operation project about the improving water distribution management, support by a long-term specialist and a short-term specialist concerning the water management at the field level is executed as a farming support activity.

5.5.2 Capacity of Operation and Maintenance

The New Naga Hammadi Barrage, which was situated as the second barrage from the High Aswan Dam, was implemented by financial assistance of the Government of Germany and was operated on 31 May 2008. The barrage has over-flow type radial gates with flap gates, the same as the Dirout Group Regulators, with a dimension of 17m wide 13.5m high, with seven (7) vents. The barrage has a maximum discharge capacity of 650 $m^{3/}$sec through the flap gates in an ordinary period and 7,000 m^3/sec through the radial gates by underflow in an emergency case. The MWRI has assigned skillful technicians who can accurately operate the gates in any case.

The MWRI has already installed the large scale of the gates in the Esna Barrage to take in the water from the Rive Nile, and has operated it safely. It shows that the MWRI has enough capacity to manage, operate and maintain the gates designed by the latest technology, from the aspect of the operation technology and manpower.

The double leaf gate has been installed at the four (4) regulators of the Lahoun, the Mazoura, the Sakoula and the Dahab regulators, which have been implemented by Japan's Grant Aid. The engineers, who belong to the MWRI, are assigned to the sites for the operation and maintenance works.

Table 5.1.11 Number of the O/M technicians

	Esna Barrage (Excluding Hydro power)	Naga Hammadi Barrage (Excluding Hydro power)	Existing DGR
Allocated number of O/M Technician	35	23	15
Required number of O/M Technician	3	11	5
Total	38	34	20

5.5.3 Budget of the Operation and Maintenance

The budget of the Operation and Maintenance is allocated one (1) percentage of the cost of the all equipment in each facility. The operation and maintenance cost of the telecommunication system and electricity and personnel expenses are included.

Table 5.1.12 Operation and Maintenance

Items	O/M Cost (1,000LE/Year)
Dirout Group of Regulators	4,638
Improving Water Distribution System	1,500
Priority Minor Structures	867

CHAPTER 6

ENVIROMENTAL AND SOCIAL CONSIDERATION

Chapter 6 Environmental and social considerations

6.1 EIA study

6.1.1 Schedule of EIA Study

RGBS had initiated to arrange the preparation of the Environmental Impact Assessment (EIA) in January 2010. On January 14, 2010 RGBS had a meeting with the Environmental Climate change Research Institute (ECRI) and introduced the proposed project to initiate the EIA study. After a week (January 21, 2010), RGBS also had a meeting with the office of the Egyptian Environmental Affairs Agency (EEAA) and informed them of the EIA study initiative for the Dirout group of Regulators (DGR).

On February 11, 2010 RGBS established the environmental group in this sector which would take care of the environmental and social considerations of the proposed DGR project. ECRI commenced the EIA study on March 03, 2010 after being commissioned by RGBS for the EIA study. The ECRI completed the EIA study at the end of May, 2010.

A draft EIA report was submitted to RGBS on June 14, 2010. After submission of the draft EIA report, meetings among RGBS, ECRI and JICA consultant convened. ECRI revised the EIA report after receiving corrections and modifications. ECRI finalized the EIA report and submitted it on June 27, 2010. The final EIA report was submitted to EEAA on June 29, 2010. After receiving the EIA report EEAA reviewed and sent comments to RGBS. RGBS has answered the comment in August 2010.

The approval of the EIA by EEAA has been obtained on 27th September 2010. The results of the EIA study are described in the below. Table 6.1 shows comments of EEAA and from replication from RGBS to EEAA.

Table 6.1 Comments of EEAA and Replication from RGBS for EIA report

No.	Comment from EEAA	Reply of RGBS
1.	Countermeasures on the following items. a. Natural Danger (Weather, Flooding, Storm and Earthquake) b. Work Danger (Sudden stop of electronic control room) c. Security Danger (Terrorism and Damage)	a. The DGR is designed considering the max flood capacity and to resistance against the earthquake and wind pressure in accordance with Egyptian Code and there will be a monitoring plan for present and future affects on the DGR. b. The control room for DGR is operated with the electronic control panel which controls the gates to pass the exact flow discharge according to a certain water levels. In addition, an automatic security system is provided for the protection of the control system. c. The control house is supported by security staff working 24 hours a day and there is cooperation with the police security office at the site. d. To avoid the above dangers, the safety program will take into consideration the following points. • Maintenance and inspection for emergency exists and fire protection equipment. • Safety for all tools and equipment • Repeatable fire protection test • Monitoring foe all electrical machines and tools • Taking into consideration earthquake effect • Recording the earthquakes with the Seismograph
2.	Improvement on foundation of structures to avoid settlement,	a. The design of DGR takes into consideration of the foundation resistance and settlement protection. b. There will be additional soil mechanics investigation. The concrete piles, if necessary, will be driven by a low noisy vibrator.

3.	Effect of vibration to surrounded buildings during construction.	• Use sheet piles around the structure • Pile driving time is limited at the day time. • Eliminate the driving hours. • Fix vibration measuring instruments to measure and evaluate the actual vibration effect in accordance with Egyptian Code. • Treat the crack if it happens at the existing DGR. • Use a flexible footing under construction equipment.
4.	Environmental Monitoring Plan after implementation for weeds growing and fishery production	a. The monitoring plan is mentioned in the chapter 8 of EIA report. b. Measurement for noisy weekly, sedimentation twice a month, water quality once a month. c. Data base for records during construction and operation stage with cooperation with the EEAA.
5.	Sewage net work improvement proposal at the site area.	According to the Drainage Department there is no drainage problems and the project will not affect the ground water at the project area.
6.	The procedures to control the ground water level during pumping.	a. Long term solution is to make a sewage net work, canal lining and drainage rehabilitation. b. Short term solution is to construct surface drains to cut the water seepage line and control the ground water, and to construct a deep well net work for pumping to the surface drain.

6.1.2 Screening

According to the "Guidelines for Egyptian Environmental Impact Assessment" published by EEAA, the list approach depends on screening the project into three categories based on different levels of EIA requirements according to the severity of possible environmental impacts as follows:

1. **White list projects** for projects with minor environmental impacts.
   The project proponent has to fill in the environmental screening form "A".
   The white list projects for MWRI apply to proposed expansion or modification of existing irrigation and drainage structures where the expansion or modification would lengthen the structure by 10% or less.

2. **Grey list projects** for projects which may result in substantial environmental impact.
   The project proponent has to fill out environmental screening form "B". The procedure consists of two stages, filling out form B and possibly followed by a scoped EIA on certain identified impact processes.
   The grey list project for MWRI applies to proposed expansion or modification of existing irrigation and drainage structures where the expansion or modification would lengthen the structure by more than 10%

3. **Black list projects** which require complete EIA due to their potential impacts.
   The projects are screened by activities, quantity of production and project size.
   The black list projects for MWRI apply to new irrigation projects including dams and barrages.

As for DGR project, it was determined that the alignment of new regulators would be 140m downstream of the existing one. In this case, the proposed project is categorized as a **black list project**.

6.1.3 Scoping

Scoping is to identify the key impacts requiring further investigation and to prepare the terms of reference for the study. Scoping of the proposed project was conducted based on the EIA source book published by MWRI and term of reference for full EIA of irrigation and drainage projects for which MWRI conducted EIA in the past. Items of environmental and social considerations considered for the proposed project are shown on the following table.

Considered Environmental and Social Assessment	Assessment Measurement
• Permit and approval, explanation	-EIA study -Approval of EEAA -Explanation to stakeholders (Public hearing and consultation)
• Anti-pollution measures	-Air quality -Water quality -Wastes -Noise and vibration -Odor
• Natural environment	-Geography and geology -Climate -Ecosystem
• Social environment	-Resettlement -Livelihood -Historical cultural sites -Health conditions
• others	-Impact during construction -Mitigation measures -Environmental monitoring plan

As shown in table 6.2, the scope of the EIA items of the EIA study of the proposed project cover almost all EIA items recommended by the guidelines for the Egyptian environmental impact assessment and JICA guidelines for environmental and social considerations. Table 6.2 shows a comparison of the scope of EIA items for the project.

Table 6.2 Comparison of scope of EIA items for the Irrigation Project

Guidelines for EEAA	JICA Checklist	EIA Study of DGR	Remarks
[1] Description of the proposed project	Category 1	Chapter III	OK
[2] Description of the environment		Chapter IV	OK
1. Physical/Chemical environment	Category 2 & 3	Chapter IV.1.4.2	OK
2. Biological environment		Chapter IV.1	OK
3. Sociocultural environment		Chapter IV.2.1.4	OK
[3] Legislative and regulatory considerations		Chapter II	OK
[4] Determination of the potential impact of the proposed project	Category 4 & 5	Chapter VI	OK
1. Establishment location:			No
- Resettlement of people	Category 4 (1)	Chapter IX	resettlement people except
- Impact on flora and fauna	Category 3 (2)	Chapter IV	of replacement
- Impact on historical cultural sites	Category 4 (3) and (4)	Chapter IV.2.1.4	of mosques
2. Establishment design:	Category 4 (2)		OK
- Drainage problem	Category 4 (2)	None	No impact
- Crossing for people and animals		None	No public
3. Establishment operation:	Category 2		bridge
- Pollution by agrochemical	Chapter 4 (2)	None	constructed
- Impact on soils (water logging, salinization)	Category (1)	Chapter IV.1.4.2	Not applicable
- Impact of water-borne and water-related diseases		Chapter IV.1.4	OK
			OK
[5] Alternative to the proposed project		Chapter V	OK
[6] Development of Management Plan to Mitigate Negative Impact	Category 4	Chapter VII	OK
[7] Development of Monitoring plan	Category 5 (3)	Chapter VIII	Under modification
1. Quality of irrigation water and drainage effluents	Category 2 (1)	None	Not applicable

2. Hydrology, groundwater and drainage effluents		Chapter VI	OK
3. System performance and salinity control	Category 4 (2)	Chapter IV.2.1.3 Chapter IV.2.1.3	OK OK
4. Public health		Chapter IV	OK
5. Flora and fauna			
[8] Secure interagency coordination and public/NGO participation	Category 1 (2), (3)	Chapter IX b	OK
[9] Environment assessment report			
1. Executive summary		Executive Summary	OK
2. Policy, legal and administrative framework		Chapter II	OK OK
3. Description of the proposed project		Chapter I	OK
4. Description of the environment		Chapter IV	OK
5. Significant environmental impacts		Chapter VI	OK
6. Analysis of alternatives		Chapter V	OK
7. Mitigation management plan		Chapter VII	OK
8. Interagency and public/NGO communications		Chapter IX	
9. Non technical summary of the report for political and public use			
10. List of reference			
11. Appendices			

6.2 Legislative and Institutional Framework

6.2.1 Institutional Framework

The institutional framework responsible for implementing legislation and environmental obligations of the study area consists of:

- ✓ EEAA with its regional branch in Assuit city
- ✓ Environmental affairs office of the country
- ✓ MWRI with its different authorities
- ✓ Ministry of health with its different authority
- ✓ Ministry of Agriculture and Land Reclamation (MALR)

Table 6.3 shows main roles of each organization.

Table 6.3 Main Roles of the Principal Organizations

Organization	Abbreviation	Location	Duties	Project Phase	
Ministry of Water Resources and Irrigation (MWRI)				**Pre**	**Post**
Reservoir and Grand Barrages Sector and other concerned sectors	RGBS	Cairo	Arrange the execution process and is responsible for barrage operation and maintenance	Huge	Huge
Egyptian Survey Authority	ESA	Cairo	Determine the compensation according to law 10/1990	Huge	Diminutive
Survey Directorate and Pricing Department	PD	Cairo Assuit	Execute a survey to evaluate the compensation due to expropriation	Huge	Diminutive
Ministry of State for Environmental Affairs					
Egyptian Environmental Affairs Agency	EEAA	Cairo	Approve the EIA according to environmental Law 4/1994, that amended by law 9/2009	Huge	Diminutive
Ministry of Agriculture and Land Reclamation (MALR)					
Agriculture Directorate	AD	Assuit	A member in the crop	Diminutiv	Diminutiv

			compensation committee	e	e
Ministry of Social Solidarity					
Social Affairs Directorate	SAD	Assuit	Deliver the compensation	Huge	Diminutive
Ministry of Health					
Health Directorate	HD	Assuit	Health issues during and after construction	Diminutive	Diminutive
Ministry of Local Development					
Governorate	G	Cairo Assuit	Administrative procedures before and during construction	Huge	Diminutive

6.2.2 Environmental Legislation

The legislations related to the EIA study in Egypt are listed as follows:

a. Law 4/1994: for environmental protection, as amended by Law No. 9/2009.
This law aims to maintain components of the environment and to prevent deterioration or pollution. Those components include the air, seas and inland waters including the River Nile, lakes, groundwater, lands, nature reserves and other natural resources.

b. Law10/1990: for Expropriation of Real Estate for Public Utility.
This law deals with the expropriation for public utility. Decree No. 2 defines this public utility, such as, energy, water, sanitation, construction, bridges, streets and transport projects.

c. Law12/2003: Labor law and the decision of the Ministry of Manpower and Immigration No. 211/2003 concerning border security requirements and precautions to prevent threats to the physical, mechanical, biological, chemical, and negative conditions and secure the working environment.

d. Law 48/1982: for protection of the River Nile and Waterways from Pollution and its Executive Regulation.
This law aims to protect the River Nile and waterways from pollution and bans the dumping of wastes (solid, liquid or gaseous) from ships, commercial and industrial establishments, tourism, drains and municipal waste exchange operations in streams and other water for the entire length while plateaus may only obtain a license from the MWRI after ensuring safety precautions are met.

e. Law 53/1966: promulgating Agriculture Law.
The law protects the wealth of both agriculture and livestock. The law prohibits hunting of birds that are useful for agriculture or wild animals or to kill or keep those in any way, prohibiting capturing. The law prohibits the dumping of the bodies of dead animals in the River Nile, canals, drains, ponds or in the road.

f. Law 58/1937: promulgating the Penal law.
The penal law is concerned with protecting waterways and the River Nile against pollution. The lawmakers decided upon a fine for loud shouting or excessive noise during the night which could disturb the residents.

g. Law 66/1973: with the Traffic Law as amended by Law No. 155/1999 and its Executive Regulation issued by Decree No. 2777/2000, amended by Law No.121/2008.
A penalty fine was adopted for each driver from whose load harmful substances to public health are blown off or that compromise the validity of the way of passage, such as dust, stones and construction materials. Institutions, public and private companies, contractors and others must obtain the approval from the traffic department before the start of drilling operations or construction, and they should put warning signs and boards at least one hundred meters from the construction site.

h. Law 100/1964: Organizing the Renting and the Disposal of Real-Estate Owned by the State Under Private Holding.
Most of the areas adjacent to the banks of the River Nile and the islands in the Nile follow

organization of agriculture reform, so they are owned by the government and leased by them. This law represents the base through which the tenants can be compensated on MWRI lands.

i. Law140/1956: regard the Occupancy of Public Roads and its Executive Regulation.
The law shows that, it is not permitted without a permit from the competent authority to occupy the public road, such as for excavation and construction, with an obligation not to block traffic, and it is prohibited to perform construction work unless the road is surrounded by a barrier of wood or any other substances, and the competent authority shall determine the height of the barrier, its distance from the front building and the edge of the pavement as well as the maintenance of trees and lampposts and other things.

j. Guidelines for Egyptian Environmental Impact Assessment
The guidelines were published by the Environmental Management Sector of EEAA to guide the process of EIA for competent administrative agencies in Egypt.

k. EIA Source Book
The EIA Source Book was published by MWRI in October 2001 for aiming guidelines by the Environmental Management Sector of EEAA to guide the process of EIA study for projects in MWRI. The projects are classified as ①New irrigation projects, ②Irrigation improvement projects, ③Drainage projects, ④Dams, barrages, reservoirs and flash flood projects and ⑤Shore protection projects.

6.3 Public Hearing/Consultation

Public hearing and consultation are one of major item of the EIA study. RGBS and ECRI who conducted an EIA study for the DGR project conducted the public hearing/consultation on April 21 and May 27, 2010 at the project site. In the meetings, RGBS and ECRI reported to stakeholders the objectives of the proposed project and the necessity of EIA study for the project. Afterward, the explanation questions and answerers were conducted.

6.3.1 First Public Hearing

In the public hearing conducted at the project site on April 21, 2010 the following items were reported by RGBS and ECRI. Questions and discussions were entertained after the explanation.

- Introduction of the project
  - Dirout group of regulators was created in the era of Khedive Ismail during the period from 1869-1872. It was renewed and strengthened in 1962 and had maintenance work on the doors in 2001. Due to aging of the barrages, as they exceeds their life spans, and due to the desire to improve full control elevation and discharge, a feasibility study of the Dirout group of regulators is executed.

- Problems of the existing structure
  - The existing barrages were constructed 138 years ago, and then some cracks and corrosion in the body of the barrages appeared. The situation has led to many problems with water management of the regulators.

- Objectives of EIA Study
  - To improve and provide the future needs of water.
  - To improve the social and economic conditions for most residents in the area without damaging the surrounding environment.
  - To suggest ways to reduce the negative effects during the different phases of the project.

- Screening
  - Depends on the result of screening of the proposed project for environmental and social assessment; the proposed project is categorized as a black list project which needs a full EIA

study.

- Project Alternative
  - Alternatives plans of the proposed project (3 plans at existing, upstream and downstream)

- EIA Study Activities
  - Data collection about the project
  - Legislation study
  - Study of the properties of water and sediments
  - Inventory of aquatic weeds upstream the barrages
  - Inventory and classification of phytoplankton and zooplankton upstream and downstream the barrages
  - Hydrographic survey of water body in the study area
  - Traffic survey
  - Socio-economic survey of the populations of the study area
  - Study the environmental impacts (negative and positive)
  - Study the establishment of procedures to mitigate the negative environmental impacts, if any
  - Environmental monitoring plan for the project

- Questions and Discussions
  - Record of the questions and discussions are shown in Table 6.5.

6.3.2 Second Public Consultation

A second public consultation was conducted at the project area on May 28, 2010 and the items shown below were reported. Especially, it is reported that the alignment of new regulators is selected at 140m downstream of the existing regulators. Besides, it is explained that 2 mosques will be removed with full compensation of the cost by RGBS.

- Objectives of EIA study

- EIA study plan

- Results of EIA study
  - The aquatic environment of the study area
  - Uploaded hydrographic
  - Study of traffic
  - Economic and social environment
  - Healthy environment
  - Environment, archaecological and tourist
  - Aalmhajer
  - Public damps
  - Mitigation measures for negative impacts during construction and operation phases

- Questions and Discussions
  - Record of the questions and discussions are shown in Table 6.5.

6.3.3 List of Attendees of the Public Hearing/Consultation

The list of invitees included representatives of EEAA, the general authority for roads and bridges and transport, national organization for portable water and sanitary drainage, Assuit and Minya governorates in addition to a number of guests from RGBS, stakeholders and others as shown in Table 6.4 and Table 6.5.

Table 6.4 List of representative attendees of the first public hearing

Organization	Representative	No. attendance
EEAA	Director	2

General authority for roads and bridges and transport	Director	1
National organization for potable water and sanitary drainage	Director	1
Assiut and Minya governorate	Director	4
RGBS Cairo	Directors and Engineers	6
Egyptian public and consulting parliaments, from different political parties	Members	3
Assiut governorate Education administration	Vice director	1
Railway administration	Director	1
Potable water and sanitary agency company	Chief Engineer	1
Fishing wealth administration	Employers	6
Agriculture engineers	Director and engineers	6
Dirout engineering irrigation	Employers	5
Farmers	Personals	21
Total		58

Table 6.5 List f representative attendees of the second public consultation

Organization	Representative	No. attendance
EEAA	Director	2
General authority for roads and bridges and transport	Director	2
National organization for potable water and sanitary drainage	Director	3
Assiut and Manya governorate	Director	5
RGBS Cairo	Directors and Engineers	7
Egyptian public and consulting parliaments, from different political parties	Members	7
Assuit governate Education administration	Vice director and employers	4
Railway administration	Directors	3
Potable water and sanitary agency company	Chief Engineer	6
Fishing wealth administration	Employers	8
Agriculture engineers	Director and engineers	8
Dirout engineering irrigation	Employers	7
Farmers	Personals	25
Total		**87**

6.3.4 Questions and Discussions in the Public Hearing/Consultation

Questions and discussions were entertained in the two public hearings/consultations conducted by RGBS at the project area. The records of the questions and discussions are in Table 6.6 shown below.

Table 6.6 Record of Questions and Answers

Hearing/Consultation	Question	Answer
First Public Hearing	-ECRI ignores the socio-economic study for the fishermen and is interested in farmers only?	-ECRI in the environmental impact assessment considers all activities in the study area.
	-Is there cooperation between irrigate Assuit and irrigate Minya in order to control in barrage water use?	-There is cooperation between irrigate Assuit and irrigate Minya in order to solve any problem for barrage water use if any.
	-The site of the new regulators will not be used as a means of transportation. This is because of its presence in front of a densely populated area and therefore it will lose its traffic aim?	-There is a circular road around Dirout city that has been established and is currently in use. Thus, the traffic within Dirout city in the study area does not have any trouble.
	-Why does not the market move and individuals on the old Dirout regulators be deported – as it can used as an aesthetic and antique	-Deportation of individuals and movement of the market are the responsibility of the Dirout city council and police. Thus, we

	view?	wish more cooperation to obtain the desired antique and aesthetic view.
Second Public Hearing	-The productivity of some crops is high per acre?	-Those numbers are an average of 191 samples, so there are numbers higher than the existing number, numbers much higher than the existing number, and numbers lower than the existing number.
	-Some available numbers in the environmental health data are not accurate.	The environmental health data were taken from a trustable source which is the information center in the local council in Assiut City.
	-I am a farmer, but no one asked me about my cultivation.	Samples of agricultural environment are taken through systematic random sample, which represents the whole region, so agricultural data do not mean that all the farmers in the study area were asked.

6.4 Involuntary Resettlement

Involuntary resettlement is also one of the major items for the EIA study. However, no such resettlement is considered in the proposed construction area except for replacement of mosques because areas of newly located regulators are owned by MWRI. Two existing mosques targeted for replacement are located on the left side of the Bahr Yusef Canal and inside of MWRI land at the left side of the Ibrahimia Canal. The land of both mosques is also owned by MWRI. RGBS will reconstruct both mosques in the vicinity where land is owned by MWRI. All necessary construction costs for the replacement of the two mosques will be shouldered by RGBS. However, an agreement should be prepared between RGBS and representatives of mosques and/or local governorates before commencement of the construction works. RGBS has experienced a replacement at the Naga-Hamadi Project in the past.

Replacement plan will be schedules as follows:

①Location of replacement----------In the areas owned by MWRI downstream of the existing mosques.

②Schedule of replacement----------Replacement will be re-constructed before starting of new regulators construction.

③Publicity to stakeholders----------The information will be disclosed at mosque message board, assembly at mosque and publicity of Dirout city

④Management mechanism of claims----------RGBS project management office (PMO) is the window of claims

⑤Monitoring framework of replacement----------PMO and the project consultant will monitor the plan.

A stockyard will be required for temporary use during construction. The stockyard might be proposed at existing wide and vacant ground near the project area. Accordingly, resettlement will not be

required. Only leasehold ground rent is required without any other compensation. After completion of the project the rented land has to retrocede in an original condition. It is one of conditions in the construction contract. The plan of the rental stockyard is shown below:

① Location of the leasehold ground----------The area is located at 150m downstream of right bank of Bahr-Yusef Canal.

② Schedule of the leasehold ground----------Rented period will be during construction period.

③ Publicity to stakeholders----------The information will be disclosed by publicity of Dirout city and direct explanation to the concerned.

④ Management mechanism of claims----------RGBS project management office (PMO) is the window of claims

⑤ Monitoring framework of the leasehold ground----------PMO and the project consultant will monitor the plan.

6.5 Information disclosure

In principal, project proponents disclose information about the environmental and social considerations of the project. For this project, RGBS disclosed the information of the DGR project in the public hearings on April 21 and May 28, 2010. Also, RGBS will disclose the information as for the environmental and social considerations as much as possible at additional public hearings and through the RGBS provincial office. As the need arises, the information of the environmental and social considerations will be disclosed. In the case of the project revised, RGBS will hold other public hearing and disclose the information to the stakeholders. The results of environmental monitoring will be reported to EEAA on a quarterly basis.

6.6 Baseline of Present Environmental and Social Assessment

Baseline of the proposed project on the present environmental and social assessment is shown in Table 6.7.

Table 6.7 Baseline of Present Environmental and Social Assessment

No	Impact	Evaluation	Reasons
1	Topography and geology	D	The project is small enough to affect both
2	Weather and climate	D	No effect due to insignificant rainfall, wind, etc.
3	Air Emission	D	No effect of air emission
4	Surface Water Quality	D	No effect, water quality within the Egyptian standard
5	Groundwater Quality	B	Groundwater is expected to rise
6	Water Flow and River Morphology	D	Project has no adverse impact on the hydrological environment
7	Archeological Treasure	D	The project is small enough to not affect archeological treasure
8	Land Use and Land Tenure	D	No effect due to the proposed land belonging to the Ministry of Water Resources and Irrigation
9	Fishing	D	No effect due fishing prohibited by law in the area between the existing RGD and the proposed one.
10	Growth of Weed	D	Weeds grow on both banks upstream of Ibrahimia and have no effect on water flow.
11	Noise	B	Noises will be induced in the region due to railway station, taxi 8Motorcycle) station and vegetable and fruit market.
12	Vibration	B	Vibrations will be induced in the region due to railway station, taxi (motorcycle) station.

13	Oder	B	The impact may be due to a cumulated algae and dead animals.
14	Sediment	B	Currently sedimentation is occurred in front of Abo-Gabal and El-Sahyliya Canal.
15	Solid Waste	B	The wastes are generated from vegetable and fruit market which is located above DGR.

Evaluation category:
A: Serious impact is expected
B: Some impact is expected
C: Extent of impact is unknown
D: No impact is expected. EIA is not necessary
F: Positive impact

6.7 Potential Impact Assessment

The potential impacts assessment of the proposed project is phased in two construction and operation stage as shown in Table 6.8 and Table 6.9. The existing regulator was constructed 138 years ago, and it is one of oldest irrigation structure in Egypt. MWRI file applications on the historical irrigation facility in Egypt will be conducted. Due to the new construction located at 140m downstream of the existing regulators, no effect to the existing regulator from new construction will be considered. Ethnic minorities and indigenous peoples do not exist in the project area. However, due to construction of new regulators the maximum water level in the regulators is assumed to be raised up 0.60m than the present water level. It will be examined in the detailed design and appropriate measures are taken after the result of analysis. Any protected area designated by the country's laws is not included in the proposed project area.

Table 6.8 Environmental Impact Assessment Checklist During Construction Phase

No	Impact	Evaluation	Reasons
1	Topography and geology	D	The project is small enough to affect both
2	Weather and climate	D	No effect due to insignificant rainfall, wind, etc.
3	Air Emission	B	Using heavy machinery and vehicles may cause air pollution and reduce air quality limits.
4	Surface Water Quality	B	Water quality may be affected by the extraction processes. Oil might leak under certain circumstances.
5	Groundwater Level	B	Groundwater is expected to rise up.
6	Water Flow and River Morphology	B	May be affected due to half of the Ibrahimia canal, and Bahr Yousef will be closed for the construction process.
7	Archeological Treasure	D	MWRI is proposing the existing structures to be historical monument.
8	Land Use and Land Tenure	D	No effect due to the proposed land belonging to the Ministry of Water Resources and Irrigation
9	Fishing	B	Turbidity may endanger fish larvae, benthic organism and planktons.
10	Income	F	Project construction period will create the need for some additional facilities (e.g. restaurant, cafeteria, etc.), which will increase the income of some citizens, as well as workers coming from nearby villages.
11	Access to the Project Site	B	Conveying the construction material by heavy transport might obstruct the traffic.
12	Noise	B	Using heavy machinery and vehicles may produce noise.
13	Vibration	B	Vibrations will be induced during constructing piles, excavation and movements of heaving machinery and vehicles.
14	Health and safety	B	May effect on public and workers
15	Labor accommodation campus	D	No accommodation campuses are required to be constructed as the workers will come from nearby villages.
16	Safety of the Regulators	B	Due to construction of new regulators the maximum water level in the regulators is assumed to be raised up 0.60m than the present water level. It is considered a

			little effect but will be examined in the detailed design and appropriate measures are taken after the result of analysis
17	Odor	B	The impact may be due to accumulated algae and dead animals.
18	Sediment	D	No impact as excavation carried out.
19	Solid Waste	B	Wastes materials are generated by the construction activities.

