4. 4. 3 Intake Facilities of Branch Canals

Most of the intake facility of the branch canals, which are made of bricks and are out of life span. Different types of gates such as sluice gates with small spindle winch, F.H gates, sluice gates with large size chain winding, etc. Out of the existing 44 intakes provided with gates, only five intakes and eight gates facilities are in favourable condition. According to the outline of the rehabilitation mentioned in section 4.3.3, the rehabilitation plans are prepared as follows for the respective intakes.

1) Small Scale Intake Facility with Single Gate

The span length of this type intake ranges 0.7 to 1.5 m, and there are 28 facilities provided with spindle winding sluice gates. The related civil work structures as well as gates have been so deteriorated and damaged that total improvement shall be made and the sluice gates shall be renewed as well.

2) Medium Scale Intakes with Single Gate

The span length of this type ranges from 2.0 to 3.0 m, and eight intake facilities with F.H gate exist. The leaf is so high by 2.5 to 3.7 m that mechanical damages have been caused in gate operation. Out of eight intakes, five intakes shall give a slight repair in view of light damages with them, while other three intakes shall be totally improved together with F.H gates due to the fact of heavy deterioration and damages on leaves and other civil work structures. Gate winding guide frames shall be provided all the intakes for smooth O/M of the facilities (refer to Figure F-3-10 in Appendix F).

3) Medium Scale Intakes with Plural Number of Gates

There are six intake facilities with two to four F.H gates that span lengths range from 1.0 to 3.0 m. Since the gate height is high, the mechanical damages have been caused in gate operation. Because gates and structures of three facilities called as Oftan, Wahbi and Aroos, out of six intake facilities, are comparatively in favorable conditions, repairing works would be proposed. The gate winding guide frame would be proposed to repair the existing gates. However, other three damaged facilities with old gates and structures, would be reconstructed. The gate type would also be changed to the wheel gate type (refer to Figure F-3-10 in Appendix F).

a) Manshat El Dahab Branch Canal Intake

This intake has been playing a vital role to cover the irrigation area of 50,400 feddan. The existing intake facilities have four F.H gates with a span length of 2.5 m in brick structure. The present effective vent width is 10 m in total. The improvement plan has employed two highly operative wheel type gates with a span length of 5.0 m but the effective total vent width shall be unchanged. The rehabilitated facilities shall be located at the place where the present facilities shall be removed.

Scale	:	Span length of 5.0 m × 2 nos. piers width of 1.5 m × 3 nos., gate length of 11.5 m (total length 14.5 m)
Regulator body	:	Concrete structure with spread foundation
Superstructures	:	O/M Bridge of 6.0 m width
Gates	:	Double leaf wheel gates, wire-rope winch type, span length of 5.0 m, leaf height of 2.45 m × 2 leaves × 2 gates

b) Saab Branch Canal Intake

This intake is an important facility to irrigate the command area of 17,000 feddan. The present intake has two F.H gates with a span length of 2.5 m in brick structure. The present effective width is 5.0 m in total. The proposed plan has a employed highly operative wheel type gate with a span length of 5.0 m, and the effective width shall be unchanged. The rehabilitated structures shall be located at the place where the existing facilities shall be removed (refer to Figure F-3-10 in Appendix).

Scale	:	Span length of 5.0 m × 1 nos. piers width of 1.5 m × 2 nos., gate length of 5.0 m (total length 8.0 m)
Regulator body	:	Concrete structure with spread foundation
Superstructures	:	O/M Bridge of 6.0 m width
Gates	:	Double leaf wheel gates, wire-rope winch type, span length of 5.0 m, leaf height of 1.9 m × 2 leaves × 1 gate

c) Harika Branch Canal Intake

The intake facility is important to irrigate the command area of 18,800 feddan. The existing intake has two F.H gates with a span length of 2.5 m in brick structure. The proposed plan has employed a highly operative wheel type gate with a span length of 5.0 m. The effective

vent width shall be unchanged as the present one. The proposed facility would be located at the same place where the present one shall be removed (refer to Figure F-3-10 in Appendix F).

Scale	:	Span length of 5.0 m × 1 nos. piers width of 1.5 m × 2 nos., gate length of 5.0 m (total length 8.0 m)
Regulator body	:	Concrete structure with spread foundation
Superstructures	:	O/M Bridge of 6.0 m width
Gates	:	Double leaf wheel gates, wire-rope winch type, span length of 5.0 m, leaf height of 1.9 m × 2 leaves × 1 gate

4) Large Scale Intake with Plural Number of Gates

The intakes of this type provide span length by 3.0 m with four to five gates by chain block winding double leaf sluice gates, and there are two intakes of the existing Giza and Hassan Wasef branch canals. Both intakes are very important facilities to cover about 153,100 feddan and about 118,300 feddan of command areas, respectively. These two large scale intakes have been heavily deteriorated and damaged with structures and equipment, but the huge effect produced from total rehabilitation is expected in view of their important roles in the areas. Total rehabilitation shall be made with gates renewed by double leaf wheel gates because of having high leaves.

a) El Giza Branch Canal Intake

The existing intake has five double sluice gates with a span length 3 m in brick structure. The present effective vent width is 15 m in total. The proposed plan has employed four operative wheel type gates with a span length of 4 m and the total effective vent width is 16.0 m. Considering an operationability, the same span length of 4.0 to 5.0 m of gates would be basically proposed. The proposed intake facility is located at the same place of the existing one which will be removed (refer to Figure F-3-11, Appendix F).

Scale	:	Span length of 4.0 m × 4 nos. piers width of 1.5 m × 5 nos., gate length of 20.5 m (total length 23.5 m), pier height of 9.0 m
Regulator body	:	Concrete structure with spread foundation
Superstructures	:	O/M Bridge of 8.0 m width
Gates	:	Double leaf wheel gates, wire-rope winch type, span length of 4.0 m, leaf height of 2.4 m × 2 leaves × 4 gates

b) Hassan Wasef Branch Canal Intake

The existing intake facility has four double sluice gates with a span length 3 m in brick structure. The present total effective vent width is 12 m. The proposed plan has employed three operative wheel type gates with a span length of 4 m and the total effective vent width is 12.0 m as the same as the existing one. Considering an operationability, the same span length of 4.0 to 5.0 m of gates would be basically proposed. The proposed intake facility is located at the same place of the existing one which will be removed (refer to Figure F-3-12 Appendix F).

Scale	:	Span length of 4.0 m × 3 nos. piers width of 1.5 m × 4 nos., gate length of 15.0 m (total length 16.0 m), pier height of 9.75 m
Regulator body	:	Concrete structure with spread foundation
Superstructures	:	O/M Bridge of 6.0 m width
Gates	:	Double leaf wheel gates, wire-rope winch type, span length of 4.0 m, leaf height of 2.65 m × 2 leaves × 3 gates

4.4.4 Branch Canal

The rehabilitation and improvement plan of branch canal has been formulated that applying the continuous irrigation system, as the existing cross section has an enough capacity to convey the design discharge, the minimum rehabilitation such as trimming the particular portion where has restricted on the water flow was necessary. And the existing regulators and the tail escape which have the necessity of operation would be reconstructed but the existing second regulator had been reconstructed in 1991 so that it was deleted from the plan. The new regulator which would be installed at the immediate downstream of Nazlet Ramadan intake was proposed to construct.

As the design velocity of the regulator was arranged 0.5 ~ 0.6 m/sec, the elevation of gate sill was set about 30 cm higher than the canal bed. The gate of regulator would be installed the proposed wheel type and the span of the gate should be less than 3.0 m. The specification of those facilities are shown as below;

		Regulator No.1	Regulator No.4.	Tail Wasteways	New Regulator
Design Discharge	(m^3/s)	5.169	2.434	0.292	3.533
Gate Type		Wheel	Wheel	Slide	Wheel
Dimension of Gate	(m)	2.5×2.3×2	2.5×2.1×2	1.0×1.3×1	2.0×1.85×2
Design WL	(EL.m)	31.75	31.00	30.10	31.59
The Max. WL	(EL.m)	32.15	31.36	30.30	31.75
Gate sill EL	(EL.m)	29.85	29.30	28.80	29.90

4. 4. 5 Drainage and Irrigation Pump Stations

1) Basic Concept for Rehabilitation

There are many drainage and irrigation pump stations, which are as old as more than 10 years and have pumps and mechanical equipments with poor operation efficiency and old building. Based on the study of the present conditions of these pump stations, the rehabilitation/improvement plan by pump station, which is a construction of a complete new pump station, and/or replacement of pump(s) and/or its appurtenant equipment such as motors, submerged parts of pump(s), bearing(s), etc., would be proposed.

For the pump stations which will be adversely affected by low water level as a result of improvement of the Bahr Yusef canal, the pump equipment and devices together with such civil works as intake facility and suction pits, etc. are to be renewed.

As the existing problem to be solved in the field of operation and maintenance of the facilities, needed spareparts shall be sufficiently supplied with the facilities to be continuously used in future, and a mechanical weed screen cleaning machine shall be proposed for all stations. A by-pass canal and/or a gravity spillway shall be proposed to enable gravity drainage available.

For the proposed low head pump equipment with a total head of less than 5.0 m to be renewed, two pump types such as a vertical shaft type and a inclined shaft type would be considered. And finally, the inclined shaft type would be proposed in consideration of easiness in O/M works, advantages in little hydraulic loss, long lasting popularity in Egypt.

2) Rehabilitation Plan of Drainage Pump Stations

a) El Badraman Station

The pump shed of the El Badraman drainage pump station, which was constructed in 1937 and is quite deteriorated, shall be completely reconstructed. The relevant seven units of pump equipment with operation panels are also as old as 55 years in use and quite low in their working efficiency, and shall be totally renewed. A gravity by-pass way for gravity drainage shall be proposed as a part of the civil work structures.

Pump unit : (renewed)

Pump type	:	Inclined shaft type
Specification	:	Diameter of 1,000 mm, capacity of 2.0/2.5 m^3/sec, actual lifting head of 2.4 m
Pump number	:	3/4 units (total 7 units)
Pump shed	:	Civil work structure such as lifting, delivering facilities and discharging canal shall be rehabilitated.

b) Kabkab Station

The operation panel shall be renewed and the needed spareparts, especially for electric equipment and devices) shall be sufficiently supplied. A mechanical weed screen cleaning machine shall be proposed and a by-pass canal with checks enabling gravity drainage shall be constructed for about 300 m practice successful O/M works of pump facilities.

c) Tona El Gabel Station

The relevat pumping equipment and operation panel, which are as old as 19 years in use, shall be totally renewed due to their low operation efficiency. A by-pass canal with checks enabling gravity drainage available shall be proposed for about 300 m to practice successful O/M of the pump facilities.

Pump unit : (renewed)

Pump type	:	Inclined shaft type
Specification	:	Diameter of 500 mm, capacity of 0.6 m^3/sec, actual lifting head of 3.0 m
Pump number	:	4 units

d) Manshat El Dahab Station

The operation panel shall be renewed and the needed spareparts, especially for electric equipment and devices, shall be sufficiently supplied. A mechanical weed screen cleaning machine shall be proposed and a by-pass canal with checks enabling gravity drainage shall be constructed for about 300 m to practice successful O/M works of pump facilities.

e) Beni Mazar Station

The operation panel shall be renewed and the needed spareparts, especially for electric equipment and devices, shall be sufficiently supplied. A mechanical weed screen cleaning machine shall be proposed and a by-pass canal with checks enabling gravity drainage shall be constructed for about 300 m to practice successful O/M works of pump facilities.

f) Dier El Sankria Station

The operation panel shall be renewed and the needed spareparts, especially for electric equipment and devices, shall be sufficiently supplied. A mechanical weed screen cleaning machine shall be proposed and a by-pass canal with checks enabling gravity drainage shall be constructed for about 300 m to practice successful O/M works of pump facilities.

g) Abu Raheb Station

Since the pumping equipment has become as old as 12 years in use and deteriorated, they shall be totally renewed together with the operation panel. A mechanical weed screen cleaning machine shall be installed.

Pump unit : (renewed)

Pump type	:	Inclined shaft type
Specification	:	Diameter of 1,300 mm, capacity of 3.8 m^3/sec, actual lifting head of 2.1 m
Pump number	:	4 units

h) Sakoula Station

The pump equipment has become as old as 14 years in use and lower in efficiency, and the pumping equipment and operation panel shall be renewed. A mechanical weed screen cleaning machine shall be installed. A by-pass canal with checks enabling gravity drainage

available shall be constructed for about 300 m to practice successful O/M works of the pumping equipment.

Pump unit : (renewed)

Pump type	:	Inclined shaft type
Specification	:	Diameter of 1,400 mm, capacity of 4.5 m^3/sec, actual lifting head of 2.9 m
Pump number	:	4 units

i) Mazoura Station

Since the pump equipment has become as old as 12 years in use and lower in efficiency, the pump equipment and operation panel shall be renewed. A mechanical weed screen cleaning machine shall be proposed. A by-pass canal with checks enabling gravity drainage available shall be proposed for about 300 m to practice successful O/M works of the pump equipment.