Evaluation category:
A: Serious impact is expected
B: Some impact is expected
C: Extent of impact is unknown
D: No impact is expected. EIA is not necessary
F: Positive impact

Table 6.9 Environmental Impact Assessment Checklist During Operation Phase

No	Impact	Evaluation	Reasons
1	Topography and geology	D	The project is small enough to affect both
2	Weather and climate	D	No effect due to insignificant rainfall, wind, etc.
3	Air Emission	F	Air quality will be improved due to operation the regulators which will generate air emissions.
4	Surface Water Quality	D	No effect of water quality during operation.
5	Groundwater Quality	B	Groundwater is expected to rise
6	Water Flow and River Morphology	D	No effect due to discharging the same water flow.
7	Archeological Treasure	D	Operating the new DGR will not affect archeological treasure.
8	Land Use and Land Tenure	D	No effect due to the proposed land belonging to the Ministry of Water Resources and Irrigation. Stockyard utilized during construction temporally retrocede in an original condition
9	Aquatic Weeds	B	Aquatic weeds might be trapped in front of the gates and the navigation locks during operation.
10	Fishing	D	Fishing and fisherman will not be affected due to fishing prohibiting by law in the area between the existing DGR and the proposed one.
11	Noise	D	No effect, due to DGR is supported with an electronic control room.
12	Vibration	D	No effect, due to DGR is supported with an electronic control room.
13	Health and safety against electrical shack	D	No risk, due to the fact that the public and the workers will not be able to reach the electronic control room.
14	Labor accommodation campus	D	No accommodation campuses are required to be constructed as the workers will come from nearby villages.
15	Safety of the Regulators	D	No effect, due to water flow, and the new DGR is downstream from the existing one.
16	Odor	B	The impact may be due to accumulated algae and dead animals and mitigated by removal of the accumulated particles.
17	Sediment	B	No impact as excavation carried out.
18	Solid Waste	D	No impact

Evaluation category:
A: Serious impact is expected
B: Some impact is expected
C: Extent of impact is unknown
D: No impact is expected. EIA is not necessary
F: Positive impact

6.8 Proposed Alternatives

The existing regulator has been utilized for 138 years. Due to the long utilization, there have been

many cracks and punctures on bricks and stones which have been used as the body of the regulator, and erosions occurred by the water's stream; thus it is judged the existing regulators should be repaired in full scale.

Alternative plans for the location of regulators were prepared and evaluated. The alternative plans consist of: Plan-A (rehabilitation of the existing regulators at the original alignment); Plan-B (new regulator at upstream); and Plan-C (new regulators at downstream). The comparing result of evaluation is shown in Table 6.10.

Table 6.10 Comparison of Alternatives Plans

Item	Plan-A	Plan-B	Plan-C
Hydraulic Performance	1	2	3
Stability of Structure	1	3	3
Ease of Construction	1	1	3
Operation & Maintenance	1	3	3
Heritage and View	1	1	2
Environmental	3	2	1
Comprehensive Evaluation	**8**	**12**	**15**
Working Life	40 yrs	100 yrs	100 yrs
Navigation Lock	Existing	Not possible	Possible
Hydropower Plant	Not possible	Not possible	Possible

Evaluation Category； 1：Low、 2：Medium、 3：High

The result of the evaluation on environmental and social consideration was shown in Table 6.11. Plan-A is given highest scores for the environmental and social considerations, however, Plan-C was given highest scores for the other items (engineering, project life and the rest). In a comprehensive consideration, Plan-C was selected.

Table 6.11 Comparison of Alternatives Plans for Environmental & Social Considerations

Item	Plan A	Plan B	Plan C
Heritage and View	In case of electrifying the existing gates, installation of switching devices on the existing structures will damage the landscape of DGR. **Point:+1**	Because the new regulators are constructed at the upstream side and feeder canals are constructed from the new regulators to the existing DGR, the landscape of the upstream side of DGR will drastically change. **Point:+1**	Because the new regulators are constructed at the downstream side, the view of the downstream side of the existing DGR will change. **Point:+2**
Environment	There will be no land acquisition or removal of housing. **Point:+3**	There will be no land acquisition or removal of housing. Also, the hydro-power plant and navigation lock set on the regulators might require land acquisition **Point:+2**	There is a mosque at the left bank of Bahr Yusef. This mosque will need to be moved during construction work **Point:+1**

6.9 Mitigation Measures

Mitigation measures that would counteract the negative impact during the construction phase and operation phase are shown in Table 6.12 and Table 6.13.

Table 6.12 Mitigation Measures during Construction

Negative Impact	Mitigation Measure(s)
Air Emission NOx, CO2, SOx, CO and PM10 will be produced due to using drilling machines at the site.	• Maintenance equipment is conducted regularly to always keep good conditions. • Spread water on the road and construction site. • Monitor air quality (SO_2, NO_2, CO_2, CO, and PM)
Water Quality: Water quality may be affected by the extraction processes. Oil might leak under certain circumstances.	• Monitor the water quality (pH, SS, ED and DO) • Use electrical pumps to avoid oil leakage. • To avoid oil leakage regular maintenance of equipment is required. • Construct Sheet Pile Walls during excavation to avoid excessive water turbidity that might affect the aquatic organisms. • Supervise the site technically.
Groundwater: The groundwater is expected to rise	• Implement piezometer well pump. • Monitor groundwater level. • Raised up ground water level is only 60cm that is likely minor impact. The impact will be examined in the detailed design and it will takes appreciate measures if any.
Fishing Turbidity may endanger fish larvae, benthic organism and planktons.	• Reduce water turbidity caused by sheet piles used around construction areas. • No effect to the fisheries due to passing water construction method. • Monitor water quality.
Access to the Project Site Conveying the construction material by heavy transport might obstruct the traffic.	• Limitation of quantity of transportation. • .Night work for materials carried in the site • .Arrangement of traffic security guards.
Noise: Using heavy machinery and vehicles may produce noise.	• Implement sheet piles to avoid the noise. • Use modern techniques construct piles. • Minimize noise by using proper device of mufflers equipped to equipment.
Vibration: Vibrations will be induced during constructing piles, excavation and movements of heaving machinery and vehicles.	• Introduce the modern sheet pile equipment. • Maintain the equipment regularly to keep good conditions • Reduce speed of running equipment/cars to be slow around the construction areas..
Health and Safety: Impact on the workers and inhabitants is expected.	• Contractor comply to the health and safety regulations • To protect air and water pollution and reduce noise and vibration caused by construction activities.
Oder The impact may be due to accumulated algae and dead animals.	• Materials caused to Oder will be collected and carried out to disposal site regularly.
Waste Wastes materials are generated by construction activities..	• Waste materials generated by construction actibvities are carried out to disposal pit.

Table 6.13 Mitigation Measures during Operation

Negative Impact	Mitigation Measure
Groundwater Level: The groundwater is expected to rise	• Implement peizomertic well pump. • • Monitoring groundwater level periodically. • In case groundwater level raised up the investigation and countermeasure will be conducted by PMO.
Aquatic Weeds: Aquatic weeds will accumulate U/S gates.	• Install Weed Racks and Trash Racks. • Remove the weeds periodically.
Odor: The impact may be due to accumulated algae and dead animals	• Removal of particles causing odor in water body periodically.
Sedimentation:	• Excavation carried out periodically

6.10 Environmental Monitoring Plan

Monitoring plans stated in EIA report consist of three (3) steps which are the Pre-construction monitoring plan, the Construction monitoring plan and the Operation monitoring plan.

6.10.1 Responsible Authority of Environmental Monitoring

Environmental registering through RGBS and MWRI and supervision and follow-up of EEAA are important in environmental monitoring programs. Table 6.14 shows the responsible authority for monitoring each phases.

Table.6.14 Responsible Authority for Environmental Monitoring Plan

Phase	Subject	Responsible Authority
Design and Bid	Environmental Studies and licenses	EEAA, MWRI, RGBS
	Environmental Assessment to the Bids	RGBS
	Environmental Complains	RGBS
	Information about the project supplied to the inhabitants	RGBS
	Acquisition of land which is required for the project contractor and others studies	MWRI, RGBS
Construction	Environmental Monitoring • Surface and ground water quality will be determined twice each month • Noise pollution will be measured on a weekly basis • NO_2, CO_2, So_2, CO and PM10 will be measured on a weekly basis	RGBS
	Monitor the socio-economic impacts including health and safety indicators	RGBS
	Registering workers data include number, names, wages, hours of work and accidents at the project location Implementing the contract and take the necessary actions to ensure the health and safety of workers. Training the laborers for the use of safe construction methods.	RGBS, Contractor
	Complaints	RGBS, Local authority
Operation	Environmental Monitoring • Surface and ground water quality as well as noise will be determined monthly • Sediments will be determined every three months.	EEAA, RGBS
	Monitoring the methods of ensuring health and safety to the workers.	EEAA, RGBS

6.10.2 Monitoring Plan before Construction Phase

In the pre-construction phase, all construction activities are prepared as follows.

- Information about the project will be supplied to all inhabitants:
- Environmental studies which continue to show the nature and extent of expected impacts of the project:
- Tenancy required by the construction contractor

6.10.3 Monitoring Plan for Construction Phase

During the construction phase, the monitoring plan is executed by performing measurements and applying standards as follows:

① Measure of the executive indicators for 20- 25 samples including the following:

- Surface water quality will be physically, chemically and biologically determined twice each month
- Groundwater quality will be physically and chemically determined twice each month.
- Sediment and soil characteristics will be examined on a monthly basis.
- Noise output of equipment used will be measured on a weekly basis.
- NOx, CO2, Sox, CO and PM10 will be measured on a weekly basis

② Monitoring the socio-economic impacts including health indicators.

③ Register complaints

④ Follow up on the issuing of licensing and its requirements

A quarterly report should be submitted to the EEAA for previous monitoring operations to assess the situation during construction.

6.10.4 Monitoring Plan for Operation Phase

The various parameters will be measured every three months for sediments and monthly for surface and ground water and noise. Intensify the monitoring period when a problem occurs, suddenly taking into account the implementation of occupational safety and health.

On the other hand, the monitoring plan should include the support of the Environmental Affairs Agency in the governorate in order to send forward the public complaints of the workers and inhabitants to the responsible authorities.

Table 6.15 Monitoring Plan

No	Impacts	Responsible Authority	Pre-construction	Construction	Operation
1	Topography and geology	RGBS	Once before construction		-
2	Weather and climate	RGBS/ Contractor	Once before construction	weekly	-
3	Air Emission (NO_2, CO_2, So_2, CO and PM10)	EEAA/ RGBS	Once before construction	weekly	-
4	Surface Water Quality (pH, SS, EC, DO)	EEAA/ RGBS	Once before construction	twice/month	monthly
5	Groundwater Quality	RGBS	Once before construction	twice/month	monthly
6	Water Flow and River Morphology	RGBS	Once before construction	weekly	Weekly
7	Archeological Treasure	MWRI/ RGBS		-	-
8	Land Use and Land Tenure	MWRI/ RGBS	Once before construction	monthly	-
9	Fishing	RGBS	Once before construction	monthly	monthly
10	Income	RGBS	Once before construction	monthly	-

11	Access to the Project Site	RGBS/ Contractor	Once before construction	monthly	-
12	Noise	RGBS/ Contractor	Once before construction	weekly	monthly
13	Vibration	RGBS/ Contractor	Once before construction	weekly	monthly
14	Health and safety	RGBS/ Contractor	Once before construction	monthly	-
15	Labor accommodation campus	RGBS/ Contractor	-	Monthly	-
16	Safety of the Regulators	RGBS	Once before construction	monthly	monthly
17	Wastes	RGBS/ Contractor/ LGU	Once before construction	monthly	monthly
18	Odor	RGBS/ Contractor	Once before construction	twice/month	monthly
19	Sediment	RGBS	Once before construction	monthly	every three months
20	Growth of weeds	RGBS	Once before construction	Twice/month	monthly
21	Complaints	RGBS/ LGU	-	weekly	monthly

6.11 JICA Checklist & Monitoring Form

6.11.1 JICA Checklist

A JICA consultant has handed over the JICA guidelines for environmental and social considerations and the environmental checklist to RGBS for an understanding of JICA policy for the environmental and social considerations. Filling up columns required in the JICA environmental checklist were conducted by RGBS with cooperation of a JICA consultant. The checklist filled up is shown in Table 6.16.

6.11.2 Monitoring Form

JICA will request RGBS to submit regularly the results of environmental monitoring conducted by RGBS and other agencies. The results of the monitoring are required to fill up in the monitoring form complying with JICA form. According to the JICA guidelines the results of the environmental monitoring will be disclosed by JICA. The draft monitoring form is shown in Table 6.17 which will be finalized before starting the project.

6.12 Environmental and Impact Assessment (EIA) for Minor Structures

The environmental and impact assessment (EIA) for Minor Structures has not been conducted in the feasibility study because the feasibility study for the minor structures was only for evaluation of 128 minor structures offered by RGBS and excluded specific design for rehabilitation. The environmental and social considerations for required minor structures will be done after confirmation of the specific plan.

Table 6.16 JICA Check list (Agriculture)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b)-Y (c)-Y (d)-Y	(a) RGBS through ECRI has conducted EIA study and submitted to EEAA at end of June 2010. (b) RGBS has received comments from EEAA on EIA report and replied to EEAA. RGBS is waiting for approval of EEAA. (c) RGBS has not yet approval from EEAA at present. (d) Other environmental permits from appropriate regulatory authorities have not required.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) N	a) Public hearing and consultation have been conducted in the project area and RGBS disclosed the information to stakeholders for getting understanding. (b) The comments from the stakeholders are reflected to the project design. It has been informed by RGBS that the project would not affect the fisheries because the construction will be implemented with flowing water in canals. The replacement of mosques will be constructed by RGBS with full compensation of the cost in the areas of MWRI owned areas.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternative plans of the location of the project have been examined with social and environmental consideration.
2 Pollution Control	(1) Water Quality	(a) Are considerations given to water pollution of the surrounding water bodies, such as rivers and groundwater by effluents or leachates from agricultural lands? Are adequate use/disposal standards for fertilizers, agrochemicals, and livestock wastes established? Is a framework established to increase awareness of the standards among farmers? (b) Is a monitoring framework established for water pollution of rivers and groundwater?	(a) Y (b) Y	(a) N/A (the proposed project includes only improvement of regulators without agricultural lands) (b) RGBS and PMO monitor the water quality of canals such as pH, SS, EC and DO.
	(2) Wastes	(a) Are wastes properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) Wastes during construction will be extracted to disposal area in accordance with the Egyptian Law..
	(3) Soil Contamination	(a) Is there a possibility that impacts in irrigated lands, such as salinization of soils will result? (b) Are adequate measures taken to prevent soil contamination of irrigated lands by agrochemicals, heavy metals and other hazardous substances? (c) Are any agrochemicals management plans prepared? Are any usages or any implementation structures organized for proper use of the plans?	(a) (b) (c)	(a) N/A (the project include only improvement of regulators without agricultural land). (b) N/A (the project include only improvement of regulators without agricultural land). (c) N/A (the project include only improvement of regulators without agricultural land).
	(4) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) No extraction of a large volume of ground water around the project area. Then no subsidence is not occurred.
	(5) Odor	(a) Are there any odor sources? Is there a possibility that odor problems will occur to the inhabitants?	(a) Y	(a) The Oder will be disappeared by the new overflow type gates which will flow out the Oder materials.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project area is not located in the protected area.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) Is there a possibility that the project will result in the loss of breeding and feeding grounds for valuable wildlife? If they are lost, are there substitutes for the grounds near the original locations? (d) Is there a possibility that overgrazing will cause ecological degradation, such as impacts on wildlife habitats and desertification? (e) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	(a)N (b) N (c) N (d) N (e) N	(a) The project site is located at residence area. Then no forests are existed around the project area. (b) The project area does not have a protected habitats. (c) There is no kind of valuable wildlife around the project area. (d) There is no case of overgrazing. (e) No significant ecological impact is existing in the surroundings of the project area.
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to the installation of structures, such as weirs will adversely affect the surface and groundwater flows (especially in "run of the river generation" projects)?	(a) N	(a) Hydraulic changes caused by new regulators will be analyzed and clarified at Basic Design (B/D) stage.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	(a) N	(a) No involuntary resettlement is caused by the project implementation. Only the replacements of two small mosques are required. RGBS compensate all construction costs. As the re-construction of mosques are constructed in the MWRI owned land, land acquisition are not required. Stockyard is utilized for construction. The contractor pay the leasehold ground rent under supervision of RGBS and restore the ground as the original condition after the project. No impact to fisheries is considered because of construction method with flowing water in the canals.
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	(b) Y	(b) RGBS has explained to stakeholders in the public hearing on replacement of two mosques and full compensation of RGBS.
		(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	(c) Y	(c) The development plan of mosques replacement will be prepared by RGBS and confirmed by stakeholders. The two mosques are constructed in the vicinity land owned by MWRI.
		(d) Is the compensations going to be paid prior to the resettlement?	(d) Y	(d) The replacement of mosques are completed before starting construction works of the new regulators.
		(e) Is the compensation policies prepared in document?	(e) Y	(e) Agreement of the mosques replacement is prepared and confirmed by RGBS and stakeholders before starting the works.
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	(f) Y	(f) Replacement plans for two mosques and ground rent exclude resettlement.
		(g) Are agreements with the affected people obtained prior to resettlement?	(g)-	(g) Replacement plan was agreed, however, the written agreement will be prepared and confirmed before the replacement.
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	(h) Y	(h) The replacement of mosques is implemented by RGBS with full responsibility including the cost. RGBS had experienced the mosques replacement at other project.
		(i) Are any plans developed to monitor the impacts of resettlement?	(i) N	(i) The replacement of mosques is scheduled to be completed before starting construction of the new regulators. The impact of replacement of mosques and ground rent are monitored by PMO.
		(j) Is the grievance redress mechanism established?	(j) N	(j) The grievance redress mechanism will be established in the PMO.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is proper allotment made for rights to agricultural land use? Is there a possibility that the allotment will result in inequitable distribution or usurpation of land and available resources? (c) Are proper allotments, such as water rights allotment in the project area made? Is there a possibility that the allotments will result in inequitable distribution or usurpation of water rights and available resources? (d) Is there a possibility that the amount of water used (surface water, groundwater) by the project will adversely the downstream fisheries and water uses? (e) Is there a possibility that water-borne or water-related diseases (e.g., schistosomiasis, malaria, filariasis) will be introduced? Is adequate consideration given to public health education, if necessary?	(a) N (b) (c) (d) N (e) N	(a) The project will not adversely affect the living conditions of inhabitants because the project implements only inside MWRI owned lands. (b) Project is not concerned the agricultural lands. (c) No allotment is occurred because water distribution after the project is the same before the project.. (d) The project will not adversely affect the downstream fisheries because during construction water flows as usual. The project is for improvement of regulators and water utilization from the regulator is not change, then it doses not affect adversely to the downstream water use. (e) The project will not adversely affect the water-born or water related diseases
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) Y	(a) The existing regulators which were constructed 138 years ago are proposing to be registered as historical monument. The existing regulators will not be affected during the construction period by the new regulators which located 140m downstream of the existing regulators.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)	(a) No existing landscape particularly.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) (b)	(a) No existing ethnic minority and indigenous people in the project area. (b) No existing ethnic minority and indigenous people in the project area.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) The construction works comply with the Egyptian labor law. The requirement will be included construction contract. (b) Safety measures are involved in the construction contract. Safety committee organized in the construction stage and consists of RGBS, the contractor and the consultant has regular meetings for tangible safety considerations. (c) Safety measures are involved in the construction contract. The safety committee headed by PMO plans and implements the safety and health program. (d) The safety committee will have regular meetings and take appropriate measures to ensure the safety to the inhabitants around the project areas.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	(a) Y (b) Y (c) Y (d) Y	(a) Mitigations for pollutions (dusts, noise, vibrations and others) during construction are examined in the detailed design stage. The mitigations are reflected in the construction contract. (b) The project site locates in the middle of town. Forest and valuable wildlife do not exists, then the natural environment will not be adveresely affected by the project. (c) Monitoring framework will be prepared. Environmental and social impacts during construction are considered to be working conditions except of pollutions. The working conditions will be specified and regulated in details in the construction contract. The safety committee monitors and confer about the construction activities to reduce impacts. d) It might affect few traffic problems because of small town. Construction contract requires the contractor of reducing traffic congestion. The contractor has to prepare the necessary mitigation programs. The safety committee implement the monitoring for the mitigation program.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) Mitigation measures during construction will be implemented by the contractor. The safety committee headed by RGBS monitors the required environmental mitigations. (b) Monitoring plan is shown in the table below. (c) RGBS establish an adequate monitoring framework including budget before implementation of the project. (d) RGBS has to report the result of environmental monitoring to EEAA quarterly basis.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry checklist should also be checked. (b) For the projects including construction of large-scale weirs, reservoirs, and dams, where necessary, pertinent items described in the Hydropower, Dams and Reservoirs checklist should also be checked.	(a) N (b) N	(a) N/A (b) N/A
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) N/A

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Monitoring Plan

No	Impacts	Responsible Authority	Pre-Construction	Construction	Operation
1	Topography and geology	RGBS	Once before construction		-
2	Weather and climate	RGBS/ Contractor	Once before construction	weekly	-
3	Air Emission (NO_2, CO_2, So_2, CO and PM10)	EEAA/ RGBS	Once before construction	weekly	-
4	Surface Water Quality (pH, SS, EC, DO)	EEAA/ RGBS	Once before construction	twice/month	monthly
5	Groundwater Quality	RGBS	Once before construction	twice/month	monthly
6	Water Flow and River Morphology	RGBS	Once before construction	weekly	Weekly
7	Archeological Treasure	MWRI/ RGBS		-	-
8	Land Use and Land Tenure	MWRI/ RGBS	Once before construction	monthly	-
9	Fishing	RGBS	Once before construction	monthly	monthly
10	Income	RGBS	Once before construction	monthly	-
11	Access to the Project Site	RGBS/ Contractor	Once before construction	monthly	-
12	Noise	RGBS/ Contractor	Once before construction	weekly	monthly
13	Vibration	RGBS/ Contractor	Once before construction	weekly	monthly
14	Health and safety	RGBS/ Contractor	Once before construction	monthly	-
15	Labor accommodation campus	RGBS/ Contractor	-	Monthly	-
16	Safety of the Regulators	RGBS	Once before construction	monthly	monthly
17	Wastes	RGBS/ Contractor/ LGU	Once before construction	monthly	monthly
18	Odor	RGBS/ Contractor	Once before construction	twice/month	monthly
19	Sediment	RGBS	Once before construction	monthly	every three months
20	Growth of weeds	RGBS	Once before construction	Twice/month	monthly
21	Complaints	RGBS/ LGU	-	weekly	monthly

Table 6.17 MONITORING FORM

-If environmental reviews indicate the need of monitoring by JICA, JICA undertakes monitoring for necessary items that are decided by environmental reviews. JICA undertakes monitoring based on regular reports including measured data submitted by the project proponent. When necessary, the project proponent should refer to the following monitoring form for submitting reports.

-When monitoring plans including monitoring items, frequencies and methods are decided, project phase or project life cycle (such as construction phase and operation phase) should be considered.

１．Responses/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
ex.) Responses/Actions to Comments and Guidance from Government Authorities	

２．Mitigation Measures

- Air Quality（Emission Gas / Ambient Air Quality）

Item	Unit	Measured Value（Mean）	Measured Value（Max.）	Country's Standards	Referred International Standards (Japanese Standard)	Remarks (Measurement Point, Frequency, Method, etc.)
SO_2	ppm			60	0.04ppm/hr(Average) and 0.1ppm/hr	4 samples and measured weekly basis
NO_2	ppm				0.04ppm/day(Average) and 0.06ppm/hr	4 samples and measured weekly basis
CO_2	ppm					4 samples and measured weekly basis
CO	ppm				10ppm/day(Average) and 20ppm/hr	4 samples and measured weekly basis
SPM	mg/m^3			150	0.10mg/m^3/day(Average) and 0.20mg/m^3/hr	4 samples and measured weekly basis
Dust	μ g/m^3				35 μ g/m^3/day	4 samples and measured weekly basis

- Water Quality（Effluent/Wastewater/Ambient Water Quality）

Item	Unit	Measured Value（Mean）	Measured Value（Max.）	Country's Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
pH	M.g/liter			7-8.5	6.0-8.5	10 samples and measured twice a month
SS (Suspended Solid)	M.g/liter					10 samples and measured twice a month

- Living / Livelihood

Monitoring Item	Monitoring Results during Report Period
Affect to fisheries	

Turbidity	NTU					
Dissolved Solid	M.g/liter					
Chemical Oxygen Demand	M.g/liter					
Electrical Conductivity	M.moose/cm				0-3	
DO	M.g/ liter				6 mg/ m^3	10 samples and measured twice a month
Temperature	Degree centigrade					10 samples and measured twice a month

- Waste

Monitoring Item	Monitoring Results during Report Period
Removal of solid wastes	

- Noise / Vibration

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Referred International Standards (Japanese Standard)	Remarks (Measurement Point, Frequency, Method, etc.)
Noise level	db				45-55 decibel	4 samples and measured weekly basis
Vibration level	db				55-65 decibel 75 decibel for piling equipment	4 samples and measured weekly basis

- Odor

Monitoring Item	Monitoring Results during Report Period
Removal of particles and dead animals	

３．Natural Environment

- Ecosystem

Monitoring Item	Monitoring Results during Report Period
Nothing particular ecosystem in the project area. In case of crucial effect to ecosystem the grievance redress mechanism is established.	

CHAPTER 7

PROJECT EVALUATION

CHAPTER 7 PROJECT EVALUATION

7.1 Conditions of Economic Evaluation of the Project

The Project consists of 1) renewal of DGR (new construction at downstream reaches of the existing one), 2) establishment of Integrated Water Management System to improve the equitable water distribution into the command area of DGR, and 3) rehabilitation of priority minor structures totaling 128 sites). The economic evaluation of the Project is performed with the benefits accrued from the Project, which are expressed in monetary value to be compared with the Project cost.

The direct effect of the Project is to realize the improved and appropriate water distribution into the command area of DGR. Furthermore, the renewal of the facility and integrated water management will enable more rational water management, so that the water shortage for irrigation will be alleviated. Increase of agriculture productivity is expected through this effect. The increase of agriculture production is applied for the benefit of the Project in monetary value to perform the economic evaluation.

Without the Project situation, it is expected that the function of DGR will be lost in the near future due to age. That would cause the destruction of appropriate water distribution, especially in the Bahr Yusef canal, and severe water shortage along the Bahr Yusef canal would occur, leading to a decrease of agricultural production. Implementation of the Project can avoid such expected loss in the future. The value of the expected loss of agricultural production without the Project in the future will also be counted as the benefit of the Project in monetary value. Realization of these Project benefits would contribute to the long-term process of correcting regional economic disparity in Egypt through increasing farm income.

The economic evaluation of the Project is performed to estimate the economic internal rate of return (EIRR), the B/C ratio, and the net present value (NPV). Also, as a financial analysis of the Project, a farm budget analysis is carried out to estimate the incremental farm income. Additionally, the socio-economic impacts of the Project will also be discussed. Following are the basic assumptions of the economic evaluation:

1) Price is based for the year 2010. Farm gate prices of crops are adjusted from the 2009 price due to the availability of data of the recent crop season.
2) A Standard Conversion Factor of 0.93 is applied for converting the financial price to the economic price. Labor cost for unskilled labor at the financial price is converted to the economic price applying the conversion factor of 0.63, considering the concealed unemployment.
3) The Project cost is divided into a foreign currency portion and a local currency portion based on traded goods and non-traded goods, and the local currency portion is converted to the economic price by SCF.
4) The transfer cost, such as taxes, is eliminated from the economic cost, and the price contingency cost is also eliminated from the economic cost since the economic evaluation is performed with the present value.
5) The opportunity cost of capital in Egypt is considered at 12%. It is judged that the Project is economically feasible when the EIRR of the Project exceeds it.

7.2 Project Components and Cost

The Project cost consists of 1) construction cost of DGR and O&M cost after its in-service, 2) equipment installation for the Integrated Water Management System and O&M cost after its in-service, and 3) rehabilitation cost of the priority minor structures and O&M cost after its in-service. The components of 1) and 2) are implemented as one set.

The total project cost for the components 1) and 2) is estimated at 493,870,000 LE at the financial price and 446,177,000 LE at the economic price. Dividing the cost at financial price by the command area of DGR arrives at 316 LE/fed indicating the small investment from the viewpoint of the vast command area. The cost of the 128 priority minor structures is estimated at 90,723,000 LE at the financial price and 69,900,000 LE at the economic price. Hence the total cost for the three components is 584,530,000 LE at the financial price and 516,077,000 LE at the economic price. The following table shows the construction cost and O&M cost of each component.