Pump unit : (renewed)

Pump type	:	Inclined shaft type
Specification	:	Diameter of 1,100 mm, capacity of 3.57 m^3/sec, actual lifting head of 2.9 m
Pump number	:	3 units

3) Rehabilitation Plan of Irrigation Pump Station

a) Combined Pump Station of Arab Beni Khalid with Beni Khalid Stations

A new pumping station shall be constructed in unification of the existing two stations. A pump shed, related equipment and electric devices, transformers, transmission lines, suction pits and delivery tank, in civil works and related feeder canal (3.3 km) with a capacity for 1.6 m^3/sec in concrete lined open canal would be needed. The proposed new facilities are as follows:

Location	:	At the existing Arab Beni Kahlid pump station (Km 45.0)

Pump unit : (renewed)

Pump type	:	Inclined shaft type
Specification	:	Diameter of 500 mm, capacity of 0.8 m^3/sec, actual lifting head of 3.4 m

Pump number : 5 units

b) Kamadir (5) Station

All pump facilities and operation panel shall be rehabilitated to meet the canal bed lowered by about 0.7 m by Bahr Yusef canal improvement works. A pump shed and civil works shall be renewed, and Bahr Yusef canal shall be improved so as to make direct water lift available from the canal. A mechanical weed screen cleaning machine gate shall be installed. The pump house and necessary civil structures for water lifting shall be rehabilitated.

Pump unit : (renewed)

Pump type : Inclined shaft type

Specification : Diameter of 700 mm, capacity of 1.34 m^3/sec, actual lifting head of 3.9 m

Pump number : 4 units

c) Terfa (1) Station and Terfa (1) New Station

The hydraulic analysis on Bahr Yusef canal has found that the improvement of the canal in lowering the canal bed elevation would result in inability of water lift due to lower water level than suction water level of the pumps in the lowers water level period, and such differences between lowest water level and suction levels at both intake points are calculated by 65 cm and 56 cm, respectively. Consequently, all the pumping equipment and operation panel shall be renewed to make both intake facilities unified and the related civil work structures rehabilitated. The lifting capacity, however, shall be unchanged because of sufficiency in present capacity. A mechanical weed screen cleaning machine shall be proposed.

Terfa (1) Pump Station

Pump unit : (renewed)

Pump type : Inclined shaft type

Specification : Diameter of 800 mm, capacity of 1.47 m^3/sec, actual lifting head of 2.9 m

Pump number : 6 units

Tefa (1) New Pump Station

Pump unit : (renewed)

Pump type : Inclined shaft type

Specification : Diameter of 800 mm, capacity of 1.9 m^3/sec, actual lifting head of 2.9 m

Pump number : 4 units

d) Sakoula (4) Station

Since the pumping equipment is as old as 25 years in use and low in working efficiency, all the equipment and operation panel shall be renewed. A mechanical weed screen cleaning machine shall be installed.

Pump unit : (renewed)

Pump type : Inclined shaft type

Specification : Diameter of 700 mm, capacity of 1.23 m^3/sec, actual lifting head of 4.5 m

Pump number : 4 units

e) Mazoura (0) and Mazoura (0) New Stations

Since the pumping equipment of Mazoura (0) is as old as 25 years in use and low in working efficiency, all the equipment and operation panel shall be renewed. A mechanical weed screen cleaning machine shall be installed.

Mazoura (0) Pump Station

Pump unit : (renewed)

Pump type : Inclined shaft type

Specification : Diameter of 700 mm, capacity of 1.47 m^3/sec, actual lifting head of 2.0 m

Pump number : 4 units

4.4.6 Operation and Maintenance of the System

All irrigation facilities provided in the Project shall belong to MPWWR. The Irrigation Department is responsible for O/M of facilities except pump stations which are operated and maintained by MED. Actual O/M activities for canals, barrages, regulators, intakes, pump stations and other canal structures shall be undertaken by each Irrigation Directorate.

On the other hand, for water distribution control system, the operation center which controls all Bahr Yusef canal shall be established and shall undertake O/M of the system. Under the operation center, sub-centers at four Irrigation Directorates, five regulator's stations, some 18 sub-branch remote stations, nine at drainage pump stations and six at irrigation pump stations are to be established. The operation center shall be managed by the Irrigation Sector of the Irrigation Department, and sub-centers and remote stations shall be by each Irrigation Directorate (refer to Appendix G, Figure G-2-1).

Major activities of the operation center would be to compute annual water requirement for Bahr Yusef canal with breakdown, to operate and evaluate water levels at regulators and branch canal intakes, to collect and evaluate monitored water levels and to instruct water level and pump discharge adjustment when necessary based on the evaluation of water level records.

4. 5 Proposed Agricultural Development

4. 5. 1 Production Plan in Old Land

1) Improved Cropping Conditions by the Project

Projected improvement in water conveyance/distribution system of Bahr Yusef enables beneficiary farmers to maximize their land use through intensification of cropping owing to optimum, uniform water distribution. The expected advantages are as follows:

- The project feeds enough water to hitherto water deficient plots often located in the tail end of water distribution system, preventing wilting and yield drop caused by water depletion in root zone.
- Uniform and controlled water supply improves soil water regime by lowering detrimental high groundwater level in poorly drained plots. As a result, root zone is fully developed and surface salt accumulation is prevented.
- For salinity damaged plots, it allows enough salt leaching provided that suitable drainage is managed by farmers, resurrecting abandoned fields.

These positive effects will result in higher cropping intensity by higher percentage of cultivable plots; wider range of crop choice owing to less salinity, less water depletion; increased crop yields by mitigating or eliminating restraints, such as water shortage; As a side effect, easier market access is brought about by improved vehicle passage through rehabilitated barrages.

2) Yield Improvement

In old land developed throughout Nile valley as a whole, water depletion can hardly contribute as a yield limiting factor but rather excessive water often acts as a yield constraint. However, Bahr Yusef command is located in the fringe of Nile valley and this situation poses two problems; the command area covers more acreages with high water table because it is adjacent to new land and hence drained seepage from it directly affects farmland. Now complete canal lining works proceed on in new land and saving of water use by drip or sprinkler system will follow in the near future, and these will improve poorly drained conditions. It also covers more sandy soil areas with less water holding capacity where soil water depletion for crops tends to occur. Therefore, the project, providing rational water distribution to mitigate disadvantage caused by such negative conditions, can improve current yield levels up to those attained in Ibrahimia command with a similar soil/topographic conditions but whose water system has been already improved.

So long as yields of field crops are concerned, those in Egypt has already reached the world top levels and those in related governorates have reached similar levels. It would be more realistic to conservatively estimate with-project crop yields at the levels which have been actually, recently and fairly extensively achieved in the very Project Area, rather than at merely estimated levels never experienced in the area concerned or at those achieved by neighboring areas.

Accordingly, with-project yields were derived using the average of the best five actually recorded in the districts in the command in these five years, which are incidentally often comparable to the average yields in Ibrahimia command and crop yields before and after establishing WUA surveyed by USAID was also taken into consideration.

3) Alternatives for Cropping Pattern

With-project crop composition in old land is not assumed to undergo a radical change through the implementation of the project, though the project limitedly provides room for further cropping intensification. The plan is also based on the prospect that the current livestock holding would not drastically change even in the future in which acreage under berseem and other fodder crop should as a whole be maintained to sustain existing livestock herd with more improved animal productivity and this is necessary from the aspect of conserving soil fertility in the command.

Cropping intensity in the Project Area as a whole has been in a rising trend for these decades by which that in Giza has reached levelled-off, stage, saturated with commercial crops. This tendency likely continues further until it reaches at least the comparable intensity level currently observed in more advanced areas in the same governorates (mostly in Ibrahimia command). Planning of cropping intensity should reflect labor availability, in the light of the fact that farmers in Giza have already faced with family labor shortage in labor peak period.

Crops to be employed for with-project plan should be chosen from 1) ecological/physiological, 2) strategic/political, 3) economic and 4) demand-supply points of view. Factors to be considered and crops to be examined as alternatives are:

1) Ecological suitability; fertility conservation should be secured by employing or maintaining well-balanced crop rotation system, incorporating leguminous and fodder crops.
   - - - summer/Nili fodder crops, possibility of reducing berseem
2) Policy orientation; basic state-level policy has emphasized the importance of self-sufficiency in basic food/import substitution.

- - - wheat, maize, oilseeds (sunflower etc.), sugarbeet

3) Economic benefits; this is an uncertain factor because whenever current pricing systems are abolished or liberalized to allow a free market system, current profitability of a particular crop is subject to a drastic change. Yet, crops with currently higher return are examined as alternatives for their future prospect and constraints.

   - - - (profitable) wheat, garlic, onion etc. (not remunerative) barley, sorghum, berseem

   In this connection, sugarcane is rejected because the Project Area is remote from existing sugarmill in spite of its high profitability, and lupin is neglected because of minor demand and limited acreage. Barley is also overlooked because of minor area coverage.

4) Supply ~ demand relation; currently observed trends in demand and projected ones from processing or market expansion point of view are reviewed, to secure supply to existing/expected plants/mills within/adjacent to the Project Area. - - - sugarbeet, tomato, sunflower, onion/garlic

Crop Alternatives in Old Land Command

Alternative Crops		Minia	Beni Suef	Faiyum	Giza
Winter Crops					
Wheat	expansion	A	R	R	R
Broadbean	do	R	R	A	R
Alfalfa	do	A	R	R	R
Berseem	cutback	A	A	A	R
Summer / Nili Crops					
Fodder	expansion	A	A	A	R
Maize	do	A	A	A	R
Sorghum	cutback	R	R	A	R
Sunflower	expansion	R	R	A	R
Tomato	do	R	R	A	R
Sugarbeet	do	R	R	(A)	R
Garlic/Onion	do	R	R	R	R

Note: A; adopted, R; rejected, ( ): mainly new land

In the above listed alternative crops, wheat is adopted only in Minia where its expansion rate has kept high and necessity of adopting suitable crop for greater acreage under soil hazard. Broadbean is adopted in Faiyum where the yield is highest in the Project Area, and because of its low labour requirement. In Beni Suef and Minia, water borne fungal disease affected this crop and hence its expansion will be highly risky.

Acreage under berseem can be converted into strategically more important crops in Minia and Faiyum where winter feed situation is less tight. Further, a part of its acreage can be replaced into alfalfa which is more suitable to sandy soils.

Summer / Nili fodder crops with low input / labour requirement are adopted to fill short crop-free or vacant period during late summer ~ autumn with a view to promoting meat production to cope with strong demand for high quality protein, as well as to help conserving soils in all governorates except Giza where virtually no room for further crop intensification remains.

Maize is adopted in the same three governorates for acreage expansion in line with its current stable, extending trend along with crop suitability to soil conditions or low labour requirement. Sorghum, whose substantial acreage in the Project Area is only found in Faiyum, is switched into maize because it has been introduced for its drought tolerance but improved water supply can clear out water shortage problem, allowing shift to more lucrative crops.

Sunflower, one of the important oilseeds is also adopted for an expansion crop to increase material supply to local oil extraction industry. Cropping of tomato for processing / raw consumption has been steadily increased in Faiyum and still increasing demand from local processing factory or from explosive urban population is held in autumn ~ early winter period. So it is adopted as an expansion crop for Faiyum. Sugarbeet is also a promising crop for processing for which a new sugarmill is to be established in Faiyum, but its acreage will be expanded at the sacrifice of other minor winter ones in old land while additional supply can be expected from new land.

At any rate, too intensive cropping by sacrificing berseem must be too risky to propose because it may destroy equilibrium between soil fertility consumption and creation, which has been maintained for thousands of years. And small-holders can hardly get along with if livestock disappears from their daily life, because in the majority of farm houses in the command livestock is just inseparable family members occupying the same life space as local families live. Even in recently reclaimed areas, livestock has always been involved in farming and any new villages free from livestock cannot be found. It should be noted that livestock products are higher value-added with bullish demand growth and often more lucrative than field crops.

4) Planned Agricultural Production

With-project agricultural production from the given set of alternatives thus formulated is presented and the increment or reduction from the current production is estimated in Table H-2-1 to H-2-7 in Appendix H, while their cropping patterns are given in Figure H-2-1 ~ 2-7 in Appendix H.

4. 5. 2 Planned Production in New Land and Expansion Area

In the existing reclamation in new land located in desert land of Minia and Beni Suef, the remaining reclamation works are to be completed in the early stage of the project period. Further, expansion area will be reclaimed in the future as a part of Bahr Yusef command. It is needless to say that additional farm land should be reclaimed as far as water is available either from Nile River or from underground sources, according to state-wide policy orientation to cope with population increase. As stated in the foregoing paragraph, yield increase in old land is quite limited because current yields already began to level off, while reclamation can convert barren land into productive fields allowing to create production from null base though yield levels tend to be lower than that of old land.

As regards yield levels in new land, farm plots in it are still immature and as crop soil maturity improves soil fertility or land productivity, with-project yields increase at higher rates than those in old land, though they are hardly catch up with the achieved levels by old land. With-project yields for expansion land are estimated referring to those obtained in Faiyum, because the farming conditions are similar to newly reclaimed land. Proposed cropping follows basic principles of reclaimed land soil conservation by incorporating green manure crops to fairly extent while giving a considerate cropping intensity of 137% (equal to currently prevailing level) to 145% (representative intensity in existing reclaimed land) because new land has only low fertility which would be subject to degradation only if it is a bit intensively exploited.