Table 7.2.1 Project Cost and O&M Cost at Financial and Economic Prices

Component	Financial Price (000LE)			Economic Price (000LE)		
	F/C	L/C	Total	F/C	L/C	Total
Dirout Group of Regulators	314,953	137,621	452,574	306,431	100,751	407,182
Integrated Water Management	37,110	4,123	41,233	35,343	3,652	38,995
Total (1)	352,063	141,744	**493,807**	341,774	104,403	**446,177**
Priority Minor Structures	63,506	27,217	90,723	49,980	19,920	69,900
Total (2)	415,569	168,961	**584,530**	391,754	124,323	**516,077**
O&M	4,526	4,526	-	4,072	4,072	4,072
-	1,500	1,500	-	1,395	1,395	1,395
-	907	907	-	699	669	869

7.3 Project Benefit

7.3.1 Project Benefit

As discussed in section 4.3, the renewal of DGR and establishment of an integrated water management system will improve the appropriateness of water distribution, and the amount of the distribution from the main canal to the branch canals will increase. It is expected that the improvement of water distribution leads to the increase of agricultural productivity. As proposed in Section 4.5, the increase of productivity will be calculated by the increase of unit yield of crops.

Furthermore, the function of DGR will be lost without the Project and a decrease of water distribution into the Bahr Yusef canal would occur in the near future. In this case the expected decrease of crop production without the Project can be counted as a benefit of the Project, which would protect such future loss. This benefit to avoid future

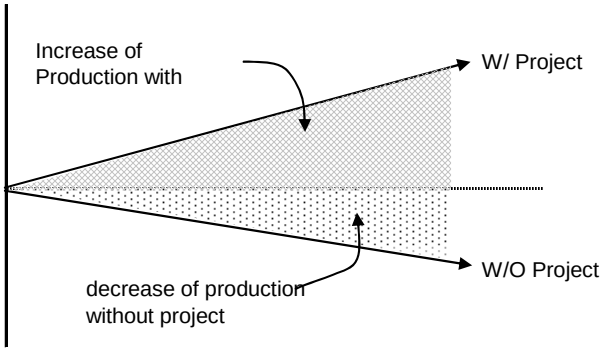


Figure 7.3.1 Concept of Benefit

loss without the Project will be counted as a benefit of the Project. The following table summarizes the category of benefits accrued from the Project:

Table 7.3.1 Project Benefits

Component	Benefit	Target Area
Renewal of DGR (Improvement of Gates)	Improving shortage of water distribution in the Bahr Yusef canal (increase of distribution in winter and summer by 6% and 10% respectively)	808,000fed (339,360ha)
	Stabilizing water discharge in the five main canals apart from Bahr Yusef and Ibrahimia	180,400fed (75,768ha)
Integrated Water Management System	Reducing ineffective discharge in winter and improving shortage of water distribution in Minia along Bahr Yusef (increase of distribution in winter by 33%)	202,100fed (84,882ha)
	Realizing appropriate water distribution along the Ibrahimia canal	576,700fed (242,214ha)
Renewal of DGR	Function of DGR is lost without the Project and water distribution into Bahr Yusef will be 26% lower than design distribution. This future loss will be alleviated with the Project.	808,000fed (339,360ha)
128 Minor Structures	Improving irrigation efficiency	70,430 fed (29,581ha)

7.3.2 Estimation of Project Benefit

The Project only deals with the renewal of the major facility and improvement of water management along the main canals to the vast command area of DGR, which is 1,565,100 fed (657,342ha). The facility on the main canal, namely DGR, is the core to make the irrigation system of the whole region functional. However, the extent of the benefit accrued to the Project is defined, taking into consideration the contribution of the main canal to the whole system. The benefit is estimated from the increase of the unit yield of crops based on the incremental ratio of the unit yield proposed in section 4.5, and also the following points are considered to estimate the benefit.

- On the proposed cropping pattern in section 4.5, crops with little share are represented by other major crops such as maize, wheat and berseem. The table below shows the cropping pattern with representative crops. This will be the basis for estimating benefit.

Table 7.3.2 Cropping Pattern for Estimating Project Benefit

Season	Crop	Giza		Beni Suef		Fayoum		Minya		Assiut		Total	
		Area (fed)	Share (%)	Area (fed)	Share (%)	Area (fed)	Share (%)	Area (fed)	Share (%)	Area (fed)	Share (%)	Area (fed)	Share (%)
Winter	Wheat	37,999	11.4%	163,179	26.0%	173,621	23.9%	228,006	23.8%	67,070	23.8%	669,875	22.9%
	L. Berseem	36,503	11.0%	53,726	8.6%	125,393	17.2%	155,507	16.3%	45,743	16.3%	416,872	14.3%
	Vegetables	45,030	13.6%	40,378	6.4%	34,563	4.8%	37,301	3.9%	10,972	3.9%	168,244	5.8%
	Other crops (marjoram)		0.0%		0.0%	24,516	3.4%		0.0%		0.0%	24,516	0.8%
	S. Berseem		0.0%	39,710	6.3%		0.0%		0.0%		0.0%	39,710	1.4%
summer	Maize	46,675	14.1%	141,822	22.6%	135,039	18.6%	285,796	29.9%	84,070	29.9%	693,402	23.7%
	Sorghum		0.0%		0.0%	68,323	9.4%		0.0%		0.0%	68,323	2.3%
	Oil Crops (sunflower)		0.0%		0.0%		0.0%	36,775	3.8%	10,818	3.8%	47,593	1.6%
	Vegetables	67,021	20.2%	35,372	5.6%	29,339	4.0%	102,446	10.7%	30,135	10.7%	264,313	9.0%
Nile	Maize	36,951	11.1%	90,100	14.4%	71,940	9.9%		0.0%		0.0%	198,991	6.8%
	Vegetables	24,385	7.3%		0.0%		0.0%		0.0%		0.0%	24,385	0.8%
Perenial	Sugar cane		0.0%		0.0%		0.0%	41,503	4.3%	12,209	4.3%	53,712	1.8%
	Cotton		0.0%	45,383	7.2%	28,535	3.9%	36,775	3.8%	10,818	3.8%	121,511	4.2%
	Fruit trees	37,400	11.3%	17,686	2.8%	35,769	4.9%	32,047	3.4%	9,427	3.4%	132,329	4.5%
Total		331,964	100.0%	627,356	100.0%	727,038	100.0%	956,156	100.0%	281,262	100.0%	2,923,776	100.0%
Winter vegetables		Tomato		Onion		Tomato		Tomato		Tomato		Tomato	
Summer / Nile vegetables		Tomato		Cucumber		Water melon		Tomato		Tomato		Tomato	
Fruit trees		Citrus		Citrus		Citrus		Grape		Grape		Grape	
Cultivated Area (fed)		149,600		333,700		401,900		525,360		154,540		1,565,100	
Cropping Intensity (%)		222%		188%		181%		182%		182%		187%	

- The components of renewal of the DGR and the Integrated Water Management System are to deal with the main canal level to the whole irrigation system. The degree of contribution of the improvement at the main canal level to the whole irrigation system including branch level, terminal level and on-farm level should be taken into consideration in estimating the increase of crop productivity. From this viewpoint, the proposed incremental ratios of unit yield with the above two components are assumed at 1/2 of the base incremental ratios, namely 4.5% in the summer crop and 2% in the winter crop. As for the benefit with the component of the priority minor structures, it is proposed to apply the basic incremental ratios, i.e. 9% in the summer crop and 4% in the winter crop, considering the closeness of the facility to the target area.
- The extent of the benefitted area with the Project will also be taken into consideration for improvement at the main canal level only. As for the categories of the benefit with significant improvement of water distribution, namely increase of distribution by 33% in Minia along the Bahr Yusef and expected loss without project by 26% along the Bahr Yusef canal, it is assumed that the whole target area would be benefitted with an increase of crop productivity. For other categories of benefit, it is assumed that the benefitted area would be in close areas to the main canals in the whole target areas, i.e., it is assumed that 25% of the target area would be benefitted. As for the component of the priority minor structure, it is assumed that 75% of the target area would be benefitted, considering the closeness of the facility to the target command area.
- Standard data for crop budget by the Ministry of Agriculture and Land Reclamation at the governorate level is applied for estimating benefit. Table 7.3.2 summarizes the assumptions of the benefit estimation. Table 7.3.3 shows the amount of benefits estimated.

Table 7.3.3 Assumptions of Project Benefit Estimation

Category of Benefit	Incremental Ratio	Target area (fed)	Benefited area (fed)
Increase of distribution into Bahr Yusef	4.5% in summer, 2% in winter	808,000	202,000 (25%)
Stabilizing discharge at five main canals	4.5% in summer, 2% in winter	180,400	45,100 (25%)
Increase of distribution into Minia	2% in winter	202,100	202,100 (100%)
Appropriate distribution into Ibrahimia	4.5% in summer, 2% in winter	576,700	144,175 (25%)
Avoiding future loss without project	4.5% in summer, 2% in winter	808,000	808,000 (100%)
Rehabilitation of the Priority Minor Structures	9% in summer, 4% in winter	70,430	52,823 (75%)

Table 7.3.4 Incremental Benefit with Project

Category of Benefit	Increase Farm Income (Financial Price)		Increase of Net Return (Economic Price)	
	LE/fed	000LE/yr	LE/fed	000LE/yr
Increase of distribution into Bahr Yusef	348.8	70,458	276.9	55,934
Stabilizing discharge at five main canals	368.0	16,597	293.9	13,255
Increase of distribution into Minia	112.9	22,817	74.3	15,016
Appropriate distribution into Ibrahimia	348.8	50,288	276.9	39,922
Total (1)		160,160		124,127
Avoiding future loss without project (max. benefit after 30 years)	363.1	293,385	317.5	256,540
Total (2)		453,545		380,667
Priority Minor Structures (max. benefit after 20 years)	507.3	35,731	419.5	29,547
Total (3)		489,276		410,214

Note: Benefit for financial analysis is based on the farm income, which excludes family labor value from the production cost, while the benefit of economic analysis based on net return, which includes family labor value in the production cost.

7.4 Verifiable Indicators of Operation and Effectiveness of the Project

For justification of the Project and to evaluate the effectiveness of the Project after the implementation, some indicators to measure the effects of the Project are required. The following table summarizes the effects and indicators to be monitored before and after the Project implementation.

Table 7.4.1 Verifiable Indicators of Operation and Effectiveness of the Project

Verifiable indicators	Standard of indicators	Means of verification
Stabilization of the water level in main canals, and realization of the proper amount of distribution	Water level of plan on the upstream side in each regulator and flowing quantity of plan to the regulator downstream.	Water management recorded data
The degree of improvement of water shortage	The degrees of water shortage rated by five levels based on the Baseline survey	Survey of farm household economy after implementation of the project
Increase of Crop Yield	Proposed Incremental Ratio of Crop Yield: proposed at 9% or 4.5% for maize (summer crop) and 4% or 2% for wheat (winter crop). (It's based on Table 7.3.3)	Statistics of MALR, Survey of farm household economy after implementation of the project

The upstream water level of each regulator and the flowing quantity downstream of the regulator are used as an index to measure the situation of the water level stabilization in the canal and the proper amount of distribution situation. The data used for the evaluation uses the recorded data of the monitoring equipment introduced by the project

In case of any degree of improvement of water shortage, the degrees of water shortage rated by five levels based on the baseline survey will be checked again after implementation of this project.

The above-mentioned increase of Crop Yield can be grasped, as shown in the agricultural statistics published by the Ministry of Agricultural Land Reclamation. Of course, it is

impossible to extract the effect of the rehabilitation and improvement of the Dirout Group from a wide variety of activities for agriculture development in the area. Therefore, the agricultural statistics will be used as data to confirm a trend. To confirm the direct effects of the Project, periodical interviews/surveys to farmer beneficiaries is suggested after the implementation of the Project. It is an ideal target to include the Baseline survey area conducted in this study. The Study Team would suggest the site for such monitoring.

7.5 Economic and Financial Analyses of Project

7.5.1 Economic Internal Rate of Return (EIRR), B/C and Net Present Value (NPV)

The Economic Internal Rate of Return (EIRR) based on the above economic cost and benefit is calculated, and also B/C and Net Present Value (NPV) are calculated using the opportunity cost of capital in Egypt, namely 12% as a discount rate. These economic indicators are calculated as the cases excluding and including the benefit to avoid future loss without the Project. In addition, the economic indicators including the minor structure component is examined. The Project implementation period is planned as 4 years for DGR, 2 years for the Integrated Water Management System and 20 years for the Priority Munor Structures. The benefit can be fully realized from the following year of the completion of the construction as the benefit accrues from the alleviaton of water shortage. Table 7.5.1 shows the results of the analysis.

Table 7.5.1 Result of Calculating Economic Indicators (Base Case)

Project Component		EIRR	B/C	NPV (000LE)	(FIRR)
(1) DGR + Integrated Water Management	Exclude the benefit avoiding future loss without project	20%	1.80	290,332	(23%)
	Include future loss without project	26%	2.89	686,889	(28%)
(2) Minor Structures		35%	2.96	106,524	(33%)
(1)＋(2)	Exclude the benefit avoiding future loss without project	22%	1.95	396,856	(24%)
	Include future loss without project	27%	2.90	793,413	(29%)

As shown in the above table, EIRR for the renewal of DGR and the establishment of the Integrated Water management System is calculated at 20% in case of excluding the benefit of avoiding future loss without the Project and 26% in case of including said benefit. These EIRR figures exceed the opportunity cost of capital in Egypt, i.e. 12%. EIRR for the Priority Minor Structure is calculated at 35%. Though the portion of the Priority Minor Structures is small compared to the whole scale of the project, combining the three components altogether will give a higher economic return, as the EIRR for the aggregated three components is estimated at 22% and 27% in cases of excluding and including the benefit of avoiding future loss without the Project.

7.5.2 Sensitivity Analysis

Based on the above base case, a sensitivity analysis is carried out in cases of increasing cost and decreasing benefit. Table 7.5.2 shows the result of the sensitivity analysis with the cases of

1) increase of cost by 10%, 2) decrease of benefit by 10% and 3) combination of 1) and 2). The result indicates that the EIRR with the cases still exceed the opportunity cost of capital considering the economic efficiency of the Project is stable.

Table 7.5.2 Sensitivity Analysis (EIRR)

Case	DGR＋IWMS		DGR＋IWMS＋Minor Structures	
	Exclude benefit to avoid future loss w/o project	Include benefit to avoid future loss	Exclude benefit to avoid future loss w/o project	Include benefit to avoid future loss
Base Case	20%	26%	22%	26%
(1) 10% increase of Cost	19%	24%	20%	25%
(2) 10% decrease of benefit	18%	24%	20%	25%
(1) + (2)	17%	22%	18%	23%

7.5.3 Farm Budget Analysis

As a financial analysis of the Project, the incremental benefit to the average farm household in the Project area is estimated. Based on the 2006 population census, incremental income of small-scale farmers, who are the majority of the Project area, will be estimated. Farm households with land holdings of less than 2 feddan occupy 80% of the total farm households in the Project area. Therefore, the average of farm households with less than 2 feddan is targeted in the analysis. The benefit of future loss without the Project is not included in the analysis. Table 7.5.3 shows the incremental income of the farm household.

Table 7.5.3 Incremental Income of Small-scale Farm Households with Project

Item		Farm Income (LE/yr)	Incremental Benefit (LE/yr)	
Ave. Farmland Size (Ave. of less than 2fed)		0.61 feddan		
Cropping Intensity		187%		
Farm Income at present (LE/yr)		3,716	-	
Farm Income without Project (LE/yr)		3,403	-313 (92%)	-
With Project	Exclude Minor Structures	3,965	249 (107%)	562 (117%)
	Include Minor Structures	4,427	711 (119%)	1,024 (130%)

Note: Ave. farm land size is based on the households with less than 2 feddan in 2006 census.

The incremental ratio of farm income in case of excluding minor structures is 7% of income level at present. In the areas in which the rehabilitation of minor structure is implemented, the incremental ratio of farm income becomes 19%. The benefited area by the priority minor structures in this Project is limited as 70,430feddan (29,581ha), but the contribution of the minor structure component to increasing farm income is considered high.

Though the impact of the improvement of the main facility would extend wide but shallow, it is the primary infrastructure that would realize all the benefits accrued to improvement from branch level to terminal level. Therefore, the Project has the highest priority. Moreover, improving the main facility and improving irrigation as a whole (including branch level and terminal level) would greatly contribute to increasing income of farm households in the Project area.

When reflecting the expected future loss of production without Project into the farm income, it

is estimated at a loss of 313LE/yr or 8% decrease of small scale farmer with 0.61 feddan. Estimating the difference of income between without and with Project situations, it is estimated at 17% in case of excluding minor structure component and 30% in case of including minor structure component.

7.6 Impacts of the Project

The following impacts would be considered by implementing the Project:

1) Food Security and Saving Foreign Currency by Production Increase of Wheat and Maize

Wheat and maize are the most important grains as staple foods of the nation, Egypt. However, the self-sufficiency ratios of wheat and maize were 54.4% and 53.2% in 2007 respectively (Sustainable Agriculture Development Strategy 2030, MALR/FAO). The Government of Egypt targets to raise the self-sufficiency ratios of wheat and maize to 80.8% and 91.9% respectively by the year 2030.

Total productions of wheat and maize were 7.4 million tons and 6.3 million tons respectively in 2007. Productions of wheat and maize in the Project area reaches to 1.7 million tons (23% of national) and 2.2 million tons (35% of national) respectively. With the Project, an annual increase of 51 thousand tons, or the equivalent of 10 million US$ (56 million LE) for wheat and 106 thousand tons, or 17 million US$ (97 million LE) for maize would be expected. These amounts of value would be substituted from importing these grains contributing to saving foreign currency reserves as well as increasing the food security for the nation. Also, if the project was not implemented, 18 thousand tons of wheat and 52 thousand tons of maize would be annually lost after the function of DGR was lost. These amounts are equivalent to 3.5 million US$ (19.5 million LE) and 8.5 million US$ (47.6 million LE).

2) Increase of Farm Labor Opportunity

With the Project, crop production is expected to increase, and proportionally, the labor demand for harvesting would increase. It is estimated that 6.17 million man days of labor demand would be created with the Project. This is equivalent to 25 thousand labor days with the annual working days per person of 250 days. Assuming that 70% of labor demand was absorbed by family labor, there would still be 7.5 thousand men of labor demand to be created.

3) Correcting Regional Disparity

The Project will contribute to increasing farm income by improving irrigation water distribution and agricultural productivity. This would contribute to improving the income status of the rural population in Upper Egypt, where the poor population has been mostly concentrated among the country, as well as contributing to correcting the regional disparity in Egypt for the long term.

CHAPTER 8

CONCLUSION

AND RECOMENDATION

CHAPTER 8 CONCLUSION AND RECOMENDATION

8.1 Conclusion

1. It is projected that the population of Egypt will reach 150 million in 2050. That would be a big issue to be solved from the national security point of view, especially the national food security. For instance, the production of wheat, the staple food of the country, has to be doubled to meet the demand in 2050 from the current seven (7) million tons per year, provided that the current wheat self-sufficient ratio of 54.4% were maintained. The horizontal expansion (expansion of the arable land) and vertical expansion (increase of agricultural productivity) is therefore an urgent pursuing measure of the Government. The success of the measure heavily depends on securing the water resources and stable water supply.

2. The Dirout Group of Regulators (DGR) has a function to deliver the irrigation water of 9.6 billion m^3 (BCM), which is equivalent to 17% of Egypt's annual quota of 55.5 BCM, into the seven (7) main canals through the five (5) regulators commanding 1,565,100 feddan, which occupies 17% of the total arable land in Egypt. As the existing DGR has deteriorated, since it was constructed in 1873, its original function has seriously declined. That is a major cause of the drop of crop productivity in the Project area, which is a food supply center in the Upper Egypt region.

3. The Project aims at realizing the appropriate water distribution and resolving the decreasing agriculture productivity due to water shortage in the Project area through the rehabilitation and improvement of the existing DGR. It is expected that the Project would contribute to increasing crop production, which would lead to increase of farm income and creation of job opportunity during harvest season, and eventually contribute to alleviating poverty and improving the living standard of the people in the Project area in Upper Egypt, situated in an area of high poverty incidence.

4. The Project consists of (1) New construction of the existing DGR, (2) Establishment of the Improved Water Distribution System, and (3) Rehabilitation of the Priority Minor Structures. The total project cost is 0.59 Billion LE. The Project performs high economic efficiency as the Economic Internal Rate of Return (EIRR) is estimated at as high as 27%.

5. It is expected that the production of wheat and maize would increase by 44,000 tons per annum (equivalent to annual consumption of 252,000 people) and 92 thousand tons per annum (equivalent to annual consumption of 800,000 people) respectively. These increases would contribute to saving foreign currency reserves as the values of the increase of wheat and maize production at the international market price are 8.6 million US$ and 15 million US$ respectively. The Project would therefore contribute to the fiscal status of the Government as well as the National Food Security. Furthermore, the Project would create job opportunities of about six (6) million man days, or about 25,000 people in the agriculture sector.

6. Under the pressure of population growth, people have been moving from rural areas to urban areas to seek job opportunities. The rehabilitation and improvement of the major structures alleviates the irrigation water shortage and contributes to stabilizing and increasing farm income. That would promote the motivation of the farmers to succeed on the land, engage in farming, and develop agriculture technologies. Such a qualitative impact is also expected from the Project.

7. In conclusion, it is judged that the Project is feasible based on the high economic efficiency and values. It is also judged that the Project is socially viable as a public investment since the Project

follows and contributes to the policies of the Sixth Five-Year Plan, which are (1) Raising income and living standards, (2) Achieving food security, and (3) Contributing to increasing employment opportunities.

8.2 Recommendation

1. It is recommended to apply the Japanese ODA Loan for the Ministry of Water Resources and Irrigation (MWRI) to secure the fund for the implementation in order to realize the Project benefits as early as possible.

2. It is proposed to establish the new Dirout Group of Regulators Construction Project Office under MWRI for earlier realization of the Project benefits accrued from the operation of the new structure. It is also proposed to procure foreign consultants as the core of implementation organization for smooth execution in case of applying the Japanese ODA Loan for the Project.

3. In order to realize the Project benefits as early as possible and for the Project objective to take root, it is essential to develop a system of decision process for water distribution based on the water level and water discharge volume, which are observed at the intake facilities and weirs located along the seven (7) main canals and measured as a function of the water distribution of the new DGR, as well as the improvement of the engineering of operation and maintenance of the facilities and equipment. It is proposed that MWRI would apply for the technical cooperation scheme by the Government of Japan as the best way of developing the system.

4. The governmental policy on the National Security, especially the policy on Food Security, is defined in the Sixth Five-Year Plan as the long term plan towards the Year 2017 (Refer to the Sixth Five-Year Plan, page 93). The Project is to increase the agricultural productivity and production through improving irrigation efficiency by recovering the appropriate function of the water distribution of 9.6 BCM (equivalent to 17% of 55.5 BCM agreed in the Nile River Agreements) to irrigate the beneficiary area of 1.565 million feddan by the Ibrahimia Main Canal. Realizing an appropriate water distribution system is an essential factor to meet the increasing demand of food accompanied with the population growth. However, the appropriate irrigation system without a water shortage can be realized in accompaniment with the rehabilitation of the irrigation canal network, rehabilitation of more than 3,000 minor structures, and on-farm irrigation improvement. It is therefore recommended that MWRI should implement the improvement of the total irrigation system of the Ibrahimia Main Canal as a long-term plan and the Project of the new DGR construction as its initiation.

5. At the beginning of the Detailed Design stage, it is recommended to carry out a geological survey with the necessary number and depth of the borehole drilling at the location of the new DGR in order to obtain basic data for the safety design with enough capacity of strength and stability for the long term use of the facility.

6. Since the important buildings for religion are located at the proposed site of the new DGR, it is requested that MWRI should discuss and agree with the involved parties for the issue including the possibilities of removing the buildings at the detailed design stage.

7. The navigation lock is one of the successive functions from the existing DGR to the new DGR. It is recommended for MWRI to make a final decision on the succession of the navigation lock at the detailed design stage from the viewpoint of the future effective transportation system.

8. It is recommended that MWRI should accelerate consensus-making regarding the future regional

transportation system and designed infrastructures of the new DGR.

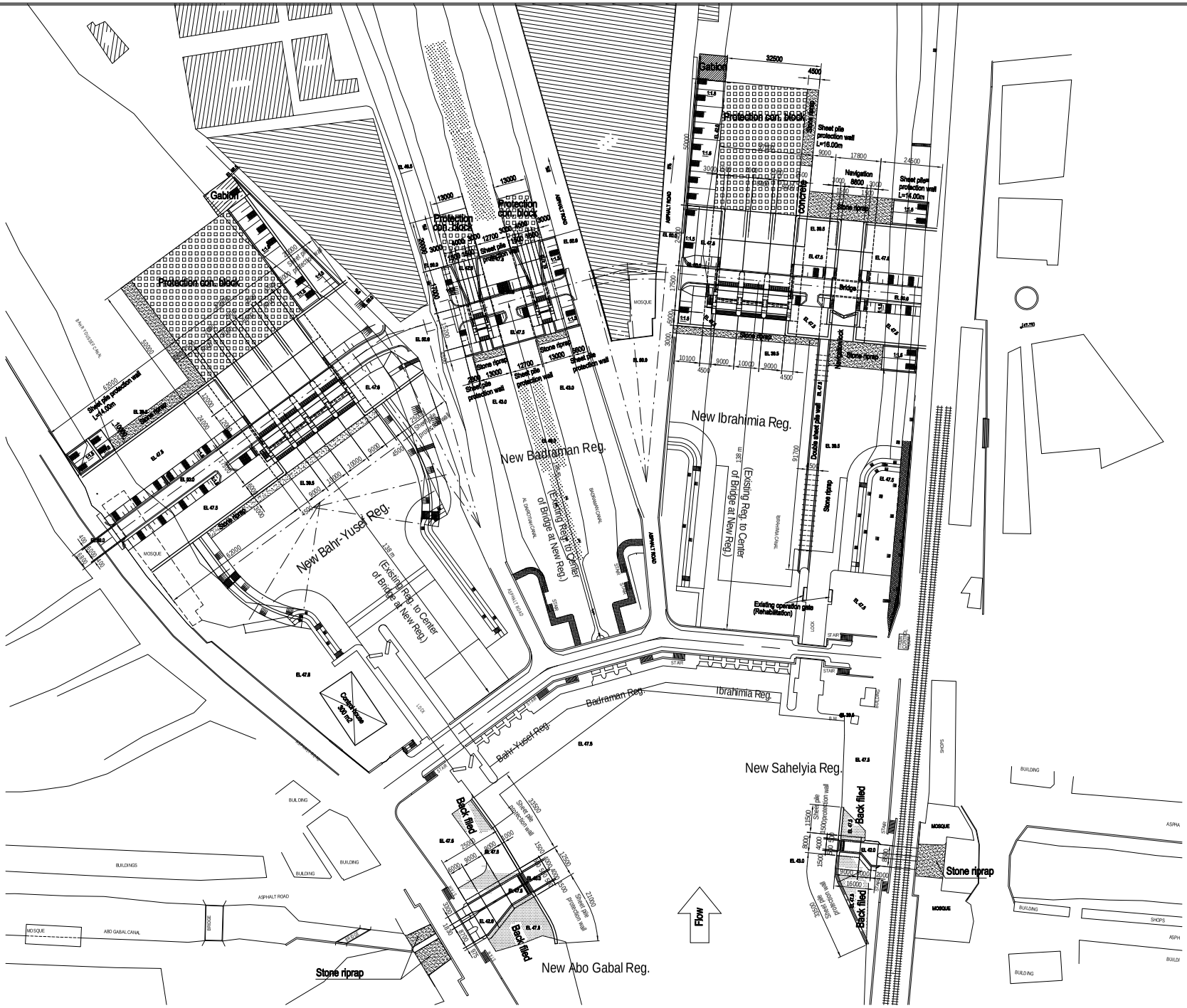
9. Upon the recommendation made by the Steering Committee, it is recommended to preserve the existing DGR as historical structure in the world with careful study to identify the required rehabilitation works based on the foundation survey and strength survey of the regulator body.