4. 5. 3 Livestock Production Plan

Livestock sector most probably remains as it is now from two main reasons, one of which is what was already mentioned above, the close link with agricultural practices, and the other, that livestock is only one source for organic matter for both old land and new reclaimed land for maintaining soil fertility. With-project livestock remains in the present status because it is only a limited room for its further expansion, and its production plan can only be established in a way that the current herd be maintained with a little improved productivity in the command area. Proposed cropping patterns for four related governorates contribute to a limited extent to improve currently feed deficit situations, but it won't meet the total demand for sustaining the whole existing herd without supplying feed out of command. Feed supply from new land / expansion area will be the last resort to be relied upon if self-sufficiency of feeds are sought within the command, because nearer the source of supplying feed is available, the cheaper the transportation / marketing cost of commercial feeds amounts to. A part of livestock

herd in old land can be tethered or pastured by contracts between livestock holders and settlers in reclaimed land, depending on the herd size held by settlers.

At present, a portion of cropped fodders is directly incorporated into sandy soils as a green manure, but when they get matured, fodder will be more efficiently utilized for feed and then finally reduced to the soils in the form of applied farmyard manure.

Milk production is projected to increase by around 88% from the current level, and meat production by about 45% through the herd replacement with improved bovine / sheep varieties, as well as more feed supply within the command even though the herd size remains in the existing level. This expanded output is sustained by the fodder production increase within the command in old land, from the current capacity of 656 thousand tons / year (equivalent to -2% in terms of total digestible nutrient) to the projected level of 933 thousand tons / year (equivalent to +15% in term of the above-mentioned but -5% in terms of digestible crude protein) (refer to Table H-2-9 in Appendix H).

4.5.4 Agricultural Research, Extension and Training

1) Agricultural Research

Agricultural research in the near future has to be carried out taking into consideration the farm management method after enforcement economic reform policy and also efficient water use on farm level. Abolition of crop control and subsidy system, and liberalization of prices would considerably change Egyptian agriculture. Following are the effects to be forecasted;

- Increase in production cost of corps
- Change in farm-gate prices of crops
- Expansion in crop selection by farmers
- Change in crop marketing
- Agricultural credit for the small-scale farmers

Considering the effects mentioned above, researches on the following items should be carried out by agencies concerned;

- Development of promising crops
- Test on water saving culture
- Test on reducing cost of crop production

- Development of appropriate storing methods and processing of crops
- Researches on appropriate utilization of crop residues for animals feed (quantity, quality, storing)
- Development of the most beneficial land use and rotation system suitable for each region

2) Agricultural Extension

As well as the agricultural research, agricultural extension can't be discussed without considering farm management method after enforcement of economic reform. It is necessary for agricultural extension to strengthen a linkage with research agencies to extend the results of the research to farmers taking into consideration the influences mentioned above, and to show farmers more beneficial way of agricultural management. The major items as shown below should be extended;

① Method for reducing production costs of crops
② Appropriate irrigation water use according to the growing stages of crops
③ Cultivating method of promising crops
④ More efficient use of agricultural credit
⑤ Land use methods which bring higher income
⑥ Reminding farmers that irrigation water is the command resource for all farmers and must be used more efficiently and more equitably
⑦ Importance of cooperative society after the economic reform

Extension service for farmers has been conducted by agricultural offices in each governorate. However, extension activities on item ① ~ ⑦ mentioned above should be emphasized taking into account the change in agricultural structure with economic reform. Especially, so far, farmers have not recognized item ⑥, so training on the efficient water use and necessity for WUA should be strengthened.

Following countermeasures shall be necessary to expand the items mentioned above;

- to train extension staff
- to enrich components of training and education
- to distribute enough motorcycles and cars to carry out careful extension services
- to enrich educational equipment and materials for training
- to build up farm models for demonstration

3) Training on Irrigation Water Use

As the result of the field survey, there exists some crops which are over-irrigated more than unit water requirement. Those over-irrigation causes inequitable water distribution among farms and results in reducing irrigable area and lower agricultural production in the area. To solve the problem, it is required that all farmers have to recognize water requirement suitable for growing stage and are requested not to over-irrigate more than unit water requirement per feddan. Training and education for not only farmers but also for field agents of IAS and MALR's extension staff should be focused on this matter to save water and to realize rational water management.

The training and education on the following items should be carried out mainly by IAS to the field staff of IAS, MALR extension staff, and leaders of farmer etc. with a close linkage between MALR and MPWWR. Training and education must be continued until recognition on water-save cropping will be extended among all farmers even it takes a long period.

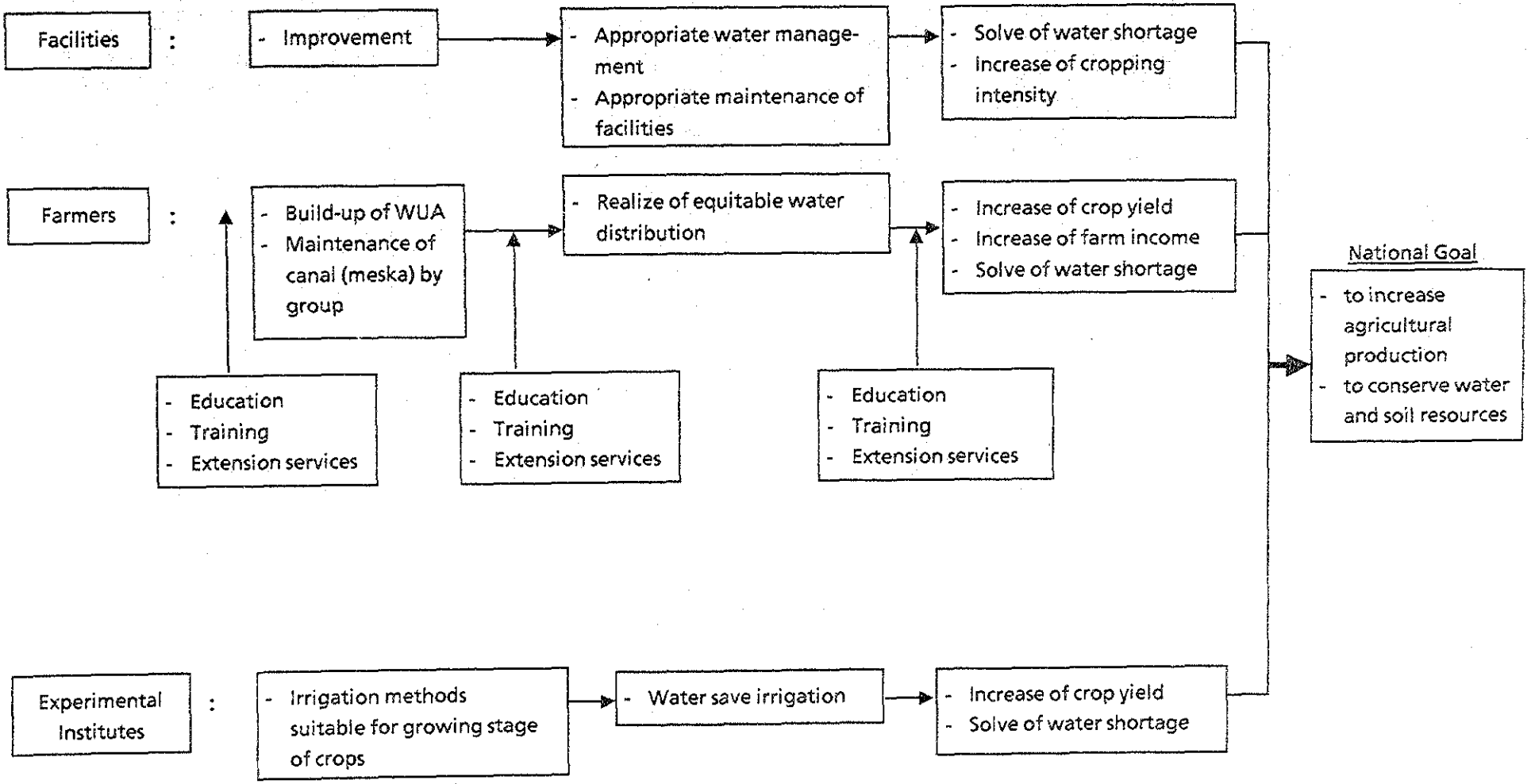
Subject of the training : Leader of farmers
IAS officials and field staff
MALR extension staff

Major themes:

- Relation between unit water requirement and operation hour of irrigation pumps
- Water requirement suitable for growing stage of crops
- Water management and necessary costs for it
- Maintenance of canal by farmers group (WUA)
- Realize of equitable water distribution and increase of crop yield and farm income
- Necessity of build-up of WUA and harmony/cooperation among farmers

By the long-term training and improvement of water control facilities, final goals will be attained both in the aspects of facilities and farmer's side, which are to realize rational water management and to increase agricultural production/farm income in the areas (refer to Figure 4-2).

Figure 4 - 2 Chart for the Procedure to the Goal of water Management Improvement



4. 5. 5 Agricultural Input Supply, Agricultural Credit, Agro-Processing and Marketing

1) Agricultural Input Supply

The subsidy system, which had been continued since 1960 for supplying agricultural inputs such as fertilizers, seeds and agro-chemicals at subsidized price, have been removed with the structural adjustment program. Hereafter, these inputs will be sold at market price through cooperative society and merchant. As it is considered that production costs of crops will be raised by abolition of subsidy systems, in which input costs would occupy higher ratios, hereafter, the cooperative society should procure agricultural inputs in lump and bulk to supply them for farmers at the lowest price possible. Farmers themselves should recognize such functions and merits of cooperative society in order to reduce production cost.

Warehouses for agricultural inputs and grain managed by cooperative society must be improved and constructed because currently both the number and quality of them are lacking, resulting in a loss of nutrients of fertilizers and cereal grains.

2) Agricultural Credit

Economic reform policy program will influence on farm management, particularly the small-scale farmers which have little capital. Considering land holding in the Project Area, in which about 50% of farmer manages less than one feddan, agricultural credit with lower interest should be provided to those small-scale farmers to maintain their living standard, and agricultural production in the regions.

3) Agro-Processing and Marketing

Agro-processing industries producing cereal flour and dehydrated vegetables etc. are existing in the Project Area, and some parts of the products have been exported, however, their scale are generally small. Those agro-processing activities should be promoted to produce value added products.

Liberalization of crop prices may change existing marketing channels. Farmers will choose markets and merchants to get the highest benefit possible. In that case, cooperative society should give aid to farmers during negotiation with market and merchant.

4. 5. 6 Farmer's Organization Plan

1) Cooperative Society

Cooperative society after the announcement of economic reform program should give aid to farmers to bring them higher benefits under the free market condition. In the concrete, the major roles of the cooperative society will be as follows;

- Supplying agricultural inputs at lower prices for individual farmers
- Collecting, storing and marketing of crops
- Assisting farmers to borrow agricultural credit from village bank
- Extension services for farmers

Farmers themselves also should change the imagination of traditional cooperative society to recognize the roles of the society which will support farmers under the free economy.

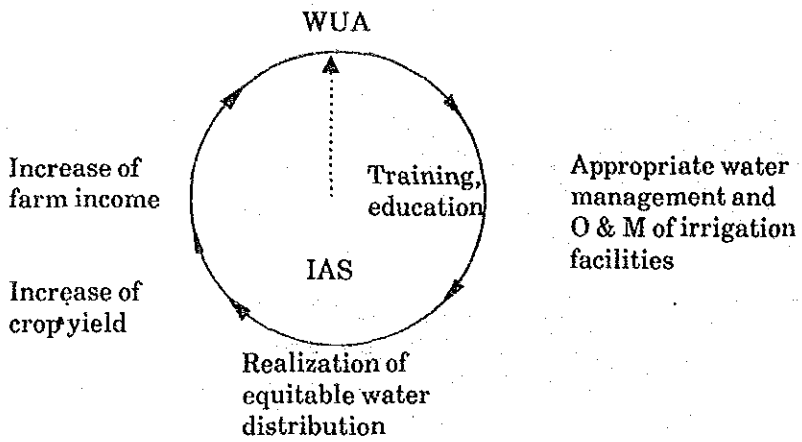
2) Water User's Association

Considering the existing condition of Nile River whose water discharge has been reduced, efficient water use would not be realized by only improvement of deteriorated facilities. Not only improvement of irrigation facilities but also efficient water use, including on-farm level, is strongly required. And farmers are also requested to recognize that irrigation water is the common resource for all farmers and to use it more efficiently. Farmers have to understand that execution of the following matters will consequently lead them to higher crop yield and higher income;

- Timely irrigation according to the growing stage of crops
- Appropriate operation and maintenance of irrigation facilities by group (WUA)
- Equitable water distribution in the group (WUA)

Three items mentioned above surely mean a necessity for establishing WUA. IIP started in 1988 and IAS established in 1989, respectively, aiming improvement of water use, and this activities must be continued to establish sustainable WUA in each region, and must be supported by MPWWR. WUAs are private organization and managed by farmers themselves, however, supporting activities such as training on water distribution should be done by IAS under MPWWR taking into consideration that it will take long time to make farmers recognize the merit of establishing WUAs and building strong WUAs.