ATTACHMENT

● Drawing of the New Dirout Group of Regulators

Contents of the drawing

No.	Title of the drawing	Pc.
1	General Plan at down stream (Approx.140m)	1
2	Cross section on Bahr Yusef Regulator	1
3	Cross section on Ibrahimia Regulator	1
4	Cross section on Badraman Regulator	1
5	Cross section on Abo Gabal Regulator	1
6	Cross section on Sahelyia Regulator	1
7	General temporary plan at Term-1	1
8	General temporary plan at Term-2	1
9	General temporary plan at Term-3	1
10	General gate plan of the Double-leaf gate(Bahr Yusef and Ibrhimia)	1
11	General gate plan of the Single-leaf gate(Bdraman)	1
12	General gate plan of the Single-leaf gate(Abo Gabal and Shelyia)	1
13	General gate plan of the Radial gate with flap (Reference)	1
	Total	13



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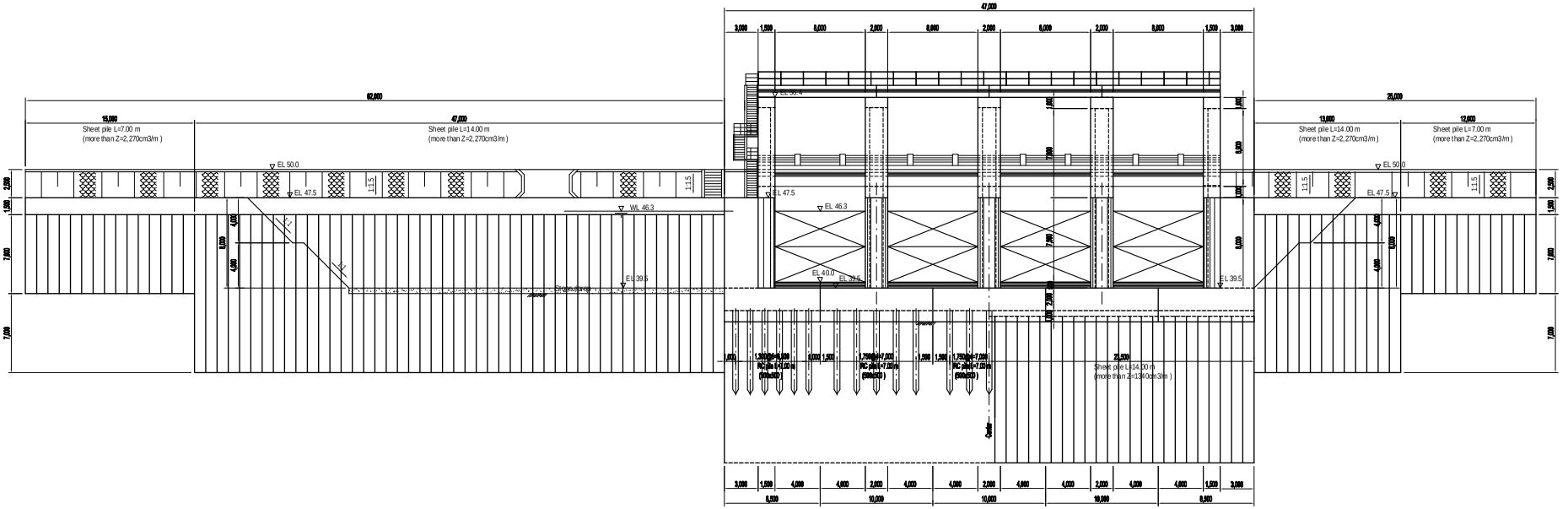
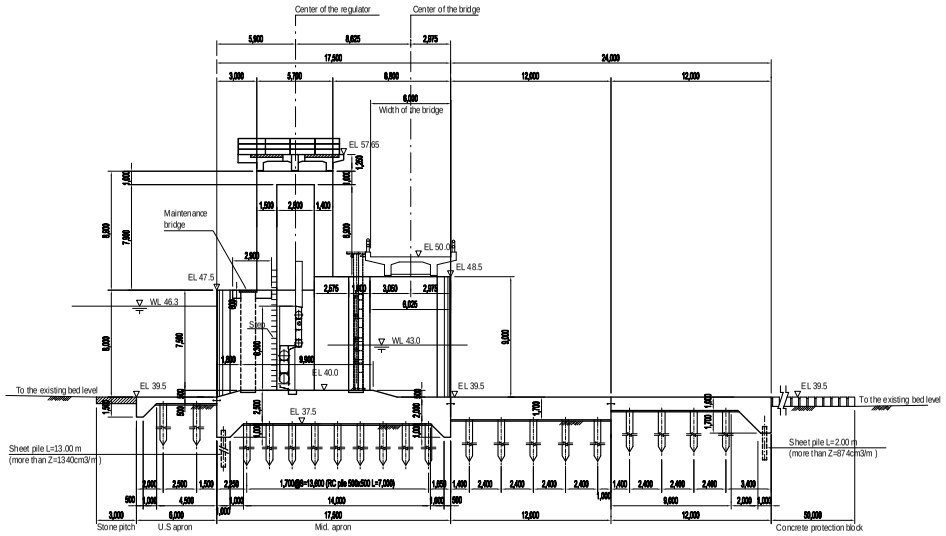
A-3

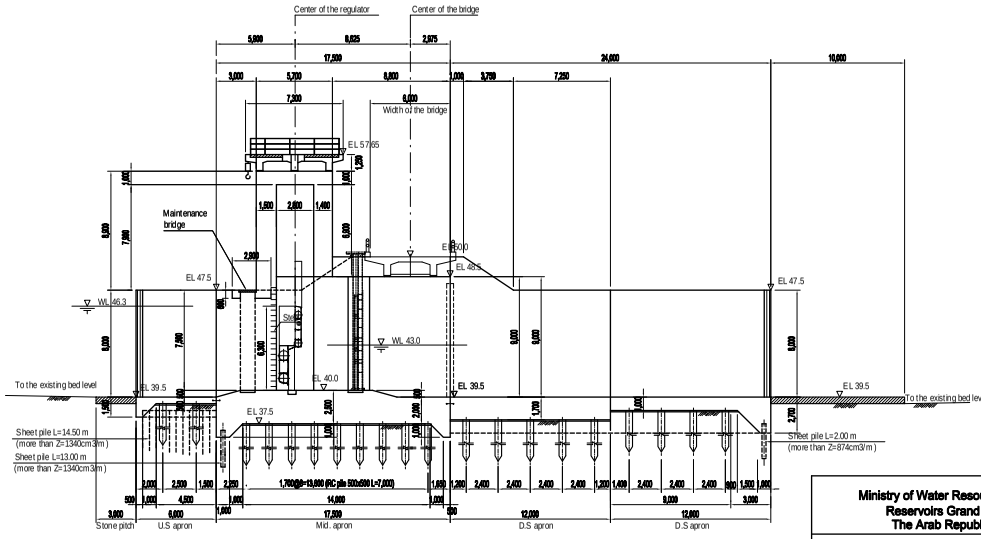
Standard section of the Bahr Yusef Regulator (Upstream)



Standard section of the middle pier on Bahr Yusef Regulator



Standard section of the abate pier on Bahr Yusef Regulator



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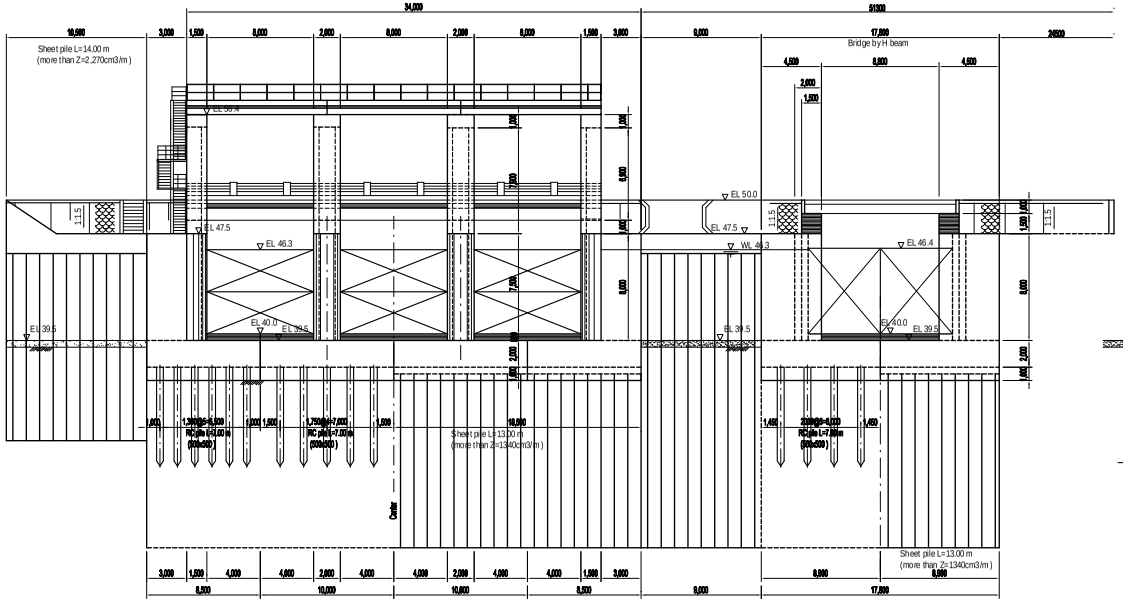
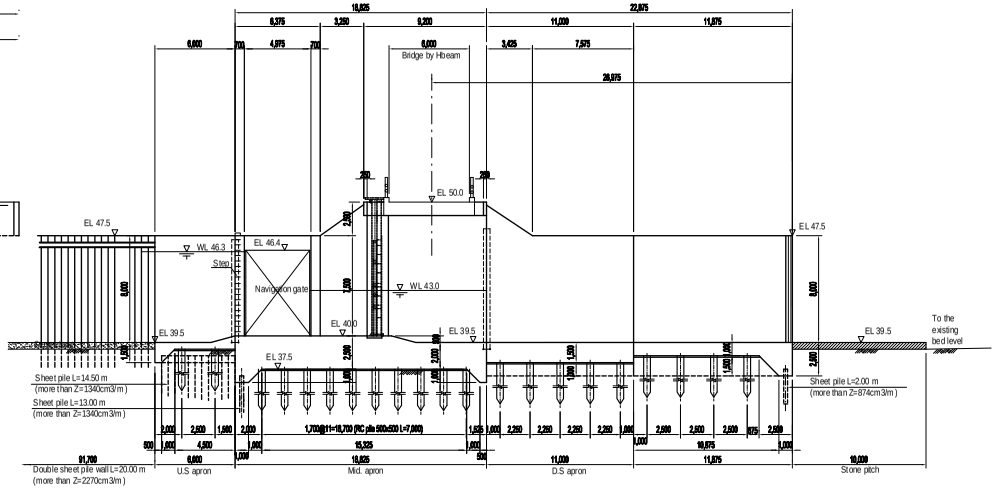
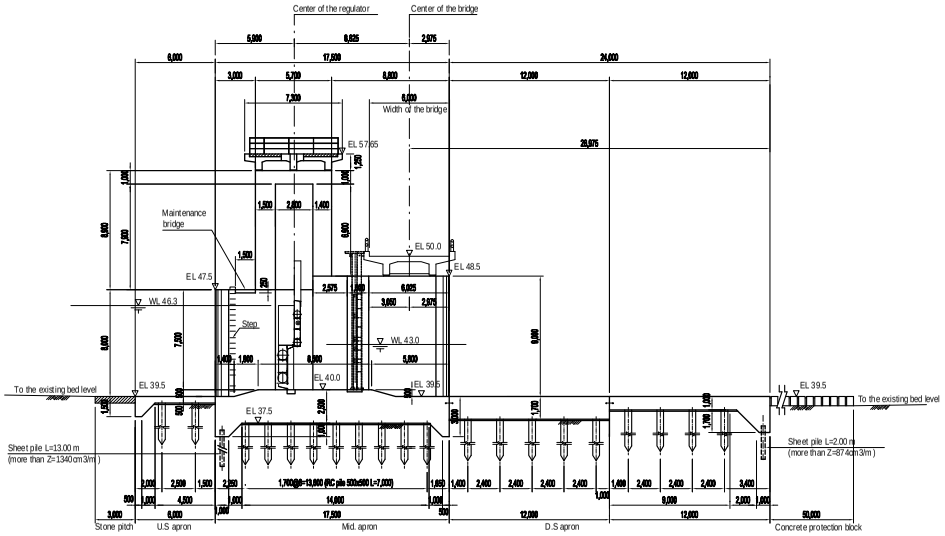
Standard section of the Ibrahimia Regulator (Upstream)



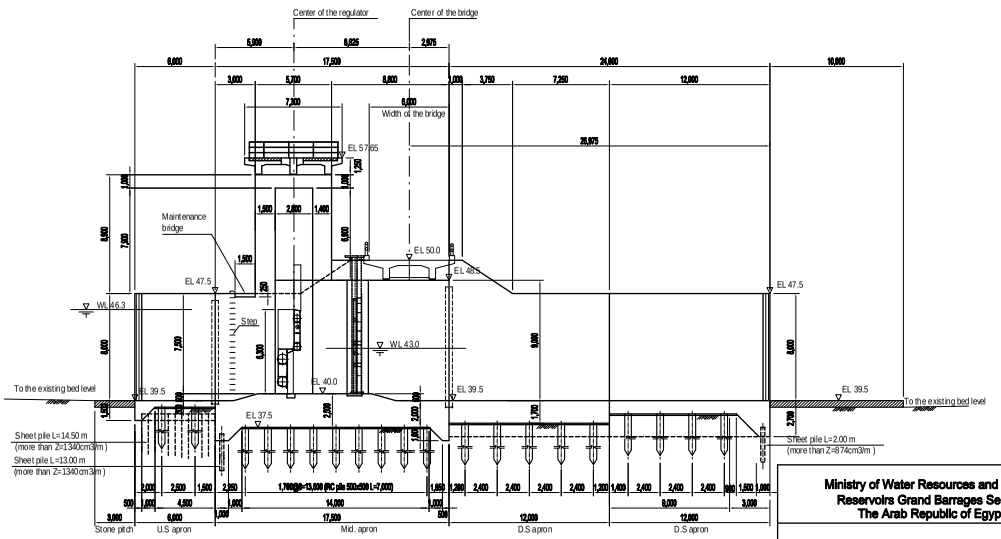
Standard section of the navigation lock on Ibrahimia Regulator



Standard section of the middle pier on Ibrahimia Regulator



Standard section of the abate pier on Ibrahimia Regulator



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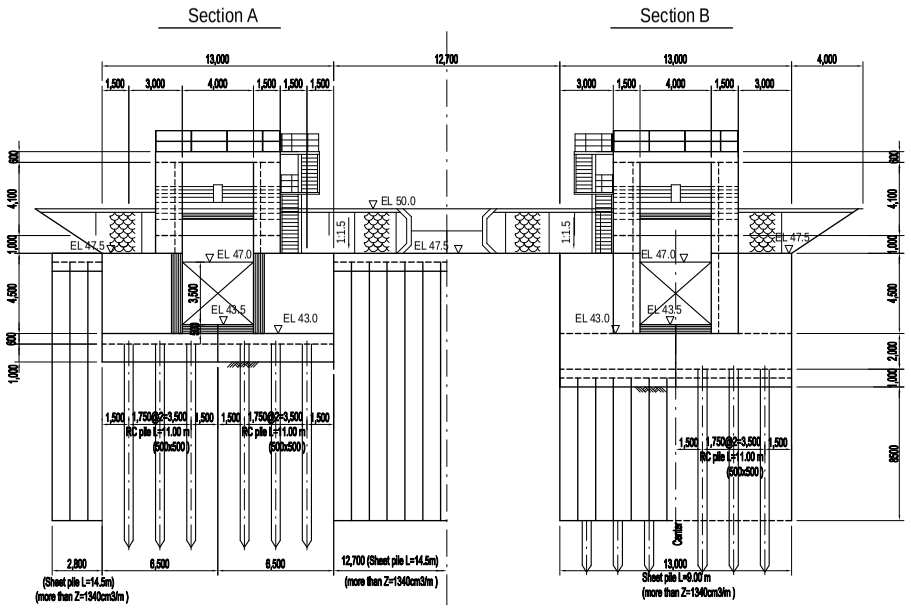
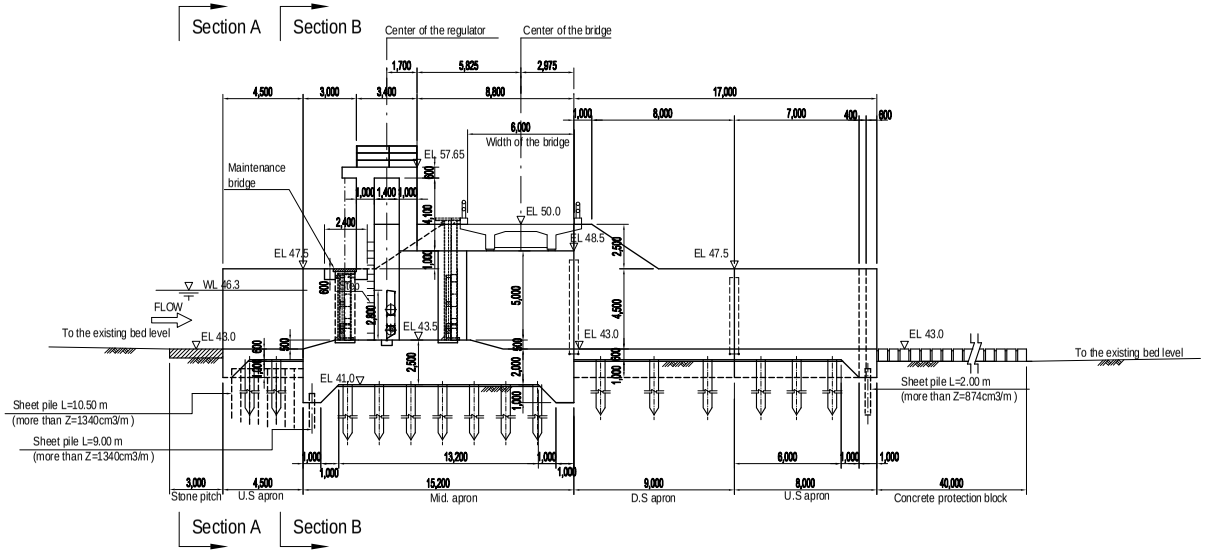
Standard section of Badraman Regulator (Upstream)



Standard section of Badraman Regulator



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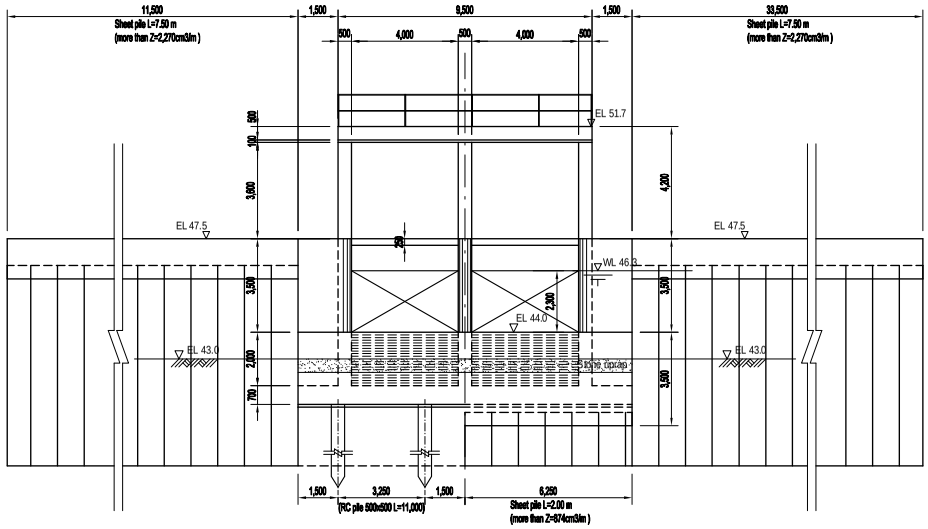
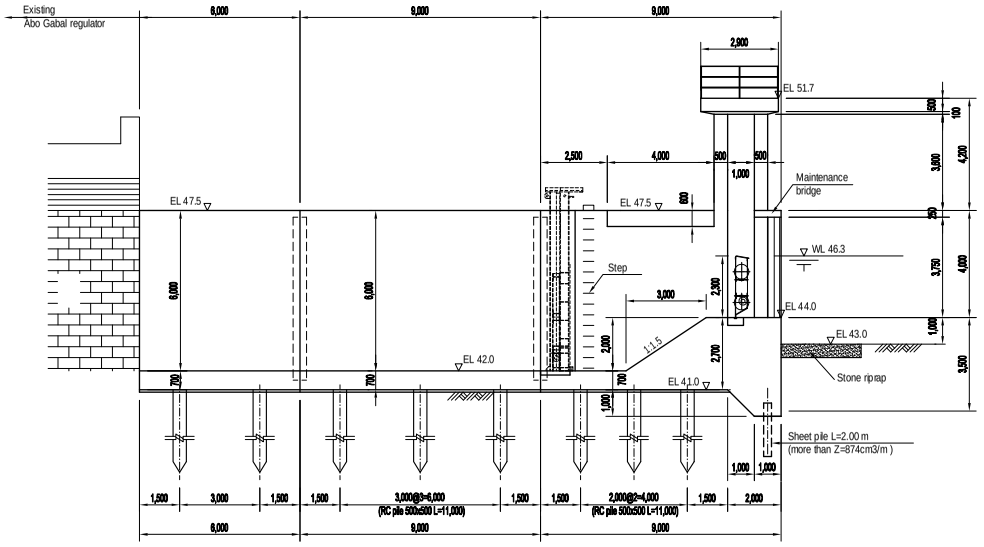
Standard section of the Abo Gabal Regulator (Upstream)



Standard section of the Abo Gabal Regulator



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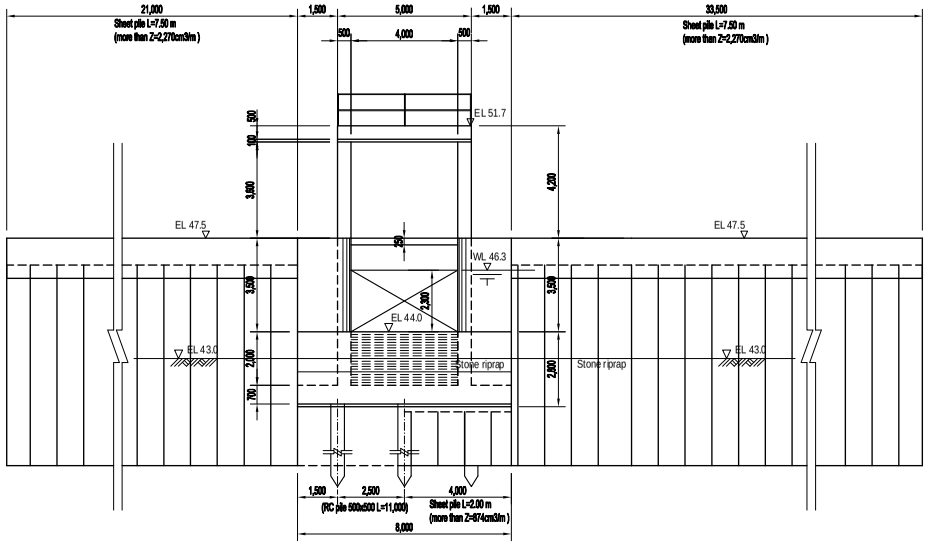
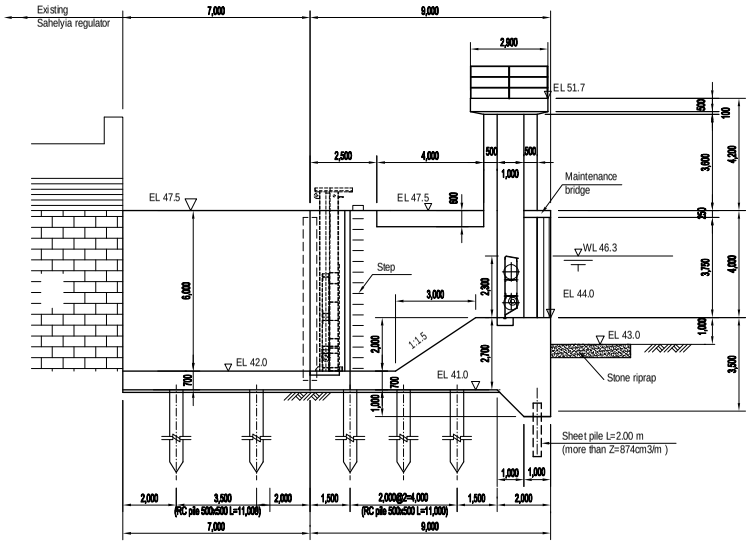
Standard section of the Sahelyia Regulator (Upstream)



Standard section of the Sahelyia Regulator



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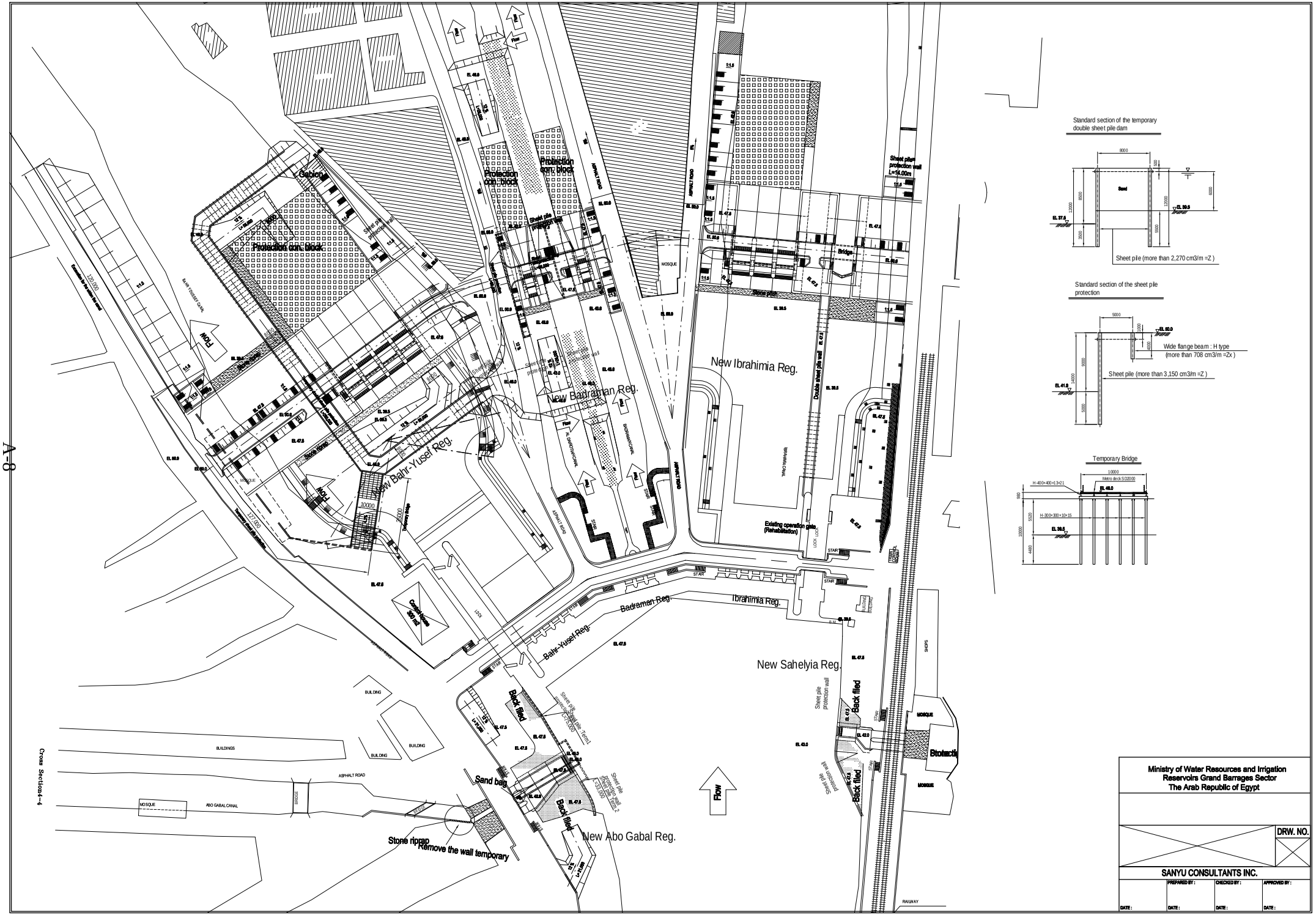