Relation between water management and WUA can be described as following figure;



As WUAs have been already set up in a part of Minia and Faiyum, it would be possible to provide educational materials recording actual merit of WUA (increasing yield and income) to farmers. Thus, farmers can understand the merit of establishing WUA, and consequently efficient water use will be recognized. For this reason, roles of IAS of Irrigation Directorate and extension services by MALR are very important.

As mentioned above, it will take a long term to establish and strengthen WUA as compared with the improvement/construction of irrigation facilities but education and training on WUA should be continued to extend the conception and merit of WUA not only in governorate level but also a national level (refer to Appendix J-2).

4. 6 Project Cost Estimate

4. 6. 1 Condition of Cost Estimate

The project cost is estimated under the following conditions:

1) The project cost is estimated based on the current market prices on September 1991.

2) The construction mode is considered by contract basis.

3) The construction unit rate for civil works and the unit price of laborers and construction materials are based on the prevailing practice of the contract works. Those which are not available cost are calculated by adding up all the necessary materials, laborers and machine at the current market price (refer to Tables K-1-1 to K-1-3 of Appendix K).

4) The miscellaneous works in the civil works is estimated at 10% of the baseline costs of the civil works, while the mobilization and the other temporary works is also added at 10% of the baseline cost.

5) The cost of gates is estimated based on their weight according to it's size and manufacturing in locally and abroad.

6) The cost of mechanical and electrical equipment for pump stations is estimated on the basis of recent tenders, which is added a customs duties and taxes to the CIF cost.

7) A provision of 15% of the cost of the works is included in the project cost to cover the engineering and administration cost of planning, design and implementation of the project by MPWWR.

8) The cost of the technical assistance is estimated at 13% of the cost of the works to cover staff charges as well as ancillary costs such as international travel, supplies and equipment and home office support costs, and a local component to cover subsistence and local expenses and support costs.

9) Physical contingency equivalent to 10% of the baseline costs is estimated in the project cost.

10) The exchange rate among Egyptian Pound, U.S. Dollar and Japanese Yen is adopted as follows:

1.00 US$ = 3.30 L.E = ¥ 140.00
1.00 L.E = ¥ 42.00

4. 6. 2 Project Cost

The project cost at current price is estimated at 850.1 million Egyptian Pound, of which 274.5 million, 291.3 million and 284.2 million Egyptian Pound are scheduled for the

phase-I development, phase-II development and phase-III development, respectively (refer to Table 4-2).

The project cost consists of the construction cost, engineering and administration cost, technical assistance cost and physical contingencies. The construction cost is composed of the direct cost including the cost of substantial construction works and subsidiary temporary works and the indirect cost including field expenses of the construction management, overhead, profit and other expenditure.

4.6.3 Operation and Maintenance Cost

The annual operation and maintenance cost is composed of salary and wages for the O/M organization staff, administration and general expenditures, equipment depreciation and repair cost, fuel and oil cost maintenance cost of the facilities and office facilities and special expenditure for training / seminar / demonstration programme (refer to Table 4-3).

Table 4-2 Project Cost

(Unit : 1,000 L.E)

Description	TOTAL		PHASE - 1		PHASE - II		PHASE - III	
	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
1. Improvement of Bahr Yusef Canal		357,700		125,600		130,900		101,200
1.1 Remodelling & Trimming of Canal		122,000		18,000		48,000		56,000
1.1.1 Improvement of Canal Section	311 km	95,000	70 km	18,000	140 km	48,000	101 km	29,000
1.1.2 Improvement of Canal Course	4.8 km	27,000	-	-	-	-	4.8 km	27,000
1.2 Improvement of Barrage/Regulator		169,000		69,000		64,000		36,000
1.2.1 Preparatory Work for Const.		20,000		20,000		-		-
1.2.2 Dairout Barrage		36,000		-		-		36,000
1.2.3 Manshat El Dahab Regulator		35,000		-		35,000		-
1.2.4 Sakoula Regulator		31,000		31,000		-		-
1.2.5 Mazoura Regulator		29,000		-		29,000		-
1.2.6 Lahoun Regulator		18,000		18,000		-		-
1.3 Improvement of Canal Structure		66,700		38,600		18,900		9,200
1.3.1 Intake of Manshat El Dahab C.		7,200		-		7,200		-
1.3.2 Intake of Harika Canal		3,200		3,200		-		-
1.3.3 Intake of Saab Canal		3,200		3,200		-		-
1.3.4 Intake of Hasan Wasef Branch		11,000		11,000		-		-
1.3.5 Intake of Giza Branch		14,000		14,000		-		-
1.3.6 Reconstruction of I.S. 3.0m	3 places	6,000	2 places	4,000	1 place	2,000		-
1.3.7 Reconstruction of I.S. 2.5m	3 places	6,000		-	3 places	6,000		-
1.3.8 Reconstruction of I.S. 2.0m	5 places	4,500		-	1 place	900	4 places	3,600
1.3.9 Rehabilitation of I.S. 1.5m	8 places	3,200	1 place	400	1 place	400	6 places	2,400
1.3.10 Rehabilitation of I.S. 1.2m	21 places	8,400	7 places	2,800	6 places	2,400	8 places	3,200
2. Improvement of Branch Canals		356,400		106,400		106,400		143,600
3. Improvement of Pump Station		94,000		26,000		37,500		30,500
3.1 Irrigation Pump Station (PS)		19,000		14,000		2,500		2,500
El Badraman PS		14,000		14,000		-		-
Other 8 PSs		5,000		-		2,500		2,500
3.2 Irrigation Pump Station		75,000		12,000		35,000		28,000
Arab Beni Khalid & Beni Khalid		12,000		12,000		-		-
Kamadir & Terfa		35,000		-		35,000		-
Sakoula & Mazoura		28,000		-		-		28,000
4.1 Operation and Maintenance		42,000		16,500		16,500		9,000
O/M Facilities		18,000		5,000		8,000		5,000
Enhancement of O/M		2,000		2,000		-		-
Water Management		12,000		4,000		4,000		4,000
Training & Education		10,000		5,500		4,500		-
Ground Total of Project Cost		850,100		274,500		291,300		284,300

Table 4-3 Annual Operation and Maintenance Cost

(Unit : 1,000 L.E)

Description	Phase - I	Phase - II	Phase - III
1. Improvement of Bahr Yusef Canal	3,968	4,727	3,196
1.1 Remodelling & Trimming of Canal	360	960	1,120
1.2 Improvement of Barrage/Regulator	2,450	3,200	1,800
1.3 Improvement of Canal Structures	1,158	567	276
2. Improvement of Branch Canals	2,128	2,128	2,872
Branch Canals covering 670,000 fed	2,128	2,128	2,872
3. Improvement of Pump Stations	780	1,125	915
3.1 Drainage Pump Station	420	75	75
3.2 Irrigation Pump Station	360	1,050	840
4. Operation & Maintenance of Bahr Yusef C.	2,210	2,480	2,150
4.1 O/M Facilities	150	240	150
4.2 Enhancement of O/M	60	-	-
4.3 Water Management	1,000	1,000	1,000
4.4 Training & Education	1,000	1,000	1,000
Grand Total	9,086	10,460	9,133

CHAPTER 5. PROJECT IMPLEMENTATION AND OPERATION

CHAPTER 5. PROJECT IMPLEMENTATION AND OPERATION

5. 1 The Executing Agency

Considering the jurisdiction of the delivery water system and the past outstanding performance of MPWWR in this field, the executing agency shall be MPWWR in close coordination with the Water User's Association (WUA) which will be organized among the farmers concerned and also other government agencies concerned led by the MALR.