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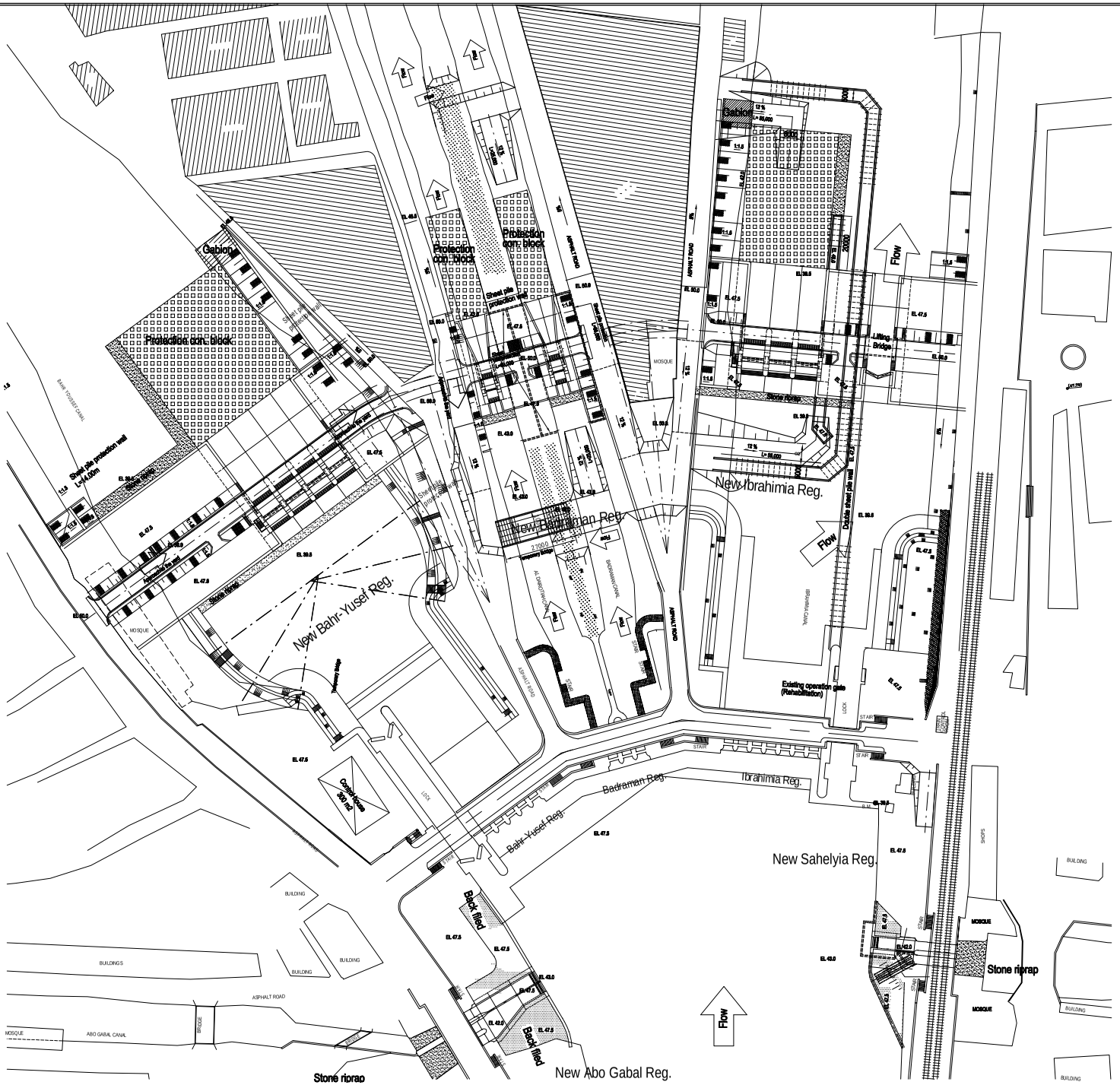
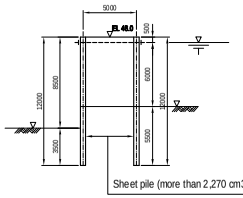
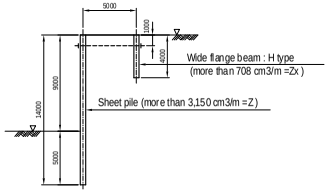


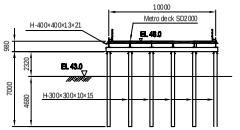
Standard section of the temporary double sheet pile dam



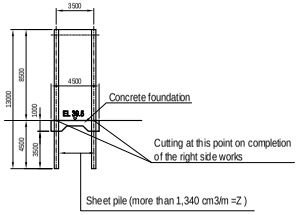
Standard section of the sheet pile protection



Temporary Bridge



Standard section of the temporary double sheet pile dam for the term of the right side works



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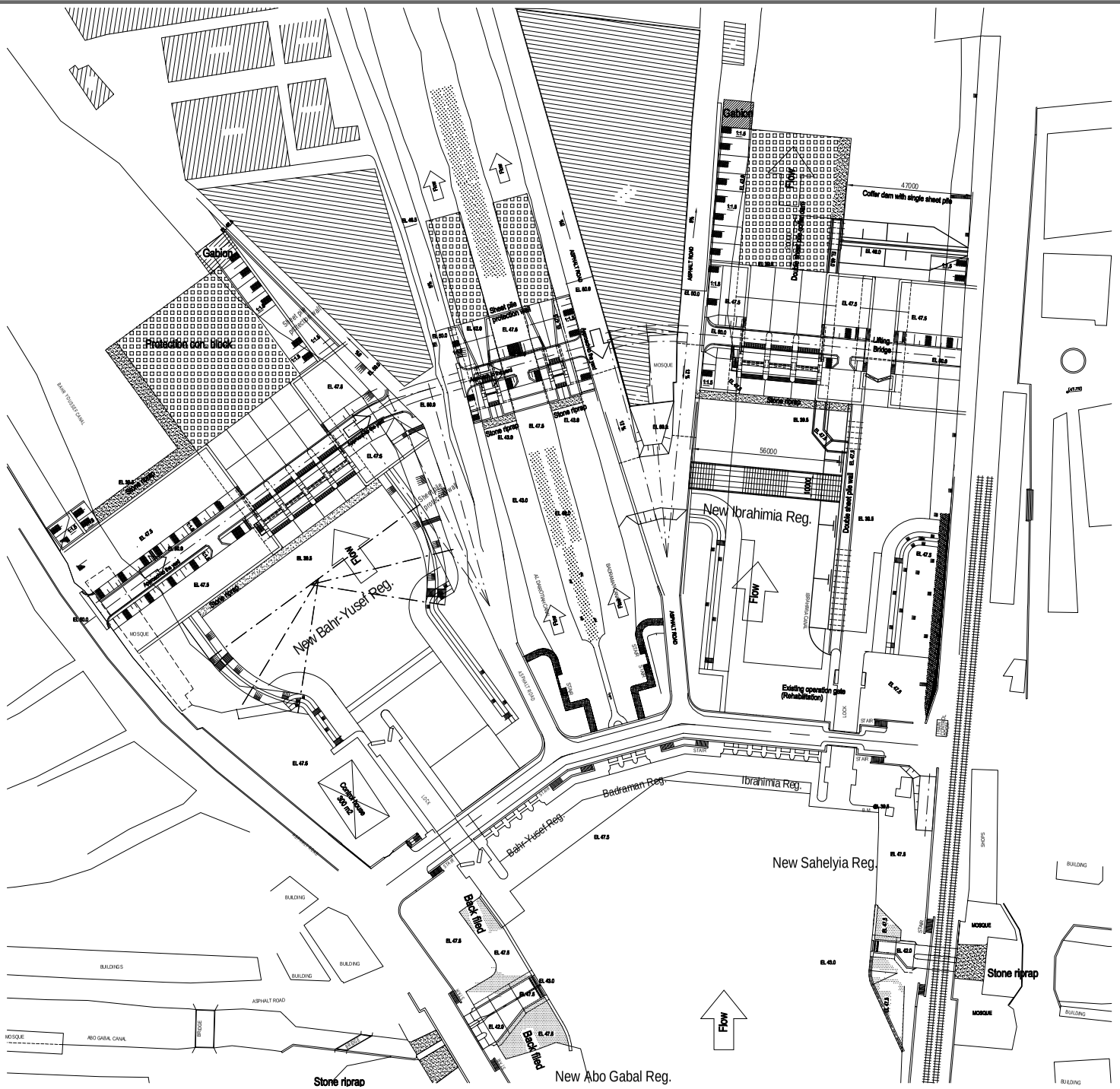
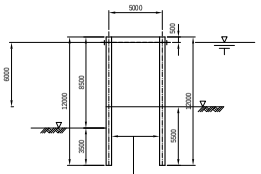
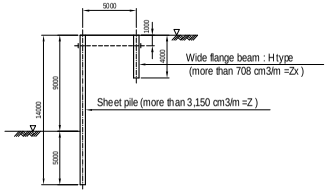


Standard section of the temporary double sheet pile dam



Sheet pile (more than 2,270 cm3/m =Z)

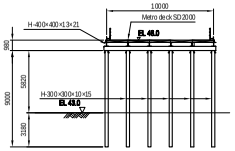
Standard section of the sheet pile protection



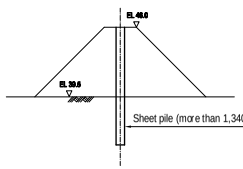
Wide flange beam : H type (more than 708 cm3/m =Zx)

Sheet pile (more than 3,150 cm3/m =Z)

Temporary Bridge

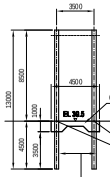


Temporary coffer dam with single sheet pile



Sheet pile (more than 1,340 cm3/m =Z)

Standard section of the temporary double sheet pile dam for the term of the right side works



Concrete foundation

Cutting at this point on completion of the right side works

Sheet pile (more than 1,340 cm3/m =Z)

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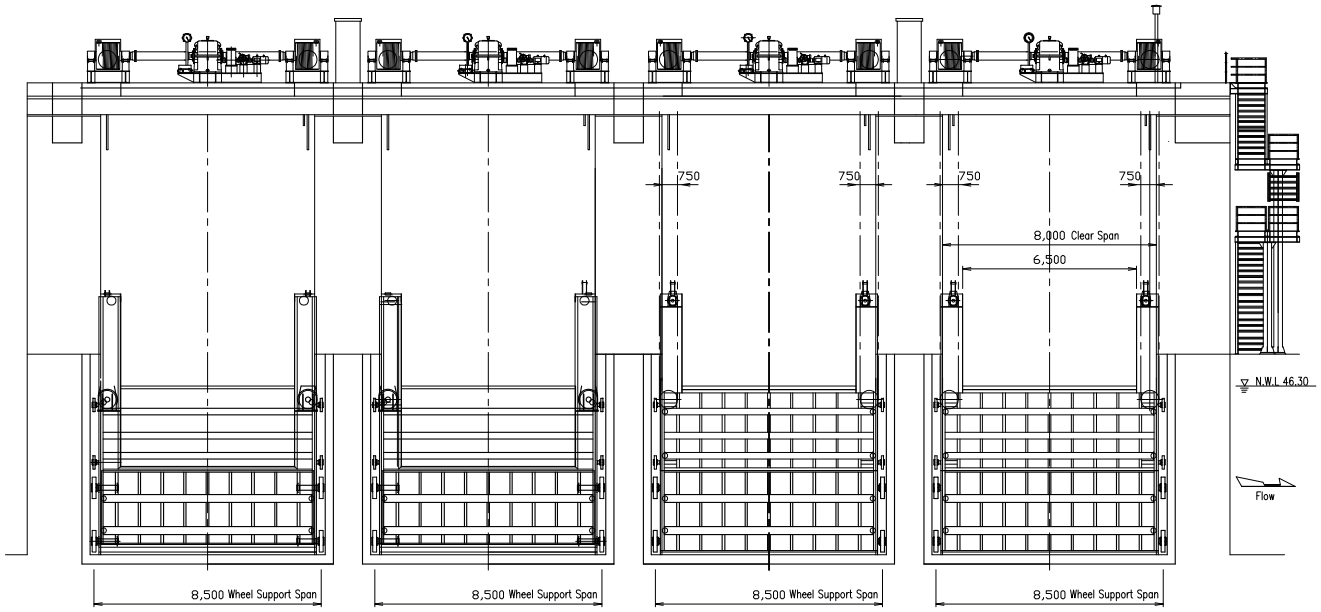
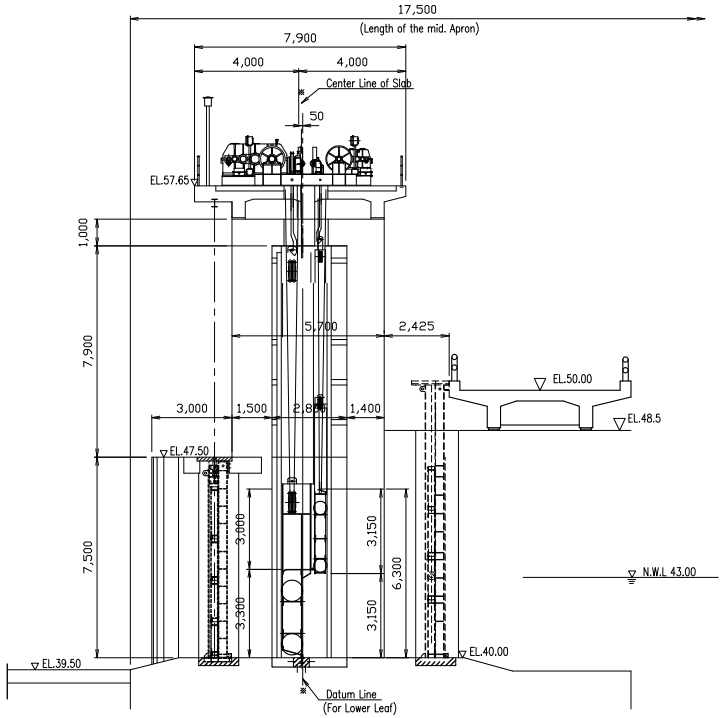
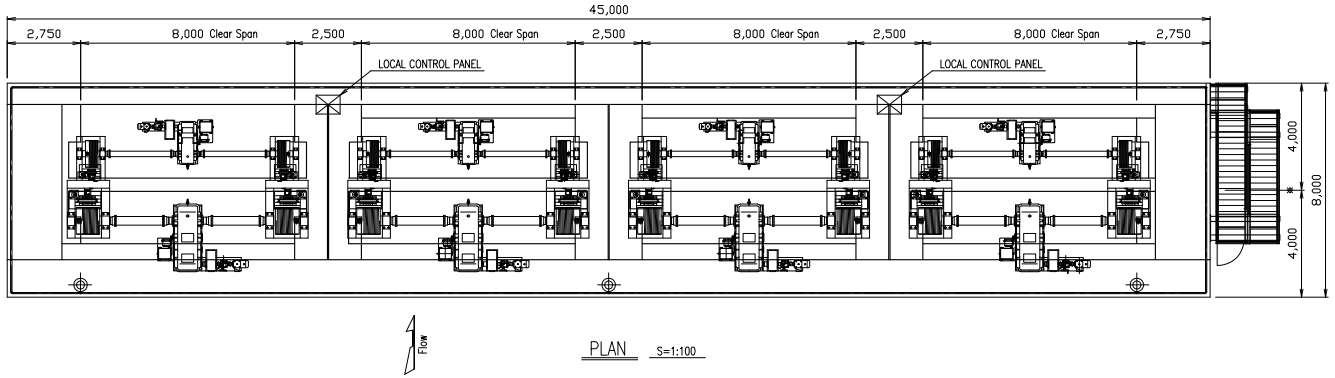


UPSTREAM ELEVATION S=1:100 DOWNSTREAM ELEVATION



SECTIONAL VIEW S=1:100



PLAN S=1:100

DESIGN DATA	
Type of Gate	Steel Double Leaf Roller Gate
Quantity	Four(4) sets
Clear span	8.000 m
Height of Gate	6.300 m
Design Water Level	Upstream : WL.46.30
	Downstream : EL.43.000
Sill Elevation	EL.40.000
Sealing System	3 Edges with Rubber Seals at Upstream
Operating Device	Electrically driven, 2motor 4drum type.
Hoisting Speed	0.3m/min
Control System	Local and remote control

Remarks : On Ibrahimia canal the number of vent is three (3).
The measurement of the gate per one is same as gate of Bahr Yusef Regulator

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General information of the Double Leaf Gate on Bahr Yusef Regulator (reference)

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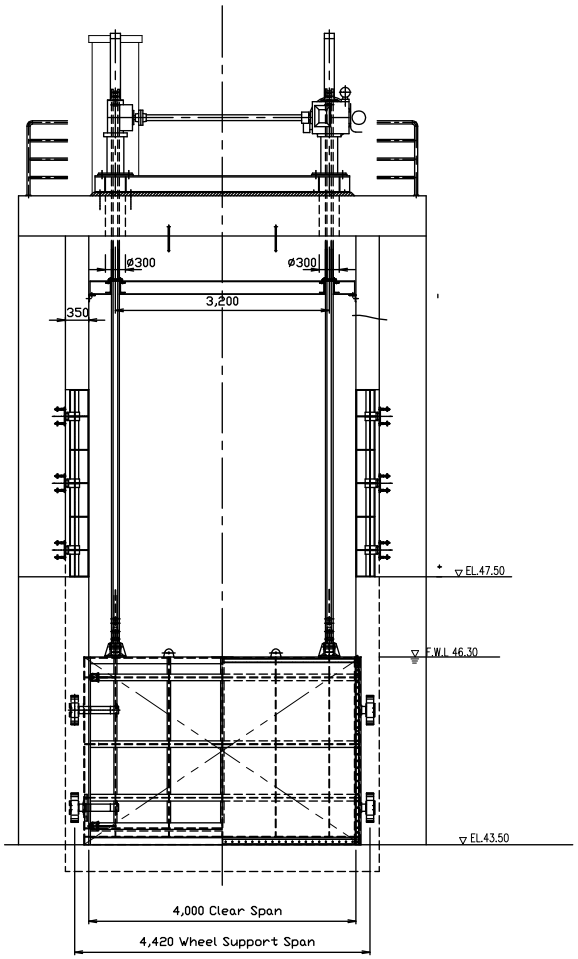
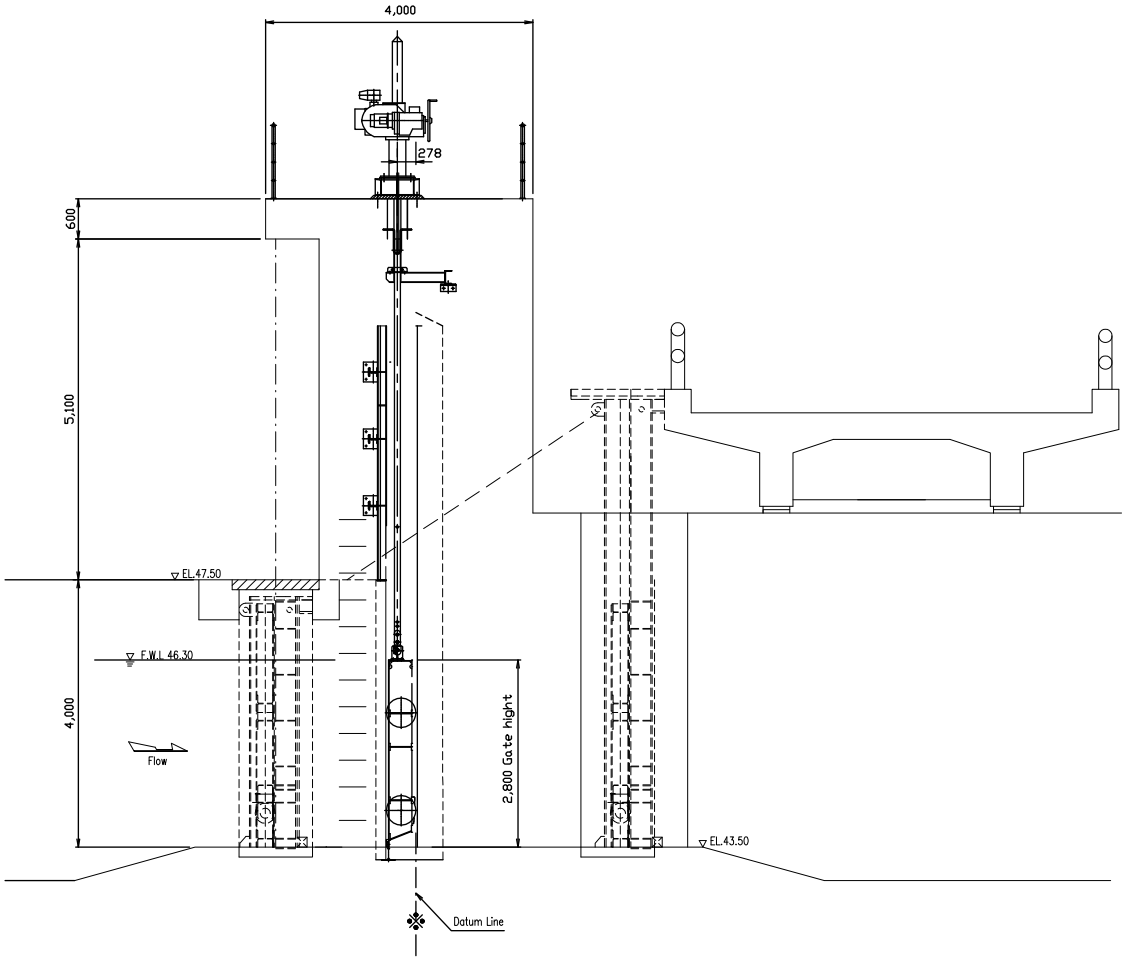
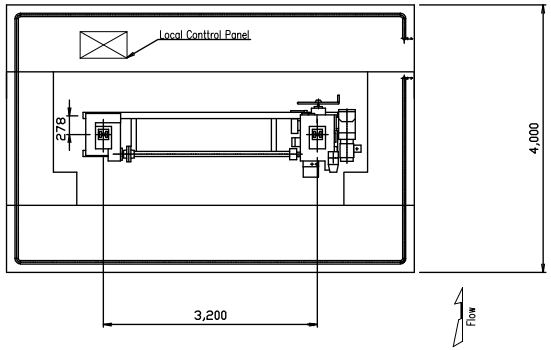


UPSTREAM ELEVATION S=1:40





DESIGN DATA	
Type of Gate	Steel Roller Gate
Quantity	2 sets of Gate
Clear span	4.000 m
Height of Gate	2.800 m
Design Water Level	Upstream : WL 46.30m
	Downstream : EL 43.50m
Sill Elevation	EL.43.500
Sealing System	3 Edges with Rubber Seals at Upstream
Operating Device	Electrically driven, rack type.
Hoisting Speed	0.3m/min
Control System	Local control and Remote control

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General information of the Steel Roller Gate on Badraman Regulator (reference)

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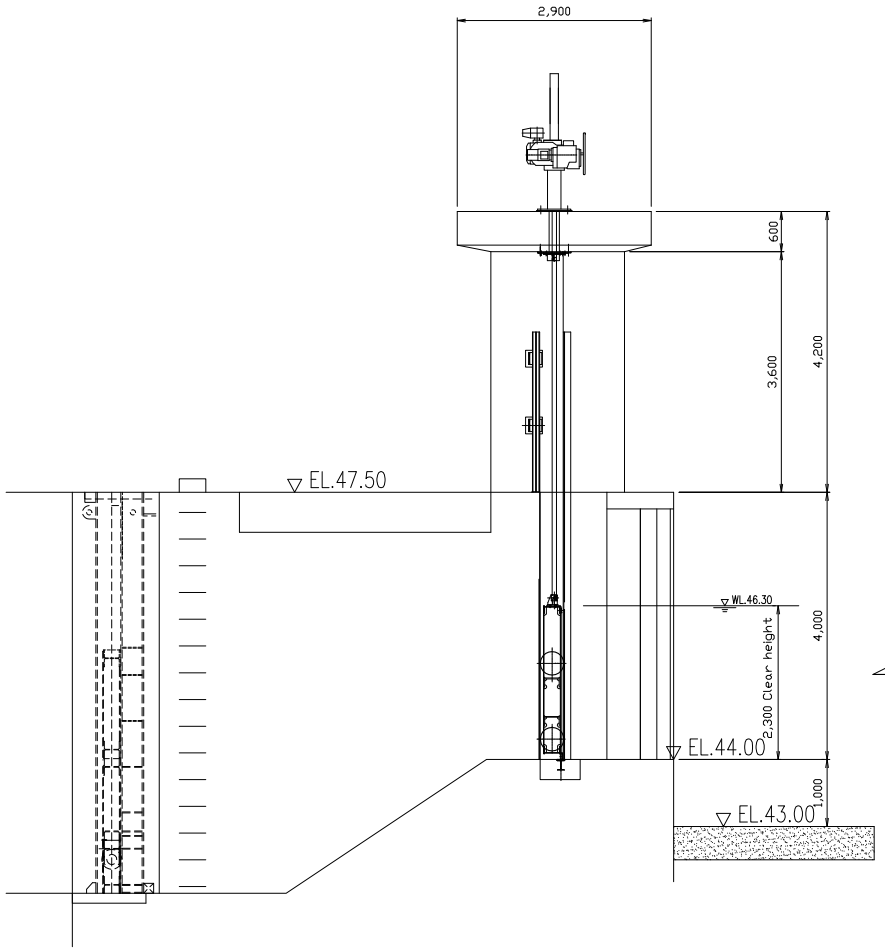
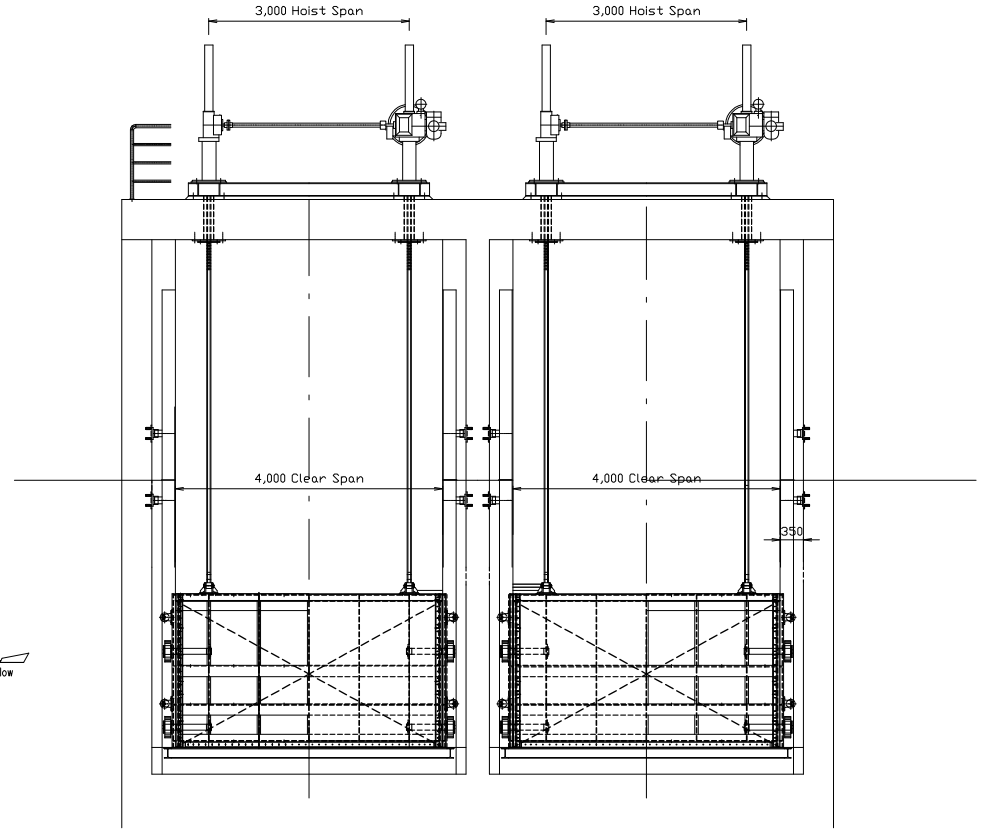
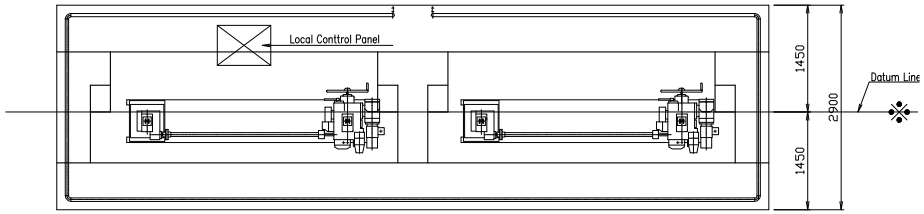




UPSTREAM ELEVATION S=1:40



PLAN S=1:40

DESIGN DATA	
Type of Gate	Steel Roller Gate
Quantity	1 sets of Gate for Sahelyia Regulator
	2 sets of Gate for Abo Gabal Regulator
Clear span	4.000 m
Height of Gate	2.300 m
Design Water Level	Upstream : WL 46.300m
	Downstream : EL 44.000m
Sill Elevation	EL.44.000
Sealing System	3 Edges with Rubber Seals at Upstream
Operating Device	Electrically driven, rack type.
Hoisting Speed	0.3m/min
Control System	Local control and Remote control

Ministry of Water Resources and Irrigation
Reservoirs Grand Barrages Sector
The Arab Republic of Egypt

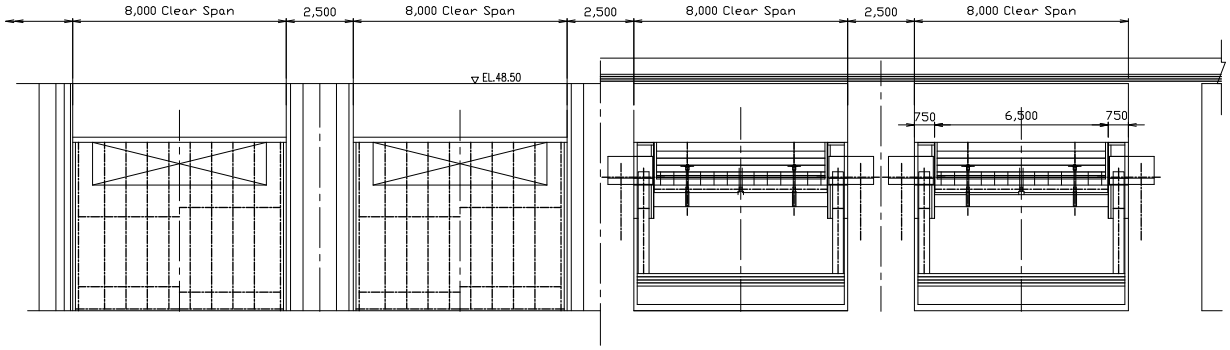
General information of the Steel Roller Gate on Badraman Regulator (reference)

DRW. NO.

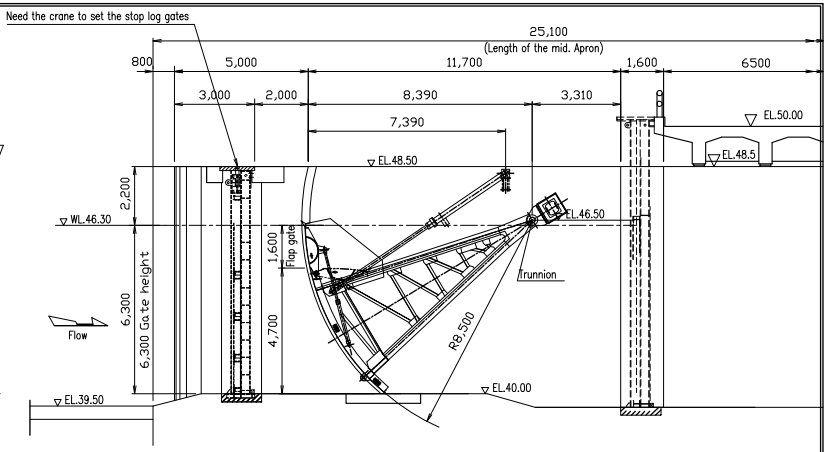
SANYU CONSULTANTS INC.

PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE : DATE :

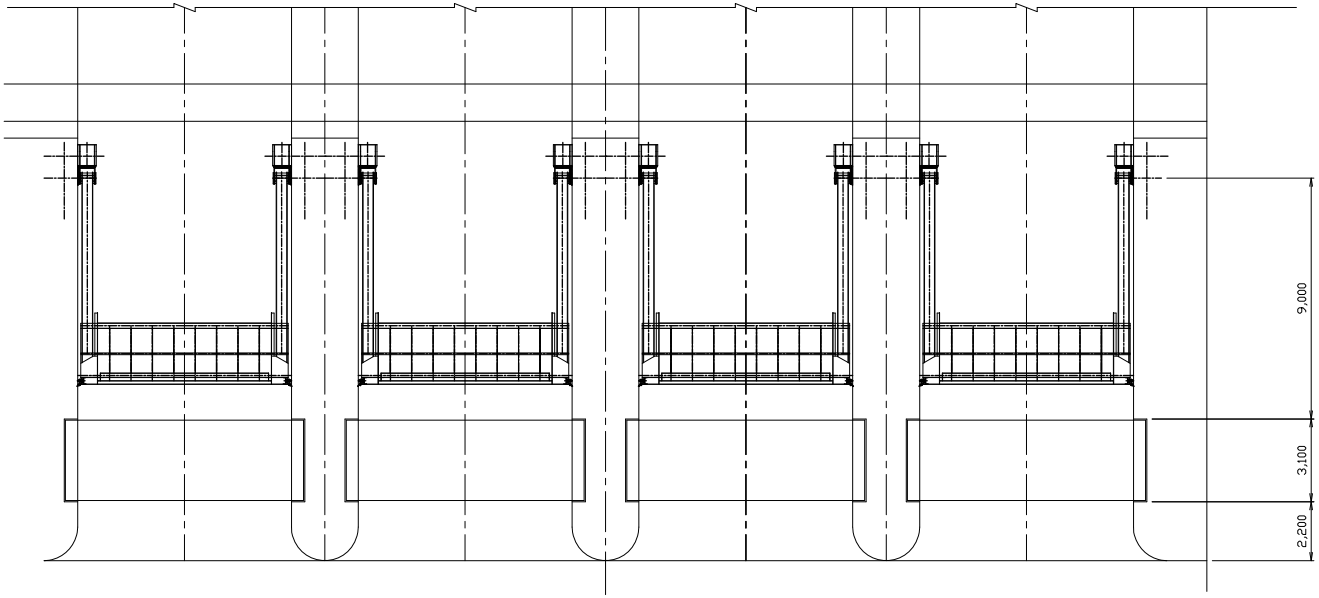
A-13



UPSTREAM ELEVATION S=1:100 DOWNSTREAM ELEVATION



SECTIONAL VIEW S=1:100



Flow PLAN S=1:100

DESIGN DATA	
Type of Gate	Steel Radial Gate With frap
Quantity	Four(9) sets on Bahr Yusef Regulator
Clear span	8.000 m
Height of Gate	6.300 m
Design Water Level	Upstream : WL.46.300
	Downstream : EL.43.000
Sill Elevation	EL.40.000
Sealing System	3 Edges with Rubber Seals at Upstream
Operating Device	Hydraulic Cylindar
Control System	Local and remote control

Ministry of Water Resources and Irrigation
Reservoirs Grand Barrages Sector
The Arab Republic of Egypt

General information of the Double Leaf Gate
on Bahr Yusef Regulator (reference)

DRW. NO.

SANYU CONSULTANTS INC.

PREPARED BY :	CHECKED BY :	APPROVED BY :
DATE :	DATE :	DATE :

A-14

●Evaluation of the Minor Structure / (Comprehensive table)

Evaluation of the Minor Structure ; Comparison Table between RGBS and Consultant

Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant											
														Evaluation of the necessary survey or study						Cost for survey (LE)	Entire cost(LE)
								Necessary works	Cost (LE)	Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey		
Giza	G1	El ayat	Giza canal	Regulator	1935	120,000	2.20	Replace the structure	5,000,000	The structure has been damaged by weathering and the roughly rehabilitation in the past. Need the reconstruction of the structure and replace the gate.	Recommend the reconstruction of the structure and replace the gate.	10,000,000	within 5yrs	●	●	●	●			500,000	10,500,000
	G2	Abu rag wan	Giza canal	Regulator	1935	100,000	2.00	Replace the structure	5,000,000	The structure and gate are not so bad. However, much garbage prevent fair distribution. Need the removal of the garbage, rehabilitation of the gate and sturucture on surface.	Recommend the removal of the garbage, rehabilitation of the gate and the sturucture on surface.	100,000	within 10yrs	●	●	●	●			5,000	105,000
	G3	El Hawamdia	Giza canal	Regulator	1935	9,000	1.70	Replace the structure	5,000,000	The structure is not so bad. However gates can not work almost. Only one gate at right side is working now. Need the replace all the gates and rehabilitation of the structure. Need the removal of the garbage.	Recommend the replace all the gates, rehabilitation of structure and removal of the garbage.	1,000,000	within 5yrs	●	●	●	●			50,000	1,050,000
	G4	El Mansoria intake	El Mansoria canal	Intake	1935	24,745	0.60	Replace the all structure	2,000,000	The much garbage prevent the suitable distribution. Need the removal of the garbage and rehabilitation of the structure on surface.	Recommend the removal of the garbage and rehabilitation of the structure on surface. And recommend to expire these gates, becouse new one is at dwonstream.	50,000	within 20yrs	●	●	●	●			3,000	53,000
	G5	El zomaor intake	El zomaor canal	Intake	1935	9,000	0.50	Replace the all structure	2,000,000	The much garbage prevent the suitable distribution. The structure body has been damaged by the weathering. Need the reconstruction and replace the gates.	Recommend the reconstruction and replace the gates.	2,000,000	within 5yrs	●	●	●	●			100,000	2,100,000
	AG1	El Mansoria regulator	El Mansoria canal	Regulator	after 1999	9,000	0.60	----------	----------	The gates can not work and can not regulate the water. Need the rehabilitation of the structure on surface and replace the gates.	Recommend the rehabilitation of the structure on surface and replace the gates.	200,000	within 5yrs	●	●	●	●			10,000	210,000
Fa-youm	F1	Hear weir	Bats Drain	Weir	Before 1943	86,000	16.40	Replace the all structure	10,000,000	The structure is very dangerous condition by the much discharge. Need the reconstruction and replace all the gates	Recommend the reconstruction and replace all the gates	10,000,000	within 5yrs	●	●	●	●			500,000	10,500,000
	F2	El asaba nasba	Sanhoor	Weir	1927	15,869	5.51	Rehabilitation	5,000,000	The sturucture has been damaged by weatherd and cracks. Need the reconstruction of the structure.	Recommend the reconstruction of the structure.	500,000	within 5yrs	●		●	●			25,000	525,000
	F3	El Elaam	El Elaam	Regulator	1927 - 1930	10,772	3.74	Replace the all structure	3,000,000	The structure has been damaged by weathering and the wide of vent is so narrow. Need the reconstruction of the structure, one of the two structures	Recommend the reconstruction of the structure	1,000,000	within 5yrs	●	●	●	●			50,000	1,050,000
	F4	Beyhmo nasba	Sennors	Weir	1926	20,590	7.15	Replace the all structure	5,000,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction and protection work at downstream of the structure.	Recommend the reconstruction and protection work on downstream	1,000,000	within 5yrs	●	●	●	●			50,000	1,050,000
	F5	El shoremy nasba	Sennors	Weir	1927-1930	21,544	7.48	Replace the all structure	5,000,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction of the structure widening the vent.	Recommend the reconstruction widening the vent	1,000,000	within 5yrs	●	●	●	●			50,000	1,050,000
	F6	Gadona	Sersena Elemomey	Weir	1927	4,216	1.46	Replace the all structure	3,000,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction of the structure widening the vent.	Recommend the reconstruction widening the vent	500,000	within 10yrs	●	●	●	●			25,000	525,000
	F7	Zmloty Culvert	El Elaam	Culvert	1927	3,763	1.30	Replace the all structure	600,000	The structure has been damaged by weathering and difficulty of the fair water distribution. The much garbage prevent the fair water. Need the reconstruction of the structure and the removal of the garbage.	Recommend the reconstruction	1,000,000	within 5yrs	●	●	●	●			50,000	1,050,000
	F8	Brka weir	El nazla	Weir	1927	16,740	5.81	Replace the all structure	600,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction and protection work at downstream of the structure.	Recommend the reconstruction and protection work at downstream of the structure.	500,000	within 5yrs	●	●	●	●			25,000	525,000

Remarks : Gray hatting is shown the different evaluation between RGBS and Consultant

Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant											
								Necessary works	Cost (LE)	Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Evaluation of the necessary survey or study						Cost for survey (LE)	Entire cost(LE)
														Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey		
	F9	El serb intake	El Elaam	Regulator	1927 - 1930	6,811	2.36	Replace the all structure	1,500,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction of the structure, replace the gate and protection work at downstream of the structure.	Recommend the reconstruction of the structure, replace the gate and protection work at downstream of the structure.	300,000	within 5yrs	●	●	●	●			15,000	315,000
	F10	Hawara Intake	Yousef	Intake	1927 - 1930	1,448	7.65	Replace the all structure	1,000,000	The structure has been damaged on surface. Those damage will be dealt by rehabilitation. Need the rehabilitation of the structure (The new pump station near site. This pump will be worked instead of this intake)	Recommend the rehabilitation of the structure	200,000	within 5yrs			●	●			6,000	206,000
	F11	El mshrk nasba	El nazla	Weir	1927	15,154	5.26	Replace the all structure	3,000,000	The structure has been damaged by weathering and difficulty of the fair water distribution. It is afraid of the scouring at downstream. Need the reconstruction and protection work at downstream of the structure.	Recommend the reconstruction and protection work at downstream of the structure.	500,000	within 5yrs	●	●	●	●			25,000	525,000
	F12	El hmam nasba	El mshrk	Weir	1927	6,225	2.16	Replace the all structure	500,000	The structure has been damaged by weathering and difficulty of the fair water distribution. It is afraid of the scouring at downstream. Need the reconstruction and protection work at downstream of the structure.	Recommend the reconstruction and protection work on downstream	500,000	within 5yrs	●	●	●	●			25,000	525,000
	F13	TALET nasba	El Ghark	Weir	------	14,808	5.14	Replace the all structure	5,000,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction with changing to the suitable width of the vent	Recommend the reconstruction with changing of the width the intake	500,000	within 5yrs	●	●	●	●			25,000	525,000
	F14	Abd El rhman weir	ZAWEA	Weir	1927	14,393	5.00	Replace the all structure	1,500,000	The structure has been damaged on surface. Those damage will be dealt by rehabilitation. It is afraid of the scouring at downstream. Need the rehabilitation and protection work at downstream of the structure.	Recommend the rehabilitation of the protection work on downstream	500,000	within 10yrs	●		●	●			25,000	525,000
	F15	naklefa intake	ZAWEA	Weir	1927	10,844	3.76	Replace the all structure	500,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction with changing to the suitable width of the vent	Recommend the reconstruction widening the vent	500,000	within 5yrs	●		●	●			25,000	525,000
	F16	Farsh weir	ZAWEA	Bridge	1927-1930	1,924	0.67	Replace the all structure	500,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction with changing to the suitable width of the vent	Recommend the reconstruction widening the vent	500,000	within 5yrs	●	●	●	●			25,000	525,000
	F17	elkharg intake	El masra	Weir	1927-1930	4,452	1.55	Replace the all structure	300,000	The structure has been damaged on surface. Those damage will be dealt by rehabilitation. Need the rehabilitation of the structure	Recommend the rehabilitation of the body	100,000	within 10yrs	●	●	●	●			5,000	105,000
	F18	End of elkharg nasba	Elkharg	Weir	1927-1930	4,436	1.54	Replace the all structure	700,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction with changing to the suitable width of the vent	Recommend the reconstruction widening the vent	300,000	within 5yrs	●	●	●	●			15,000	315,000
	F19	Seila nasba	Seila elomomy	Weir	1927-1930	8,659	3.00	Replace the all structure	5,000,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction with changing to the suitable width of the vent	Recommend the reconstruction widening the vent	750,000	within 5yrs	●	●	●	●			38,000	788,000
	F20	Tanhia intake	Tanhla	Intake	1927 - 1930	22,020	7.64	Replace the all structure	5,000,000	It si difficult to do daily cleanning works. Need to install the mechanical Trash rack or other way	Recommend to install the mechanical Trash rack or other way	200,000	within 20yrs			●	●			6,000	206,000
	F21	Esmail abd el lateef weir	nazla	Weir	1927-1930	5,947	2.07	Replace the all structure	500,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction with changing to the suitable width of the vent	Recommend the reconstruction with changing to the suitable width of the vent	250,000	within 5yrs	●	●	●	●			13,000	263,000
	F22	Hassan afndy weir	nazla	Weir	1927-1930	5,344	1.86	Replace the all structure	500,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction with changing to the suitable width of the vent	Recommend the reconstruction with changing to the suitable width of the vent	250,000	within 5yrs	●	●	●	●			13,000	263,000

Remarks : Gray hatting is shown the different evaluation between RGBS and Consultant

Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant											
														Evaluation of the necessary survey or study							
								Necessary works	Cost (LE)	Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey	Cost for survey (LE)	Entire cost(LE)
	F23	rawashdia weir	nazla	Weir	1927-1930	3,300	1.15	Replace the all structure	500,000	The structure has been damaged by weathering and difficulty of the fair water distribution. Need the reconstruction with changing to the suitable width of the vent	Recommend the reconstruction widening the vent	250,000	within 5yrs	●	●	●	●			13,000	263,000
	F24	mezar	nazla	Weir	1927-1930	2,762	0.96	Replace the all structure	300,000	No problem. Becouse this structure had already reconstructed	This structure had already reconstructed	0	within 20yrs	---------	---------	---------	---------	---------	---------	0	0
	F25	Soleman	nazla	Weir	1927-1930	20,637	7.16	Replace the all structure	1,000,000	The structure has been damaged on surface. Those damage will be dealt by rehabilitation. It is afraid of the scouring at downstream. Need the rehabilitation and protection work at downstream of the structure.	Recommend the rehabilitation of the protection work on downstream	300,000	within 10yrs	●	●	●	●			15,000	315,000
Beni-Suef	B1	ALFANT	ALFANT canal	Intake	1972	7,000	3.50	Replace the intake	1,500,000	At downstream, 500m, from the intake, many garbage prevet fair water. Need to remove the garbage urgently.	Structure is not so bad. Recommend the removal of the garbage at downstream urgently	30,000	within 5 yrs*	---------	---------	---------	---------	---------	---------	0	30,000
	B2	ELSHARAHN AELKABLIA	ELSHARAHN AELKABLIA	Intake	1965	1,000	1.00	Rehabilitation. Add the pipes to take more water	100,000	At downstream, 100m, from the intake, many garbage prevet fair water. Need to remove the garbage urgently.	Recommend the removal of the garbage at downstream urgently	30,000	within 5 yrs*	---------	---------	---------	---------	---------	---------	0	30,000
	B3	Elmagrofa elgrbia	Elmagrofa elgrbia	Intake	1960	2,888	1.60	Rehabilitation. Add the pipes to take more water	100,000	The structure has few damage. Need the maintenance of the gate	Recommend the maintenance of the gate	30,000	within 20yrs	---------	---------	---------	---------	---------	---------	0	30,000
	B4	ELSAHARA	Elmagrofa elgrbia	Intake	1953	6,190	3.50	Rehabilitation. Add the pipes to take more water	70,000	The structure has been damaged heavily by Weathering. Need the reconstruction and recommend to support into the pipe.	Recommend the reconstruction and recommend to support into the pipe.	300,000	within 5yrs	●	●					9,000	309,000
	B5	KELA	KELA canal	Intake	1935	20,000	6.50	Replace the intake	200,000	The structure has been damaged and the gates can not work at all. Need the reconstruction and replace the gates.	Recommend the reconstruction and replace the gates. (Need more study to make clear the status)	700,000	within 5yrs	●		●				21,000	721,000
	B6	Amar AELKABLIA	Amar AELKABLIA	Intake	------	1,500	0.87	Rehabilitation	200,000	The structure has been damaged and the gates can not work at all. Need the reconstruction and replace the gate.	Recommend the reconstruction and replace the gate. (Need more study to make clear the status)	300,000	within 5yrs	●		●				9,000	309,000
	B7	Asment AELKABLIA	Amar AELKABLIA	Intake	1950	4,720	2.73	Rehabilitation	100,000	The geographical survey at surround area and measurement in more detail of the structure	Recommend the replace the pipe and install the gate in front of the pipe.	300,000	within 5yrs	●		●				9,000	309,000
	B8	HAGR ALAHON	HAGR ALAHON	Intake	1965	4,720	2.10	Replace the intake	100,000	The geographical survey at surround area and measurement in more detail of the structure	Recommend the reconstruction and replace the gate.	300,000	within 5yrs	●		●				9,000	309,000
	B9	MOMTEZ CANAL	MOMTEZ CANAL	Intake	1970	1,073	0.60	Replace the intake	110,000	The structure has been damaged and the gates can not work suitable. Need the reconstruction of the intake and replace the gate.	Recommend the reconstruction of the intake and replace the gate.	300,000	within 5yrs	●		●				9,000	309,000
	B10	ELATHAR	ELATHAR intake	Intake	1970	815	0.44	Replace the intake	150,000	Measurement in more detail of the gate	Recommend the maintenance and replace the gate.	50,000	within 10yrs			●				1,000	51,000
	B11	ABWED	ABWED	Intake	----	1,400	0.81	Replace the intake	110,000	The structure has been damaged and the gates can not work suitable. This intake has severe problem to fair water. Need the reconstruction of the intake to take into consideration of the loction.	Recommend the reconstruction of the intake with take into consideration of the loction of the intake.	110,000	within 5yrs	●		●			●	6,000	116,000
	B12	ALI HAFEZ	ALI HAFEZ	Tail escape	1965	4,900	2.80	Reconstruction	25,000	The structure has been damaged and the gates can not work suitable. Need the reconstruction of the structure and replace the gate.	Recommend the reconstruction of the structure and replace the gate.	25,000	within 5yrs	●		●				1,000	26,000
	B13	DALAS WEST	DALAS WEST	Tail escape	1965	2,300	1.33	Reconstruction	25,000	The gate is not so bad. Need the some rehabilitation and maintenance of the gate.	Recommend the some rehabilitation and maintenance of the gate.	25,000	within 20yrs	---------	---------	---------	---------	---------	---------	0	25,000

Remarks : Gray hatting is shown the different evaluation between RGBS and Consultant

Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant											
								Necessary works	Cost (LE)	Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Evaluation of the necessary survey or study						Cost for survey (LE)	Entire cost(LE)
														Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey		
	B14	SOLTANE (3)	SOLTANE (3)	Tail escape	1965	214	0.60	Reconstruction	25,000	The structure is not so bad. Need the some rehabilitation and removal of the weeds at upstream.	Recommend the some rehabilitation and removal of the weeds at upstream.	5,000	within 20yrs	---------	---------	---------	---------	---------	---------	0	5,000
	B15	SOLTANE (4)	SOLTANE (4)	Tail escape	1975	150	0.60	Reconstruction	25,000	The structure has been damaged and the gates can not work suitable. Need the reconstruction of the structure and replace the gate.	Recommend the reconstruction of the structure and replace the gate.	25,000	within 5yrs	●		●				1,000	26,000
	B16	SOLTANE (5)	SOLTANE (5)	Tail escape	1964	147	0.60	Reconstruction	25,000	The structure has been expired almost. According to the hearing at site, there is no problem	Recommend the removal of the garbage at end of pipe.	5,000	within 20yrs	---------	---------	---------	---------	---------	---------	0	5,000
	B17	SOLTANE (6)	SOLTANE (6)	Tail escape	1970	520	0.70	Reconstruction	25,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. Need the some rehabilitation and replace the gate.	Recommend the some rehabilitation and replace the gate.	10,000	within 10yrs			●				0	10,000
	B18	SOLTANE (7)	SOLTANE (7)	Tail escape	1970	230	0.70	Reconstruction	25,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. Need the some rehabilitation and replace the gate.	Recommend the some rehabilitation and replace the gate.	10,000	within 10yrs			●				0	10,000
	B19	AL-ASKRA	AL-ASKRA	Tail escape	1980	3,000	1.74	Reconstruction	25,000	The structure has been damaged. According to the hearing, the water has not been reached up tail escape, however, there is no problem. Need the some rehabilitation for the structure.	Recommend the some rehabilitation.	10,000	within 10yrs	---------	---------	---------	---------	---------	---------	0	10,000
	B20	ALSHAMSHERGE	ALSHAMSHERGE	Tail escape	1970	2,760	1.70	Reconstruction	25,000	The structure has been damaged. According to the hearing, the water has not been reached up tail escape, however, there is no problem. Need the some rehabilitation and remove the weeds.	Recommend the some rehabilitation and remove the weeds.	10,000	within 10yrs	---------	---------	---------	---------	---------	---------	0	10,000
	B21	Qela canal	Qela canal	Bridge	1965	12,000	7.00	Reconstruction	250,000	The surface of the structure has been damaged by Weathering. However, these damage does not seem fatal damage. Need more some test to check the current strength of the brick	Recommend to study more or test to check current status.	500,000	within 5yrs	●		●		●		25,000	525,000
	B22	AZIT bridge	Qela canal	Bridge	1950	11,500	6.50	Reconstruction	250,000	The structure has been damaged by Weathering. Especially there are cracks to be cared on the abut pier. Need the reconstruction.	Recommend the reconstruction	500,000	within 5yrs	●		●				15,000	515,000
	B23	AHMED BASA	AHMED BASA	Pipe line	1995	5,000	3.50	Reconstruction	500,000	The structure has been damaged by Weathering. Especially there are much garbage to prevent the fairs water. Need to replace the pipe to more wide and remove the garbage.	Recommend the replace the pipe to more wide and remove the garbage.	300,000	within 5yrs			●				3,000	303,000
	B24	Fr ee alkasi	Fr ee alkasi	Pipe line	1998	800	0.60	Reconstruction	1,000,000	The structure has been damaged and the gates can not work suitable. Need the reconstruction and replace the gate.	Recommend the reconstruction and replace the gate.	300,000	within 5yrs	●		●				9,000	309,000
	B25	NASRT	NASRT	Aqueduct	1960	350	0.50	Reconstruction	250,000	The structure has been damaged. Need the reconstruction of the intake and remove the weed and sedimentation in front of the intake.	Recommend the reconstruction of the intake and remove the weed and sedimentation in front of the intake.	250,000	within 5yrs	●		●				8,000	258,000
	B26	TLAT canal	TLAT canal	Aqueduct	1960	4,580	2.65	Reconstruction	500,000	They want to change to the Aqueduct for the difficulty of the supply water.	Recommend the construction as the aqueduct.	500,000	within 5yrs	●		●	●			25,000	525,000
	B27	ALI HAFZ	ALI HAFZ	Aqueduct	1960	5,000	2.89	Reconstruction	500,000	The structure has been damaged by Weathering. Need the reconstruction of the structure and replace the steel pipe.	Recommend the reconstruction of the structure and replace the steel pipe.	1,000,000	within 5yrs	●		●				30,000	1,030,000

Remarks : Gray hatting is shown the different evaluation between RGBS and Consultant

Evaluation of the Minor Structure ; Comparison Table between RGBS and Consultant (5/9)

Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant											
										Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Evaluation of the necessary survey or study						Cost for survey (LE)	Entire cost(LE)
								Necessary works	Cost (LE)					Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey		
	B28	ABO SHOSHE K0.8	ABO SHOSHE	Siphon	1960	5,000	2.89	Reconstruction	500,000	The structure has been damaged by Weathering. Need the reconstruction of the structure, replace the steel pipe and the protection works on the pipe at across the canal.	Recommend the reconstruction of the structure, replace the steel pipe and the protection works on the pipe at across the canal.	500,000	within 5yrs	●		●				15,000	515,000
	B29	ABO SHOSHE K1.5	ABO SHOSHE	Siphon	1960	5,000	2.89	Reconstruction	500,000	The structure has been damaged and the gates can not work suitable. Need the reconstruction of the structure and the protection works on the pipe at across the canal.	Recommend the reconstruction of the structure and the protection works on the pipe at across the canal.	500,000	within 5yrs	●		●				15,000	515,000
	B30	Sleem Siphon	ABO SHOSHE	Siphon	1960	3,000	2.50	Reconstruction	250,000	The structure has been damaged and the gates can not work suitable. Need the reconstruction of the structure and the protection works on the pipe at across the canal.	Recommend the reconstruction of the structure and the protection works on the pipe at across the canal.	250,000	within 5yrs	●		●				8,000	258,000
	B31	GOHR K15	QLA	Culvert	1969	11,500	6.50	Reconstruction	250,000	The structure has been damaged and the gates can not work suitable. Need the reconstruction of the structure and the protection works on the pipe at across the canal.	Recommend the reconstruction of the structure and the protection works on the pipe at across the canal.	250,000	within 5yrs	●		●				8,000	258,000
	B32	ALBEN K3	ALLAHON	Siphon	1962	800	0.60	Reconstruction	500,000	The structure has been damaged on surface. Those damage has been not fatal damage. Need the rehabilitation of the structure and the protection works on the pipe at across the canal.	Recommend the rehabilitation of the structure and the protection works on the pipe at across the canal.	100,000	within 10yrs			●				1,000	101,000
	B33	BNI SALH K3	ABOSHOSHA	Siphon	1968	800	4.60	Reconstruction	500,000	The surface of the structure been damaged by Weathering. However, these damage does not seem fatal damage. Need more some test to check the current strength of the brick	Recommend to study more or test to check current status.	500,000	within 5yrs	●		●		●		25,000	525,000
	B34	ALSH HIHA	ABOSHOSHA K2.8	Pipe line	1958	800	4.60	Reconstruction	500,000	The structure of the intake has been damaged by Weathering. Need the reconstruction of the intake and preferable install the gate in front of the intake.	Recommend the reconstruction of the intake and preferable attach the gate in front of the intake.	300,000	within 5yrs	●		●				9,000	309,000
	B35	Hdar bin hinder	Ibrahimia canal	Weir	1940	11,520	4.00	Reconstruction	300,000	The structure is not so bad. The district engineer request to be low crest level of the weir for the water shortage in the future.	Recommend to study more.	300,000	within 20yrs						●	3,000	303,000
	AB1	DALAS West Pump station	DALAS West Canal	Pump station	1998	2,300	9.00	----------	----------	One of three pumps is expired. Need to install the new one and rehabilitation of pipe at saction side and steel stage.	Recommend to study more.	500,000	within 5yrs						●	5,000	505,000
	AB2	Waseta Regulator	Ibrahimia canal	Regulator	1989	38,000	0.17	----------	----------	The surface of the gate has been damaged. There are the hole and rust on the surface of the gate. Need to replace the gate.	Recommend to replace the gate	300,000	within 5yrs			●				3,000	303,000
Minya	M1	Al Ashmonin canal	Al Dairotiya canal	Intake	1920	9,225	4.06	Reconstruction	350,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by failure and deterioration. Need the reconstruction and replace the gates.	Recommend the reconstruction and replace the gates.	1,000,000	within 5yrs	●	●	●				50,000	1,050,000
	M2	Al Desa canal	Al Sahliya canal	Intake	1918	2,575	1.13	Reconstruction	200,000	The structure and gate has been damaged by weathering and deterioration. The much garbage prevet the fair water. Need the reconstruction and replace the gates.	Recommend the reconstruction and replace the gates.	500,000	within 5yrs	●	●	●				25,000	525,000
	M3	Serry Branch	Serry Canal at Km 27.525	Intake	1930	300	0.13	Rehabilitation	150,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by deterioration. Need the reconstruction and replace the gates.	Recommend the reconstruction and replace the gates.	200,000	within 5yrs	●		●				6,000	206,000

Remarks : Gray hatting is shown the different evaluation between RGBS and Consultant

Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant											
								Necessary works	Cost (LE)	Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Evaluation of the necessary survey or study						Cost for survey (LE)	Entire cost(LE)
														Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey		
	M4	2 Serry branch intake	Serry Canal at Km 28.460	Intake	1930	500	0.22	Rehabilitation	150,000	The structure has been damaged by weathering and deterioration. The gate has not been so damaged. It is afraid of the weight of the vehicle. Need the reconstruction and preferable replace the gates at the same time.	Recommend the reconstruction and preferable replace the gates at the same time.	200,000	within 5yrs	●		●				6,000	206,000
	M5	5 th Branch canal	Bahab canal (33.15)	Intake	1920	1,850	0.81	Reconstruction	300,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the deterioration and much garbage. Need the reconstruction and replace the gates. Preferable the construction of the new one out of village Zone toward northern (300m).	Recommend the reconstruction and replace the gates. Preferable the construction of the new one out of village Zone toward northern (300m).	300,000	within 5yrs	●		●				9,000	309,000
	M6	Al sharka canal	Al sahliya canal	Intake	1920	1,020	0.45	Reconstruction	170,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and much garbage. Need the reconstruction and replace the gates	Recommend the reconstruction and replace the gates	200,000	within 5yrs	●		●				6,000	206,000
	M7	Asmant Intake	Bahr yosef canal km (63.450)	Intake	1901	2,000	0.88	Rehabilitation	300,000	The structure is not so bad, the gate has been not so damaged. Need the replace of the gate and rehabilitation of the structure.	Recommend the replace of the gate and rehabilitation of the structure.	30,000	within 10yrs			●				0	30,000
	M8	Balansora Intake	Bahr yosef km(67.370)	Intake	1910	1,500	0.66	Rehabilitation	300,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the deterioration. Need the reconstruction and replace the gates	Recommend the reconstruction and replace the gates	300,000	within 5yrs	●		●				9,000	309,000
	M9	Derwa canal	Al Badraman canal at km 17.710	Intake	1919	820	0.36	Reconstruction	200,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the deterioration and much garbage. Need the reconstruction and replace the gate	Recommend the reconstruction and replace the gate	300,000	within 5yrs	●		●				9,000	309,000
	M10	AL-Hagat Intake	Ibrahimia canal/ Serry canal	Intake	1970	430	0.19	Rehabilitation	100,000	The structure has been damaged by weathering and deterioration. The gate has not been damaged. Need the reconstruction and preferable replace the gate at same time.	Recommend the reconstruction and preferable replace the gate at same time.	350,000	within 5yrs	●		●				11,000	361,000
	M11	Al-Sheikh Kelada	Serry canal	Intake	1970	350	0.15	Reconstruction	100,000	The structure has been damaged by weathering and deterioration. The gate can not work at all by the failure. Need the reconstruction and replace the gate	Recommend the reconstruction and replace the gate	300,000	within 5yrs	●		●				9,000	309,000
	M12	Al_Sheikh Yousef	Serry canal	Intake	1980	540	0.24	Rehabilitation	100,000	The structure has been damaged by weathering and deterioration. The gate has not been damaged. Need the reconstruction and preferable replace the gate at same time.	Recommend the reconstruction and preferable replace the gate at same time.	300,000	within 5yrs	●		●				9,000	309,000
	M13	El Sultan hassan	Bahr yosef km (69.240)	Intake	1910	600	0.26	Rehabilitation	300,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate can not work suitable by the deterioration. Need the rehabilitation of the structure and replace the gate	Recommend the rehabilitation of the structure and replace the gate	50,000	within 5yrs			●				1,000	51,000
	M14	Ganabyia Al Ashmonin canal	Al Dairotiya canal	Intake	1920	1,300	0.57	Reconstruction	200,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate can not work suitable by the failure. Need the rehabilitation of the structure and replace the gate.	Recommend the rehabilitation of the structure and replace the gate.	400,000	within 5yrs	●		●				12,000	412,000
	M15	Ganabiya Al Maniekly canal	Al Badraman canal	Intake	1919	1,020	0.45	Reconstruction	200,000	The structure has been damaged by weathering and deterioration. The gate has not been so damaged. Need the reconstruction and preferable replace the gate at same time.	Recommend the reconstruction and preferable replace the gate at same time.	350,000	within 5yrs	●		●				11,000	361,000
	M16	Ganabyia Al Sahliya canal	Al Sahliya canal	Intake	1920	444	0.20	Reconstruction	200,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate can not work suitable by the deterioration. Need the rehabilitation of the structure and replace the gate	Recommend the rehabilitation of the structure and replace the gate	50,000	within 5yrs			●				1,000	51,000

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Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant										
										Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Evaluation of the necessary survey or study						Cost for survey (LE)	Entire cost(LE)
								Necessary works	Cost (LE)					Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey		
	M17	Mabrouk Intake	Bahr yosef canal km (75.475)	Intake	1902	2,000	0.88	Rehabilitation	300,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the deterioration. Need the reconstruction and replace the gate.	Recommend the reconstruction and replace the gate.	400,000	within 5yrs	●		●				12,000	412,000
	M18	Mahmoud canal	Al Badraman canal at km 12.100	Intake	1917	880	0.39	Reconstruction	200,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate has not been damaged. Need the rehabilitation of the structure and maintenance of the gate	Recommend the rehabilitation of the structure and maintenance of the gate	100,000	within 10yrs			●				1,000	101,000
	M19	Moussa	Bahr yosef at km 28.460	Intake	1990	300	0.13	Rehabilitation	300,000	This structure finish the reconstruction already.	This structure finish the reconstruction already.	0	within 20yrs	--------	--------	--------	--------	--------	--------	0	0
	M20	Nasser Feeder	Dahab canal	Intake	1936	250	0.11	Reconstruction	250,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate can not work suitable by the deterioration. Need the rehabilitation of the structure and replace the gate.	Recommend the rehabilitation of the structure and replace the gate.	100,000	within 5yrs			●				1,000	101,000
	M21	North Bahnasa canal	Bahr yosef - sabaa canal	Intake	1980	2,100	0.92	Reconstruction	450,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The surafce of gate can be seen rust. Need the rehabilitation of the structure and replace the gate.	Recommend the rehabilitation of the structure and replace the gate.	450,000	within 5yrs			●				5,000	455,000
	M22	Om El Kousour canal	Al Badraman canal	Intake	1919	1,395	0.61	Reconstruction	200,000	The structure has been damaged by weathering. The gate has not been so damaged. Need the reconstruction of the structure and preferable replace the gate at same time.	Recommend the reconstruction of the structure and preferable replace the gate at same time.	300,000	within 5yrs	●		●				9,000	309,000
	M23	Raheil intake	Dahab canal km (0.4)	Intake	1902	5,500	2.42	Rehabilitation	300,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction and replace of the gate.	Recommend the reconstruction and replace of the gate.	300,000	within 5yrs	●		●				9,000	309,000
	M24	Sakiet Dakouf	Dahab canal km (49.75)	Intake	1910	2,280	1.00	Reconstruction	190,000	The structure is not so bad. The gate has not been so damaged. Need to keep the maintenace of the gate	Recommend the rehabilitation of the structure and replace the gate.	50,000	within 10yrs			●				1,000	51,000
	M25	taheir intake	Dawood main canal	Intake	1908	200	0.09	Reconstruction	300,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate on the surface can seen rust. Need the rehabilitation of the structure and replace the gate.	Recommend the rehabilitation of the structure and replace the gate.	100,000	within 5yrs			●				1,000	101,000
	M26	Tambo intake	Ebrahemia canal / serry canal at km 106.350	Intake	1970	400	0.18	Rehabilitation	100,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction and replace of the gate.	Recommend the reconstruction and replace of the gate.	500,000	within 5yrs	●	●	●				25,000	525,000
	M27	The Left Dairotyia canal	The west hafeze canal at km 14.700	Intake	1922	2,000	0.88	Reconstruction	250,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction and replace of the gate.	Recommend the reconstruction and replace of the gate.	300,000	within 5yrs	●	●	●	●			15,000	315,000
	M28	The Right Dairotyia canal	The west hafeze canal	Intake	1922	750	0.33	Reconstruction	250,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction and replace of the gate.	Recommend the reconstruction and replace of the gate.	300,000	within 5yrs	●	●	●	●			15,000	315,000
	M29	The West Rayramon canal	Al Sahliya canal	Intake	1918	1,750	0.77	Reconstruction	200,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate has not been so damaged. Need the rehabilitation of the structure, the gate and removal of the garbage.	Recommend the rehabilitation of the structure, the gate and removal of the garbage.	100,000	within 10yrs			●				1,000	101,000
	M30	East Desout	Desout / Ebraheemeyya	Regulator	--------	1,200	0.53	Reconstruction	200,000	The structure need the function of the regulation, however this structure does not the function of the regulation. Need more study to make clear of the function of the structure.	Recommend more study to make clear of the function of the structure.	200,000	within 5yrs	●	●	●	●		●	10,000	210,000

Remarks : Gray hatting is shown the different evaluation between RGBS and Consultant

Evaluation of the Minor Structure ; Comparison Table between RGBS and Consultant

Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant											
								Necessary works	Cost (LE)	Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Evaluation of the necessary survey or study						Cost for survey (LE)	Entire cost(LE)
														Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey		
	M31	Barbakh Bani Mazar	Ebraheemeyya	Intake	1970	1,400	0.62	Reconstruction	150,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate has been damaged and can not work suitable by failure. Need the rehabilitation of the structure and replace of the gate.	Recommend the rehabilitation of the structure and replace of the gate.	100,000	within 5yrs			●				1,000	101,000
	M32	Abu Hashima	Menshat Al-Dahab	Regulator	1904	3,700	1.63	Reconstruction	400	The structure has been damaged by weathering, however these damge seem at surround the gate. The gate has not been so damaged. Need the reconstruction at front of the intake and preferabel replace the gate at same time.	Recommend the reconstruction at front of the intake and preferabel replace the gate at same time.	3,700	within 5yrs	●		●				0	3,700
	M33	Al Maniekly regulator	Al Badraman canal at km 17.710	Regulator	1919	1,930	0.85	Reconstruction	200,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction and replace of the gate.	Recommend the reconstruction and replace of the gate.	300,000	within 5yrs	●		●				9,000	309,000
	M34	Al Sahala Regulator	The East hafeze canal	Regulator	1912	2,200	0.97	New construction	250,000	The structure has been damaged, additionally, has the trouble of the fair water distribution, due to the narrow vents. The gate has not been so damaged. Need the reconstruction with changing to the suitable vent and	Recommend the reconstruction with changing to the suitable vent and preferabele replace of the gate at same time.	350,000	within 5yrs	●		●				11,000	361,000
	M35	Al Sahliya canal Reg.	Al Sahliya canal	Regulator	1918	3,224	1.42	Reconstruction	250,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction and replace of the gate.	Recommend the reconstruction and replace of the gate.	500,000	within 5yrs	●	●	●	●			25,000	525,000
	M36	Al Takhfeef Drain	Al Sahliya canal	Regulator	1918	5,000	2.20	Reconstruction	300,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction and replace of the gate.	Recommend the reconstruction and replace of the gate.	500,000	within 5yrs	●	●	●	●			25,000	525,000
	M37	Ban Al-Alam Branch	Ebraheemeyya	Regulator	1950	1,000	0.44	Rehabilitation	150,000	The structure has been damaged by weathering and deterioration. The gate can not work at all by the failure and deterioration. Need the reconstruction and replace of the gate	Recommend the reconstruction and replace of the gate	150,000	within 5yrs	●		●				5,000	155,000
	M38	East Aba Canal	Ebraheemeyya	Regulator	1975	2,500	1.10	Rehabilitation	200,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction (preferable design more low level at top of guide) and replace of the	Recommend the reconstruction (preferable design more low level at top of guide) and replace of the gate.	200,000	within 5yrs	●		●				6,000	206,000
	M39	Abu Hassiba Cana	Ebraheemeyya	Intake	1950	600	0.26	Reconstruction	500,000	The structure has been damaged by weathering, however these damge seem at surround the gate. The gate can not work suitable by rust. Need the reconstruction at front of the intake and replace the gate. Preferable support inner of pipe	Recommend the reconstruction at front of the intake and replace the gate. Preferable support inner of pipe.	1,000,000	within 5yrs	●		●				30,000	1,030,000
	M40	Al-Gendeyya Canal	Ebraheemeyya Canal	Regulator	1950	1,000	0.44	Rehabilitation	150,000	The structure has been damaged by weathering and deterioration. The gate can not work suitable by the failure and deterioration. Need the reconstruction (should be check the level of the intake) and replace of the gate.	Recommend the reconstruction (should be check the level of the intake) and replace of the gate.	300,000	within 5yrs	●		●	●			15,000	315,000
	M41	South Darweesh Canal	Ebraheemeyya Canal	Regulator		500	0.22	Reconstruction	200,000	The structure on surface has been damaged by weathering, however these damge dose not seem fatal. The gate has not been so damaged. Need the rehabilitation of the structure and maintenance of the gate.	Recommend the rehabilitation of the structure and maintenance of the gate.	50,000	within 5yrs			●	●			2,000	52,000
	M42	Sawada Canal	River Nile	Regulator	1990	10,000	4.40	Reconstruction	250,000	The structure has been damaged by weathering, however these damge seem at surround the gate. The gate has not been so damaged. Need the reconstruction at front of the intake and prefable replace the gate at same time.	Recommend the reconstruction at front of the intake and prefable replace the gate at same time.	250,000	within 5yrs	●		●				8,000	258,000
	M43	West Desout	Ebraheemeyya Canal	Regulator		1,000	0.44	New construction	150,000	The structure need the regulation function, however there is not gate. Need the reconstruction at front of the intake and install the gate.	Recommend the reconstruction at front of the intake and install the gate.	150,000	within 5yrs	●		●				5,000	155,000

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Area	No.	Name	Canal	Type	Con. Yr.	Command area	Max dis. (m^3/s)	Evaluation by RGBS		Evaluation by Consultant											
														Evaluation of the necessary survey or study							
								Necessary works	Cost (LE)	Evaluation of the structure and necessary works	Recommendation	Cost for works (LE)	Term of works	Geogra.	Geologi.	Mea-surement	Discharge volume	strength test	Oter test or survey	Cost for survey (LE)	Entire cost(LE)
	M44	1 Safsafa Branch	Ebraheemeyya Canal	Regulator		900	0.40	New construction	200,000	The district engineer requested to need new regulator at followng picture showed. In this case, need more study the purpose of the structure and condition of the water level, also discharge volume etc.	Recommend to more study the purpose of the structure and condition of the water level, also discharge volume etc.	300,000	within 5yrs	●	●	●	●		●	15,000	315,000
	M45	Bany wallems Escape	Serry Canal	Tail escape	1950	2,700	0.30	Reconstruction	50,000	The structure has been damaged by weathering and deterioration. Need the reconstruction and install the gate	Recommend the reconstruction and install the gate	50,000	within 5yrs	●		●				2,000	52,000
	M46	1 Al-Safsafa Branch	Ebraheemeyya Branch	Tail escape	1945	1,200	0.13	Rehabilitation	150,000	The structure has been damaged by weathering and deterioration. Need the reconstruction and install the gate	Recommend the reconstruction and install the gate	50,000	within 5yrs	●		●				2,000	52,000
	M47	2 Safsafa Branch	Ebraheemeyya Canal	Tail escape		900	0.10	Reconstruction	150,000	The structure has been expired almost (we could not see structure). According to the hearing to farmer, the water has not been reached up the bank, therefore, there is no	There is no problem	0	within 20yrs	--------	--------	--------	--------	--------	--------	0	0
	M48	Al-Sheikh Yousef Branch	Ebraheemeyya Canal	Tail escape	1950	600	0.07	Reconstruction	--------	The pipe has been broken at under the road. Need the reconstruction with replace the pipe.	Recommend the reconstruction with replace the pipe.	50,000	within 5yrs	●		●				2,000	52,000
	M49	West Tahnasha Branch	Al Badraman canal	Tail escape		410	0.05	Reconstruction	150,000	The structure has been damaged by weathering and deterioration. Need the reconstruction and install the gate	Recommend the reconstruction and install the gate	50,000	within 5yrs	●		●				2,000	52,000
	M50	Abu Haseeba Branch	Ebraheemeyya Canal	Pump station	1985, 2000	1,000	0.44	Construction	200,000	One of two pumps is expired. Need the replace the pump and rehabilitation.	Recommend the replace the pump and rehabilitation.	200,000	within 5yrs				●		●	6,000	206,000
	M51	Hassen Basha Drain Pump station	Hassen Basha Drain /Serry canal	Pump station		60,000	6.60	New structure	500,000	Currently, this structure is siphon. In this site has the problem of the low water level, therefore the district engineer requested the pump station instead of the siphon. Need the more study of the actual status.	Recommend the more study of the actual status.	500,000	within 5yrs				●		●	15,000	515,000
	M52	Samalout Canal Pump station	Ebraheemeyya Canal	Pump station	2000	1,000	0.50	New construction	250,000	The demand of the water has been increased, therefore one spare pump is required. Need the installation of the new pump.	Recommend the installation of the new pump.	250,000	within 5yrs	●	●	●	●		●	13,000	263,000
	M53	Sawada Intake siphon	Sawada Intake River Nile	Siphon		1,500	0.66	Rehabilitation	300	The pipe is not so bad, however the structure at edge of the pipe has been damaged. Need the rehabilitation of the structure at edge of the pipe.	Recommend the rehabilitation of the structure at edge of the pipe.	50,000	within 5yrs	●		●				2,000	52,000
	M54	Waslet Al-Shere'i	ELFASHEN CANAL / EBRAHEMIA CANAL	Bridge	1970	400	0.18	Rehabilitation	80,000	The water throgh the pipe is prevented the garbage. At across the drain, the pipe prevent the fair water. Need the reconstruction as the siphon	Recommend the reconstruction as the siphon	80,000	within 5yrs	●	●	●	●			4,000	84,000
	M55	Al-Fashneyya Canal 1	ELFASHEN CANAL / EBRAHEMIA CANAL	Bridge	1955	1,300	0.57	Rehabilitation	200,000	The structure has been damaged by weathering and deterioration. Need the reconstruction	Recommend the reconstruction	300,000	within 5yrs	●	●	●	●			15,000	315,000
	M56	Al-Fashneyya Canal 1	ELFASHEN CANAL / EBRAHEMIA CANAL	Bridge	1955	1,500	0.66	Rehabilitation	200,000	The structure has been damaged by weathering and deterioration. Need the reconstruction.	Recommend the reconstruction.	300,000	within 5yrs	●	●	●	●			15,000	315,000
	M57	Ma'atan Bridge	Serry Canal	Bridge	1950	15,000	6.60	Reconstruction	500,000	The structure has been damaged by weathering and deterioration. Need the reconstruction.	Recommend the reconstruction.	500,000	within 5yrs	●	●	●	●			25,000	525,000
	M58	Morgan Regulator	Al Badraman canal	Regulator	1917	6,935	3.05	Reconstruction	200,000	The structure has been damaged by weathering and deterioration. The gate has been expired, there is not gate. Need the reconstruction and install the gate	Recommend the reconstruction and install the gate	200,000	within 5yrs	●	●	●	●			10,000	210,000
	M59	SHEIKH YOUSEF BRANCH	Ebraheemeyya Canal	Bridge	1950	350		Rehabilitation	150,000	The structure has been damaged by weathering and deterioration. The narrow vent prevent the fair water. Need the reconstruction with wide vent.	Recommend the reconstruction with wide vent.	150,000	within 5yrs	●		●	●			8,000	158,000
	M60	WEST ABA CANAL	Ebraheemeyya Canal	Bridge	1989	1,500	0.66	Rehabilitation	150,000	The structure has been damaged by weathering and deterioration. The narrow vent prevent the fair water. Need the reconstruction with wide vent	Recommend the reconstruction with wide vent	150,000	within 5yrs	●		●	●			8,000	158,000

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●Minutes of meeting

1st Steering Committee on 7th October 2009
2nd Steering Committee on 16th December 2009
Technical Committee on 26th January 2010
3rd Steering Committee on 18th February 2010
4th Steering Committee on 29th June 2010

THE MINUTES OF THE MEETING
ON
THE INCEPTION REPORT
FOR
THE PREPARATORY SURVEY
ON
THE REHABILITATION AND IMPROVEMENT OF DIROUT GROUP OF REGULATORS
IN
THE ARAB REPUBLIC OF EGYPT

AGREED UPON BETWEEN

MINISTRY OF WATER RESOURCES AND IRRIGATION

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

Cairo, 7th October 2009

Dr. Hussein El-Atfy
Deputy Minister /
Head of Irrigation Department
Ministry of Water Resources and Irrigation
The Arab Republic of Egypt

Eng. Tomiji Shimoji
Team Leader / Irrigation Planning
Survey Team
Japan International Cooperation Agency
(JICA)

In response to the request of the Arab Republic of Egypt, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a mission to Egypt in May 2009, and agreed the basic contents of Scope of Work (S/W) with the Ministry of Water Resources and Irrigation (hereinafter referred to as "MWRI"). In accordance with the S/W, JICA dispatched a preparatory survey team for "The Rehabilitation and Improvement of Dirout Group of Regulators" (hereinafter referred to as "the Team") in October 2009.

The Team submitted thirty (30) copies of the English Inception Report (IC/R) to MWRI on 4th October 2009. The first Steering Committee meeting was held on 4th October 2009, and the contents of the IC/R were discussed among the Steering Committee members (MWRI, Ministry of International Cooperation, JICA and JICA Survey Team). Opinions were also exchanged between Egyptian and Japanese sides, and the contents of the IC/R were accepted in principle.

The main issues discussed during the meeting in relation to the IC/R are as follows:

1. The Deputy Minister of MWRI cited the history of the cooperation between the Governments of Egypt and Japan on Bahr Yousef Canal for more than 10 years, which started with the rehabilitation of the Lahoun regulator. Then the Deputy Minister stated the importance of the project that the rehabilitation of the Dirout Group of Regulators is to complete the irrigation system of the Bahr Yousef Canal, which serves 15% – 20% of agriculture land in Egypt.

2. The Deputy Minister said that the rehabilitation and improvement of 150 minor structures will also have positive impacts to improve the irrigation system of the area.

3. The Deputy Minister also asked the Team to send his regards to His Excellency, the Ambassador of Japan as he understands that the Ambassador has great interest in this Project.

4. The Deputy Minister summarized the items, which should be studied through this Preparatory Survey, as hydraulic planning, location of the regulators to be rehabilitated, hydro-power generation, O&M of the facilities, cost-benefit analysis, EIA and putting priority in 150 minor structures

5. The First Secretary of the Ministry of International Cooperation (MOIC) explained that in general the projects related to water are considered most important in the national plan.

6. The First Secretary also mentioned the process undergone until the Preparatory Survey was officially approved that the request has been submitted to the government of Japan in 2008 and many assessments have been carried out including the mission last May 2009. The First Secretary commended JICA to exert the effort to realize this Study and showed his expectation to look forward more cooperation between two governments.

7. The Deputy Minister introduced to the members of the steering committee in the MWRI side, which consists of the head of Planning Sector (PS), the head of Reservoir and Grand Barrage Sector (RGBS), and the head of Irrigation Sector (IS).

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8. It was stated that IS and RGBS should follow up the Survey with respect of M/M singed on 19th May 2009.

9. The Deputy Minister stated that the technical committee is formed with RGBS and IS headed by Eng. Somaya, the Head of Central Department for Studies, Specification and Design of RGBS and the technical committee acts as Counterparts to the Team and submit the required data to the Team.

10. It is confirmed that EIA will be conducted for the Dirout Group of Regulators but not for the minor structures and explained that EIA will be carried out through Environmental and Climate Research Institute (ECRI) in the ministry in coordination with Egyptian Environment Affairs Authority (EEAA).

11. The Deputy Minister directed that the IS will prepare the list of 150 priority minor structures and also assured that the representatives from Fayoum, Minia and Beni-Suef directorates will help complete the data for minor structures.

12. On assignment of counterparts to the Study, the Deputy Minister said that he would consider that.

13. The Deputy Minister said that the office space for the Study Team in Minia is ready and office in the HQ would be ready after one month.

14. JICA representative thanked the steering committee for accepting the Study Team and for the hospitality always given to JICA. The JICA representative explained that JICA HQ chose the relevant consultants to carry out this Preparatory Survey.

15. It was directed that the technical committee should study the Inception Report and discuss with the Team and add any comments and commence the works from the day of 4th October.

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Attached paper-1

Participants of the Meeting on 4 October 2009
(at the MWRI conference room, Cairo)

Ministry of Water Resources and Irrigation (MWRI)

Dr. Hussein El-Atfy	Deputy Minister / Head of Irrigation Department
Dr. Mohamed Abd El-Motaleb	Head of Planning Sector
Eng. Ibrahim Farag Abd El-Khalek	Head of Reservoir and Grand Barrage Sector
Eng. Abd El-Shakor Mohamed	Head of Irrigation Sector
Eng. Somaya Sherif	Head of Central Department for Studies, Specification and Design, RGBS
Eng. Nabila Bahaa	Head of M&E Unit, Irrigation Department
Dr. Reda Abd El-Mahdy Rady	Minister's Technical Office
Dr. Koji KITAMURA	Policy Adviser for Agriculture and National Water Resources Management, JICA Expert

Ministry of International Cooperation (MOIC)

General / Mr. Nabil Abdel-Hamid Hassan	First Secretary of State / Minister's Assistant for Asian Affaire

JICA Egypt Office

Mr. Takuro TAKEUCHI	Representative
Dr. Ashraf M. El-Abd	Chief Program Officer
Ms. Satoko KIMURA	Senior Program Officer

JICA Study Team

Mr. Tomiji SHIMOJI	Team Leader/ Irrigation Planning
Mr. Seiji TANABE	Irrigation Facility (Regulators)
Mr. Fusataka ARAKAWA	Water Management System
Mr. Akihiko HATA	Agriculture / Agro-processing and Marketing

THE MINUTES OF THE MEETING
ON
THE PROGRESS REPORT (1)
FOR
THE PREPARATORY SURVEY
ON
THE REHABILITATION AND IMPROVEMENT OF DIROUT GROUP OF REGULATORS
IN
THE ARAB REPUBLIC OF EGYPT

AGREED UPON BETWEEN

MINISTRY OF WATER RESOURCES AND IRRIGATION

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

Cairo, 16th December 2009

Dr. Hussein El-Atfy
Deputy Minister /
Head of Irrigation Department
Ministry of Water Resources and Irrigation
The Arab Republic of Egypt

Eng. Tomiji Shimoji
Team Leader / Irrigation Planning
Survey Team
Japan International Cooperation Agency
(JICA)

Somaya

In response to the request of the Arab Republic of Egypt, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a mission to Egypt in May 2009, and agreed the basic contents of Scope of Work (S/W) with the Ministry of Water Resources and Irrigation (hereinafter referred to as "MWRI"). In accordance with the S/W, JICA dispatched a preparatory survey team for "The Rehabilitation and Improvement of Dirout Group of Regulators" (hereinafter referred to as "the Team") in October 2009.

The Phase I field work commenced with the first steering committee held on 4th October 2009 and the Team carried out a series of field survey by December 2009. Then the Team submitted thirty (30) copies of the Progress Report (1) (P/R1) of the preparatory survey to MWRI on 16th December 2009. The Second Steering Committee meeting was held on 16th December 2009, and the contents of the P/R1 were discussed among the Steering Committee members (MWRI, Ministry of International Cooperation, JICA and JICA Survey Team). Opinions were also exchanged between Egyptian and Japanese sides, and the contents of the P/R1 were accepted in principle.

The committee meeting began with the introduction by the Chairman, the Deputy Minister of the MWRI. The Chairman welcomed the participants of the meeting and appreciated the continuous cooperation of the Government of Japan (GOJ) with the Government of Egypt (GOE).

After the self introduction, the Counselor of the Embassy of Japan made his opening remarks. The Counselor gave appreciations for the cooperation of the MWRI and the Ministry of International Cooperation (MOIC) with the GOJ and wished for continuing the cooperation between the two governments.

Following the opening remarks, the presentations were made. Firstly the head of the technical committee for the preparatory survey presented the progress of the Phase I field work including setting working groups by study topic and technical committee to follow the progress of work, facilitation of the field survey and meeting with relevant authorities, etc.

Then, the Team presented the contents of the Progress Report (1), which consists of the rationale of the Project, preliminary analyses of the field survey, constraints and opportunities identified and confirmation of issues towards the Phase II field work. Following are the issues discussed during the meeting:

1. Considering the EIA procedure, the Chairman instructed RGBS to contact Egyptian Environmental Affairs Authority (EEAA) from now to get their assistance for screening and to accelerate the EIA procedure, which will be done in case of constructing new barrage.

2. The Chairman stated as the desire of the Ministry that the existing Dirout Group of Regulators (DGR) should be kept as a historical monument.

3. The Team stated that a study on hydro-power generation will be further focused during the Phase II.

4. The frame "Lack of water management system" should be reframed as "Mismatching of

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water supply and demand".

5. The data and analyses presented in the Progress Report (1) should be reviewed by the technical committee. Especially the data on water balance (supply and demand) should be reviewed by the Irrigation Sector.

6. Data on water discharge at Ibrahimia intake, and intakes of Bahr Yusef and Ibrahimia at Dirout Group of Regulators in year 2009 should be collected and added to the analysis.

7. As for the selection of Minor Structures, the rationale of setting a criterion of the command area with more than 1,000 feddan was questioned. The Team explained that the criterion was set in order to select the site with bigger impact of the Project. After the discussion, it was decided that the proposed criteria for selection should be revised by the technical committee and delivered to Irrigation Sector, and by the end of December 2009 the maximum 150 Minor Structures (in Giza / Beni Suef / Fayoum / Minya) will be determined.

After the discussion, the Senior Representative of JICA made closing remarks, appreciating the participants from the MWRI, MOIC and the Embassy of Japan for the cooperative work for the preparatory survey and the meeting was ended.

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Attached paper-1

Participants of the Meeting on 16th December 2009

(at the MWRI conference room, Cairo)

Ministry of Water Resources and Irrigation (MWRI)

Dr. Hussein El-Atfy	Deputy Minister / Head of Irrigation Department
Dr. Essam Khalifa	Minister's Technical Office
Dr. Mohamed Abd El-Motaleb	Head of Planning Sector
Eng. Ibrahim Farag Abd El-Khalek	Head of Reservoir and Grand Barrage Sector
Eng. Abd El-Shakor Mohamed	Head of Irrigation Sector
Eng. Somaya Sherif	Head of Central Directorate for Studies, RGBS
Eng. Nabila Bahaa	Head of M&E Unit, Irrigation Department
Eng. Ahmed Farouk	CD-Technical Office, RGBS
Dr. Koji Kitamura	Policy Adviser for Agriculture and National Water Resources Management, JICA Expert

Ministry of International Cooperation (MOIC)

General / Mr. Nabil Abdel-Hamid Hassan	First Secretary of State / Minister's Assistant for Asian Affaire

Embassy of Japan

Mr. Takeshi ITO	Counselor
Mr Yasuaki NAKAMURA	First Secretary

JICA Egypt Office

Mr. Nobuhiro IKURO	Senior Representative
Mr. Osamu TANAKA	Representative
Mr. Takuro TAKEUCHI	Representative
Dr. Ashraf M. El-Abd	Chief Program Officer

JICA Study Team

Mr. Tomiji SHIMOJI	Team Leader/ Irrigation Planning
Mr. Akihiko HATA	Agriculture / Agro-processing and Marketing
Mr. Kazuma Akiyoshi	Irrigation Facility (Minor structure)

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THE MINUTES OF THE MEETING
ON
THE INTERIM REPORT
FOR
THE PREPARATORY SURVEY
ON
THE REHABILITATION AND IMPROVEMENT OF DIROUT GROUP OF REGULATORS
IN
THE ARAB REPUBLIC OF EGYPT

AGREED UPON BETWEEN

MINISTRY OF WATER RESOURCES AND IRRIGATION

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

Cairo, 26th January 2010

Somaya Sherif

Eng. Somaya Sherif
Head / Central Department for Studies, Specification & Design, RGBS
Ministry of Water Resources and Irrigation
The Arab Republic of Egypt

Eng. Tomiji Shimoji
Team Leader / Irrigation Planning Survey Team
Japan International Cooperation Agency (JICA)

In response to the request of the Arab Republic of Egypt, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a mission to Egypt in May 2009, and agreed the basic contents of Scope of Work (S/W) with the Ministry of Water Resources and Irrigation (hereinafter referred to as "MWRI"). In accordance with the S/W, JICA dispatched a preparatory survey team for "The Rehabilitation and Improvement of Dirout Group of Regulators" (hereinafter referred to as "the Team") in October 2009.

The Phase II field work commenced on 20th January 2010 and the Team began the field survey. Then the Team submitted thirty (30) copies of the Interim Report (IT/R) to MWRI on 24th January 2010. The Technical Committee meeting was held on 26th January 2010, and the contents of the IT/R were discussed among the Technical Committee members (MWRI and JICA Survey Team). Opinions were also exchanged between Egyptian and Japanese sides, and the contents of the IT/R were accepted in principle.

The main issues discussed during the meeting in relation to the IT/R are as follows:

1. The team leader and the members of the Team presented the summary of the interim report by using the power point. .

2. Eng. Somaya chaired the meeting and the discussion was made from the viewpoint of engineering.

3. The Technical Committee pointed out minor mistakes of description in the Interim Report.

4. The Team agreed to prepare a list of errata on the IT/R.

5. The Technical Committee approved the contents of IT/R and approved the proposal of the Team to hold the steering committee on 18th February for making decision to formulate the plan of rehabilitation method of the Dirout Group of Regulators.

6. The Technical Committee instructed to hold the working group meeting, the Dirout Regulators group, the water management group and the minor structures individually.

After the discussion, the chairperson made closing remarks, appreciating the participants from the MWRI and the preparatory survey team.

Attached paper-1

Participants of the Meeting on 26 January 2010

(at the MWRI , Cairo)

Ministry of Water Resources and Irrigation (MWRI)

Eng. Somayah Sherif	Chair person, Head of the Counterpart Head CDSSD, RGBS
Dr. Ragab Abdel Azeim	Central Counterpart
Eng. Tarek Awward Ibrahim	Central Counterpart
Eng. Ihrahim Abo El Nagga	Central Counterpart
Eng. Ashraf M. Hubeishi	Assistant Central Counterpart
Eng. Ehab Elgohary	1st Assistant Central Counterpart
Eng. Mahmoud Rafee Mohamed	2nd Assistant Central Counterpart
Eng. Ahmed Farouk	3rd Regional Field Counterpart
Eng. Ahmed Korrat	General Director for Designs, CDSSD
Eng. Amal El Saeed	Water Distribution Engineer
Eng. Rania Hassan Nashat	Engineer in General Directorate for Designs
Dr. Koji KITAMURA	Policy Adviser for Agriculture and National Water Resources Management, JICA Expert

JICA Study Team

Mr. Tomiji SHIMOJI	Team Leader/ Irrigation Planning
Mr. Seiji TANABE	Irrigation Facility (Regulators)
Mr. Fusataka ARAKAWA	Water Management System
Mr. Kazuma Akiyoshi	Irrigation Facility (Minor Structures)

THE MINUTES OF THE MEETING
ON
THE THIRD STEERING COMMITTEE
FOR
THE PREPARATORY SURVEY
ON
THE REHABILITATION AND IMPROVEMENT OF DIROUT GROUP OF REGULATORS
IN
THE ARAB REPUBLIC OF EGYPT

AGREED UPON BETWEEN

MINISTRY OF WATER RESOURCES AND IRRIGATION

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

Cairo, 18th February 2010

Dr. Hussein El-Atfy
Deputy Minister /
Head of Irrigation Department
Ministry of Water Resources and Irrigation
The Arab Republic of Egypt

Eng. Tomiji Shimoji
Team Leader / Irrigation Planning
Survey Team
Japan International Cooperation Agency
(JICA)

In response to the request of the Arab Republic of Egypt, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a mission to Egypt in May 2009, and agreed the basic contents of Scope of Work (S/W) with the Ministry of Water Resources and Irrigation (hereinafter referred to as "MWRI"). In accordance with the S/W, JICA dispatched a preparatory survey team for "The Rehabilitation and Improvement of Dirout Group of Regulators" (hereinafter referred to as "the Team") in October 2009.

The Phase I field work ended in the end of December 2009 and the Phase II field work commenced from the beginning of January 2010. The 3rd Steering Committee was held on February 18, 2010 at MWRI Communication Center in order to share the progress of the Phase II field work and make decision for the alternative plan of the rehabilitation and improvement of the Dirout Group of Regulators (DGR).

The committee meeting began with the introduction by Dr. Hussein El Atfy, the Chairman of the Committee / the Deputy Minister of the MWRI. The Chairman welcomed the participants of the meeting and appreciated the continuous cooperation of the Government of Japan (GOJ) with the Government of Egypt (GOE).

Following the introduction, Mr. Ito, the Counselor of the embassy of Japan made opening remarks. The Counselor expressed his appreciations to the Chairman and Mr. Nabil, the First Secretary of State of the Ministry of International Cooperation (MOIC) for this bilateral cooperation and also appreciated to all the participants for their cooperation. The Counselor praised the Committee for the Survey has been carried out smoothly with beneficial advice from the Chairman and the committee members. The Counselor made a remark that the cooperation between Japan and Egypt in Irrigation Sector has been very strong and gave the example of the projects of four regulators along Bahr Yusef canal.

The Counselor also made a remark that with the initiative of the Minister of International Cooperation the five Ministers (MWRI, the Ministry of Health, the Ministry of Agriculture and Land Reclamation, Egyptian Environmental Affairs Authority (EEAA) and MOIC) and the Ambassador of Japan had recently held a meeting to share the issue of water in Egypt including the quality of re-use water for agriculture. The Counselor again thanked the participants for the cooperation and expressed his expectation that the discussions on this committee would lead to the realization of the Project with Japanese Loan Scheme.

Then Mr. Nabil, the First Secretary of State of MOIC made his remarks. He welcomed the mission and remarked that this Project has been considered as one of the most important projects in Egypt. He explained that the request of this Project to the Japanese government was made in August 2008 as the top of the requested projects and the Japanese government responded to the request in February 2009. He appreciated the cooperation of Japan and told the committee that he would like to accelerate the procedure for the implementation. He also welcomed the participants of the meeting to have opportunity to visit MOIC and finally thanked the Chairman of the Committee.

Then, the Team presented the progress of the Survey, which consisted of the alternative study for DGR, progress of water management study and next step. Following are the issues discussed during the meeting:

1. Eng. Somaya referred that the technical committee of RGBS and Irrigation Sector have agreed, in principle with PLAN C and further justification for the location has been requested to the Study Team during the meeting with technical committee.

2. Eng. Nabila, Irrigation Department, made following inquiries:
   a) Why should we consider the five regulators as one unit? Are there alternatives to consider each regulator separately?
   b) On the comparison table of the three alternatives, all the indicators were considered equal to evaluate the alternatives. However, higher weight in important indicators such as "hydraulic performance" and "stability of structure" should be given to the evaluation.
   c) Cost of each alternative is not mentioned. How can we justify the alternatives without cost?
   d) The alternatives discussed were the options of rehabilitation of the existing DGR, new construction in upstream side and new construction in downstream side. We should also consider alternatives the locations of new construction within the downstream side or upstream side.
   e) Should navigation be option or compulsory?

   To the above inquiries, the Team gave following answers:
   a) As for two regulators located upstream (Delgawy and Sahylia), these regulators have been suffering from sedimentation, therefore the improvement is required. Also for realizing the integrated water management system the Team proposes to rehabilitate and improve all the regulators at the same time.
   b) The Team considered giving some weight to some indicators. However, weighing might give some subjective perception of the Team or the Team should agree about the weight with other technical committee members prior to evaluation. Therefore, the Team in this occasion decided to give equal weight to all the indicators.
   c) The Team made a rough cost estimation at this stage and got indication that the construction cost of PLAN A (rehabilitating the existing DGR) would be the cheapest but the working life would only be 40 years that meant another investment is necessary after 40 years, while the working life of the other alternatives is considered as 100 years. As for PLAN B (new construction at upstream side) and PLAN C (new construction at downstream side), PLAN C would be cheaper than PLAN B since the diversion work of PLAN B is much more complicated than PLAN C.
   d) Detail study on the location of the regulator axis will be carried out after the Committee decides which alternatives (upstream, or downstream or rehabilitating the existing DGR) to be further studied.
   e) Navigation at Bahr Yusef canal has been confirmed no use at the basic design study on the rehabilitation and improvement of the Moshat El Dahab regulator on Bahr Yusef canal. As for Ibrahimia canal, the Team has found some existing bridges on the canal are not equipped with navigation function.

3. The Chairman said that MWRI will confirm the necessity of navigation lock on Ibrahimia canal and instructed that RGBS should meet with the River Transportation Authority to get official letter concerning navigation situation both in Ibrahimia and Bahr Yusef and discuss the possibility of participation of the River Transportation Authority at the study of

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cost for constructing new navigation lock.

4. The Chairman further asked the following questions to the Team:
   a) What about the approaches to the sedimentation issue?
   b) The Alternative of PLAN C (new construction at downstream side) is considered 100 m downstream the existing DGR. Is this distance taking into account the existing Mosque near the proposed site?
   c) Has the study on hydro-power concluded?

   To the above inquiries, the Team gave following answers:
   a) The Team proposes to shift the location of the regulators together with river training in order to alleviate the sedimentation.
   b) Yes, the distance of 100m downstream the existing DGR is considering the location of the nearby Mosque. But further study on the location of regulator axis will be carried out.
   c) The Team is still studying the possibility of installing the hydro-power facility.

5. After the discussion, the Committee agreed with PLAN C and instructed the Team to go ahead for the detail study on PLAN C (new construction at downstream side of the existing DGR). The Committee instructed the Team to study alternatives to construct new regulators at the downstream for Ibrahimia, Bahr Yusef and Badrawan regulators and study again on the feasibility of other 2 regulators (Delgawy and Sahelyia). The study on the alternatives should be compared technically, hydrologically, structurally, and from cost.

6. A question on the schedule of assessment of the minor structures was raised. The Team answered that the Team will carry out the field survey based on the documents provided by MWRI by the end of March and assessment from April. The Committee instructed that from April 1 to end of May 2010 technical committee should work day by day with the Team for investigation and assessment of 124 minor structures structurally and hydrologically in the four governorates.

7. RGBS presented the progress of EIA procedure: RGBS has held meetings with Environment and Climate Research Institute (ECRI). RGBS introduced ECRI to the study providing the Progress Report (1) of the study and confirmed the time schedule and procedure for EIA. RGBS has got approval to delegate ECRI to prepare the EIA study. RGBS had also a meeting with EEAA together with ECRI and confirmed the need of full EIA in case of new construction. RGBS has asked ECRI to prepare the cost estimate to do the work. The EIA study would take three months and ECRI can start the work after the Committee agrees with the alternative. The head of RGBS has issued a degree to form Environmental Group (EG) within RGBS for EIA procedure. It would be expected that the EIA would be finished by the end of May. The Committee instructed that RGBS should complete all the process with EEAA and ECRI concerning EIA for the Study.

8. The Committee instructed that the Team should study alternatives and methodology to avoid upstream sedimentation problem.

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9. The Committee instructed that the Team should present an integrated system for the best water management for the Study area at Ibrahim and Bahr Yusef canals with respect to the outputs of demand and water use.

10. The Committee instructed that the Team should study alternatives for technical and economical feasibility for mini-hydro power at one or more regulators.

11. The Committee instructed that the technical committee should coordinate to prepare for the 4th Steering Committee to be held in June 2010.

Mr. Takeuchi, the Representative of JICA, made closing remarks. He gave his appreciations to the Chairman for his leadership and hospitality to support the work and also appreciated Mr. Nabil for the cooperation of MOIC and Sanyu Consultants, the Team, for the trustful work. He also mentioned that the most important point is the benefit for farmer beneficiaries through the Project and requested the counterparts for further cooperation with the Team for realizing the benefit of the Project.

Mr. Nabil also commended the progress of the study as a closing remark.

With the appreciation of the Chairman to the participants, the Committee ended.

Attached paper-1

Participants of the Meeting on 18th February 2010

(at the MWRI conference room, Cairo)

Ministry of Water Resources and Irrigation (MWRI)

Dr. Hussein El-Atfy	Deputy Minister / Head of Irrigation Department
Dr. Mohamed Abd El-Motaleb	Head of Planning Sector
Eng. Ibrahim Farag Abd El-Khalek	Head of Reservoir and Grand Barrage Sector
Eng. Abd El-Shakor Mohamed	Head of Irrigation Sector
Eng. Somaya Sherif	Head of Central Directorate for Studies, RGBS
Eng. Nabila Bahaa	Head of M&E Unit, Irrigation Department
Eng. Ashraf M. Hubeishi	Technical Office, Irrigation Department
Dr. Koji Kitamura	Policy Adviser for Agriculture and National Water Resources Management, JICA Expert

Ministry of International Cooperation (MOIC)

General / Mr. Nabil Abdel-Hamid Hassan	First Secretary of State / Minister's Assistant for Asian Affaire

Embassy of Japan

Mr. Takeshi Ito	Counselor
Mr. Yasuaki Nakamura	First Secretary

JICA Egypt Office

Mr. Takuro Takeuchi	Representative
Mr. Osamu Tanaka	Representative
Ms. Satoko Kimura	Senior Program Officer
Dr. Ashraf M. El-Abd	Chief Program Officer

JICA Study Team

Mr. Tomiji Shimoji	Team Leader / Irrigation Planning
Mr. Seiji Tanabe	Irrigation Facility (Regulators)
Mr. Fusataka Arawaka	Water Management System
Mr. Kazuma Akiyoshi	Irrigation Facility (Minor structures)
Mr. Akihiko Hata	Agriculture / Agro-processing and Marketing

THE MINUTES OF THE MEETING
ON
THE FOURTH STEERING COMMITTEE
FOR
THE PREPARATORY SURVEY
ON
THE REHABILITATION AND IMPROVEMENT OF DIROUT GROUP OF REGULATORS
IN
THE ARAB REPUBLIC OF EGYPT

AGREED UPON BETWEEN

MINISTRY OF WATER RESOURCES AND IRRIGATION

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

Cairo, 29th June 2010

Dr. Hussein El-Atfy Deputy Minister / Head of Irrigation Department Ministry of Water Resources and Irrigation The Arab Republic of Egypt	Eng. Tomiji Shimoji Team Leader / Irrigation Planning Survey Team Japan International Cooperation Agency (JICA)

Somaya

In response to the request of the Arab Republic of Egypt, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a mission to Egypt in May 2009, and agreed the basic contents of Scope of Work (S/W) with the Ministry of Water Resources and Irrigation (hereinafter referred to as "MWRI"). In accordance with the S/W, JICA dispatched a preparatory survey team for "The Rehabilitation and Improvement of Dirout Group of Regulators" (hereinafter referred to as "the Team") in October 2009.

The Phase I field work ended in the end of December 2009 and the Phase II field work commenced from the beginning of January 2010. The 4th Steering Committee meeting was held on June 29, 2010 at the Office of the Deputy Minister at MWRI in order to share the result of the Feasibility Study of the rehabilitation and improvement of the Dirout Group of Regulators (DGR). The Team submitted the 30 copies of the Progress Report (2) to the MWRI.

The committee meeting began with the introduction by Dr. Hussein El Atfy, the Chairman of the Committee / the Deputy Minister of the MWRI. The Chairman welcomed the participants of the meeting and praised how strong the cooperation between the Government of Japan (GOJ) and the Government of Egypt (GOE) and he looked forward more cooperation between the two countries. Also the Chairman praised the work of the Team.

Following the introduction, Mr. Ito, the Counselor of the embassy of Japan made opening remarks. He expressed his pleasure to attend the meeting and appreciated the advice given to the Team from the Ministry headed by the Deputy Minister. He stressed that the cooperation between the two countries in the field of irrigation is strong as the four regulators along the Bahr Yusef canal have been rehabilitated and also the discussion for water re-use for irrigation is on-going. Then he hoped that this Project will be implemented by yen loan and the agreement for it will be done within this Japanese fiscal year.

After the opening remarks, Eng, Ibrahim, RGBS made a presentation on some issues to have been studied. Following are the issues presented and the Committee agreed with the result of the study.

- Navigation lock: based on the discussion with the River Transportation Authority (RTA), the necessity of navigation lock on Ibrahimia canal has been confirmed.
- Road above the Dirout Group of Regulators (DGR): the road on the new DGR will be used only for maintenance of the facility due to no access to the right side. This has been agreed by the Governor of Assuit.
- Type of gate: after the examination, double-leaf gate has been adopted.
- Mini Hydro Power Plant: it has been judged not feasible after the study and discussion with the Hydro Power Authority.
- EIA Study: the final report was submitted from ECRI to RGBS and ready to handover to the Egyptian Environmental Affairs Authority (EEAA).
- Minor structures: 128 minor structures have been selected and evaluated.
- General: the presentation of the study to the Minister has been made and the Minister has agreed with the location of the new DGR.

Following the presentation by RGBS, the Team presented the result of the Feasibility Study,

which consisted of the rationale of the Project and the result of the Project evaluation. In the presentation, the Team stressed the necessity of developing the whole irrigation system of Ibrahimia main canal command area, which covers 1.5 million feddan, for the National Food Security to be threatened by the future population growth of the country. The Team positioned the Project of the DGR as the first step of the development in Ibrahimia canal command area and concluded that the Project is feasible with the Economic Internal Rate of Return (EIRR) of 27%. The contents of the presentation were basically agreed by the Committee. Following are the issues discussed during the meeting:

1. The Chairman said that the term of "Integrated Water Management System" should be changed to "Improving Water Distribution System" since the word "Water Management" would include social aspects, as well.

2. The Committee members inquired about the significance of the Priority Minor Structures since this component would only give 1% of contribution to EIRR. The Team explained that because of the beneficiary area of the priority minor structure (74,000feddan) is so small to compare with the beneficiary area of the main facility (DGR), the contribution of the Minor Structures to EIRR becomes small, but the result of the analysis shows that the rehabilitation and improvement of the Minor Structures shows adding value to the Project. Dr. Kitamura also commented that contribution to EIRR may not be big but when looking at the Net Present Value (NPV), additional value of the Minor Structures is around 30% and the NPV is the most important indicator to show the value of the Project.

3. There was a comment that RGBS should write officially to Assiut Governorate General secretary concerning the un-need to construct a new bridge and to confirm the vision & the plan of the Governorate regarding this matter.

4. There was a comment that the Survey Team will study the EIRR to implement the new DGR separated from SCADA system, as this will enable the Egyptian side to determine the priorities and the better economic ways determining the currencies, methods, and the suitable ways of financing.

5. There was a comment that RGBS has to coordinate with the HEPA Hydro Power Authority - Ministry of Electricity and Energy to emphasize the results of the DGR consultancy study concerning the issue that there is no feasibility to construct a hydro power station in the DGR.

6. The First Secretary of the Ministry of International Cooperation (MOIC) gave his view saying why this project is going to be financed not by grant but loan since GOE has so far received the grants to the rehabilitation of the regulators on the Bahr Yusef canal that has been the images of the assistance from Japan in this area. The Chairman gave his consent to the First Secretary and expressed his wish to complete the Project with the same spirit.

7. The Counselor of the Embassy of Japan explained that the Project cost is too high to apply grant. The First Secretary of MOIC inquired a possibility of phasing the Project in order to fit it into grant scheme. He also added that the Project is not going to generate the profit so that he wonders the appropriateness of loan. The Chairman also suggested that the Minor

Structure component can be implemented by the local fund. The Director of RGBS suggested that we can start the Detail Design by grant by the time of deciding the way of funding the Project implementation. Including such possibilities, the Chairman and the First Secretary of MOIC requested the GOJ for having further discussion about how to finance the Project.

8. Representative of JICA Egypt Office pointed out how big the EIRR and NPV are for this Project and stressed the Project is so important for the National Food Security that this Project is valuable for financing. The Committee members agreed with the importance and the benefit of the Project. Yet the Chairman expressed his hope for the possibility of grant though he understands the difficulty for it.

With the appreciation of the Chairman to the participants, the Committee meeting ended.

Attached paper-1

Participants of the Meeting on 29th June 2010

(at the MWRI Office of the Deputy Minister, Cairo)

Ministry of Water Resources and Irrigation (MWRI)

Dr. Hussein El-Atfy	Deputy Minister / Head of Irrigation Department
Dr. Essam Khalifa	Head of Sector of Minister's Office
Dr. Mohamed Abd El-Motaleb	Head of Planning Sector
Eng. Ibrahim Farag Abd El-Khalek	Head of Reservoir and Grand Barrage Sector
Eng. Fathey Gowaly	Head of Irrigation Sector
Eng. Somaya Sherif	Head of Central Directorate for Studies, RGBS
Eng. Ibrahim Abd El Naga	Head of General Directorate for Studies and Specification, RGBS
Eng. Nabila Bahaa	Head of General Directorate of M&E / ID
Eng. Ashraf M. Hubeishi	General Director of Information Center / ID
Dr. Koji Kitamura	Policy Adviser for Agriculture and National Water Resources Management, JICA Expert

Ministry of International Cooperation (MOIC)

General / Mr. Nabil Abdel-Hamid Hassan	First Secretary of State / Minister's Assistant for Asian Affaire

Embassy of Japan

Mr. Takeshi Ito	Counselor
Mr. Yasuaki Nakamura	First Secretary

JICA Egypt Office

Mr. Shigeru Otake	Representative
Mr. Takuro Takeuchi	Representative
Mr. Osamu Tanaka	Representative
Ms. Satoko Kimura	Senior Program Officer
Dr. Ashraf M. El-Abd	Chief Program Officer

JICA Study Team

Mr. Tomiji Shimoji	Team Leader / Irrigation Planning
Mr. Seiji Tanabe	Irrigation Facility (Regulators)
Mr. Istuo Kihata	Environmental and Social Consideration
Mr. Fusataka Arawaka	Water Management System
Mr. Kazuma Akiyoshi	Irrigation Facility (Minor structures)
Mr. Akihiko Hata	Agriculture / Agro-processing and Marketing