Under the MPWWR Headquarters, Rehabilitation and Improvement Project of Bahr Yusef Canal (RIPBY) headed by the General Director (GD) as a manager shall be established. The GD of the RIPBY shall supervise the implementation of the Project in close cooperation with the Directors of Irrigation Directorates (DDs) concerned and officers of the other government agencies (refer to Figure 5-1).

Though the irrigation of every governorate is administered by Irrigation Directorate concerned and Bahr Yusef canal serves a vast command area extending over the Governorates of Minia, Beni Suef, Faiyum and Giza, it is recommended to manage the implementation of the RIPBY by an organization throughout the delivery water system of Bahr Yusef canal for systematic and efficient execution of the project.

Construction of the project component will be executed on contract basis, particularly the construction of the major structures such as regulators, intake structures with large size, pump stations and so on through international competitive bidding.

5. 2 Schedule of Project Implementation

Implementation of the project will be done into three phases, and each phase will be implemented in four years. The project is expected to be completed within a period of 12 years (refer to Figure 5-2). Phasing of the project implementation is made taking into consideration the priority of the project component which provided based on a durability of the structure, situation of the command area concerned, budgetary availability, etc.

5.3 Engineering Services

Engineering services shall be provided during the final design of the project as well as in supervision of the project implementation in order to introduce modern engineering on design and construction management. The schedule of the engineering services will be made based on the implementing schedule of the Project (refer to Figure 5-2).

5.4 Operation and Maintenance of the Project

After completion of the construction of the project, all the facilities and equipment provided by the Project shall be turned over to the Irrigation Directorate concerned for the O/M of the system. Bahr Yusef canal is the continuous system starting from the head works to the end of the system, therefore, it is generally advantageous to handle the O/M of the system under the administration of an organization throughout the system. However, the O/M of Bahr Yusef canal is recommended to carry out by the Irrigation Directorate concerned taking into consideration the present administration of MPWWR and wide and long length of irrigation system (refer to Figure 5-3).

Figure 5-1 Organization of Implementation of Project

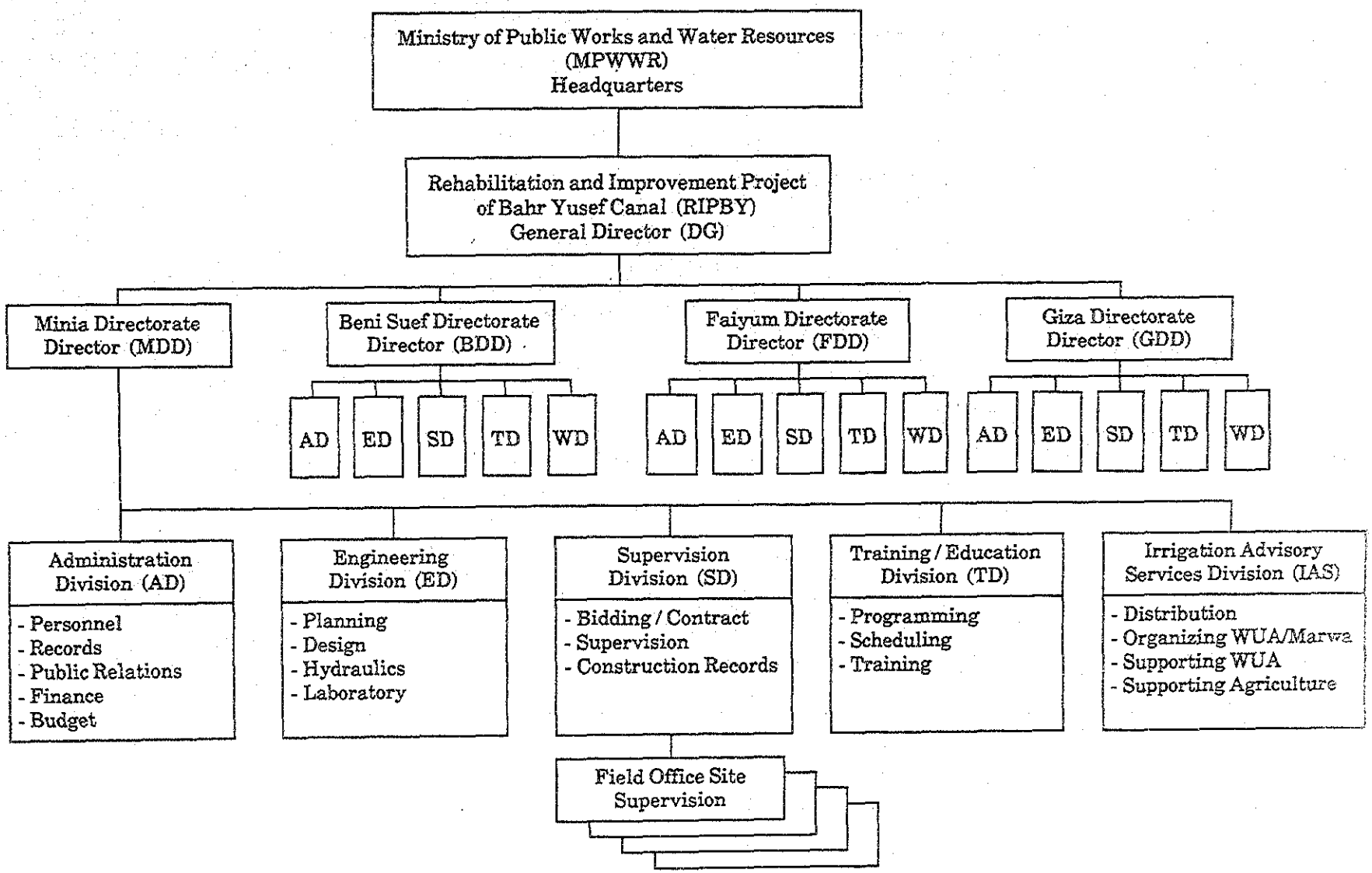
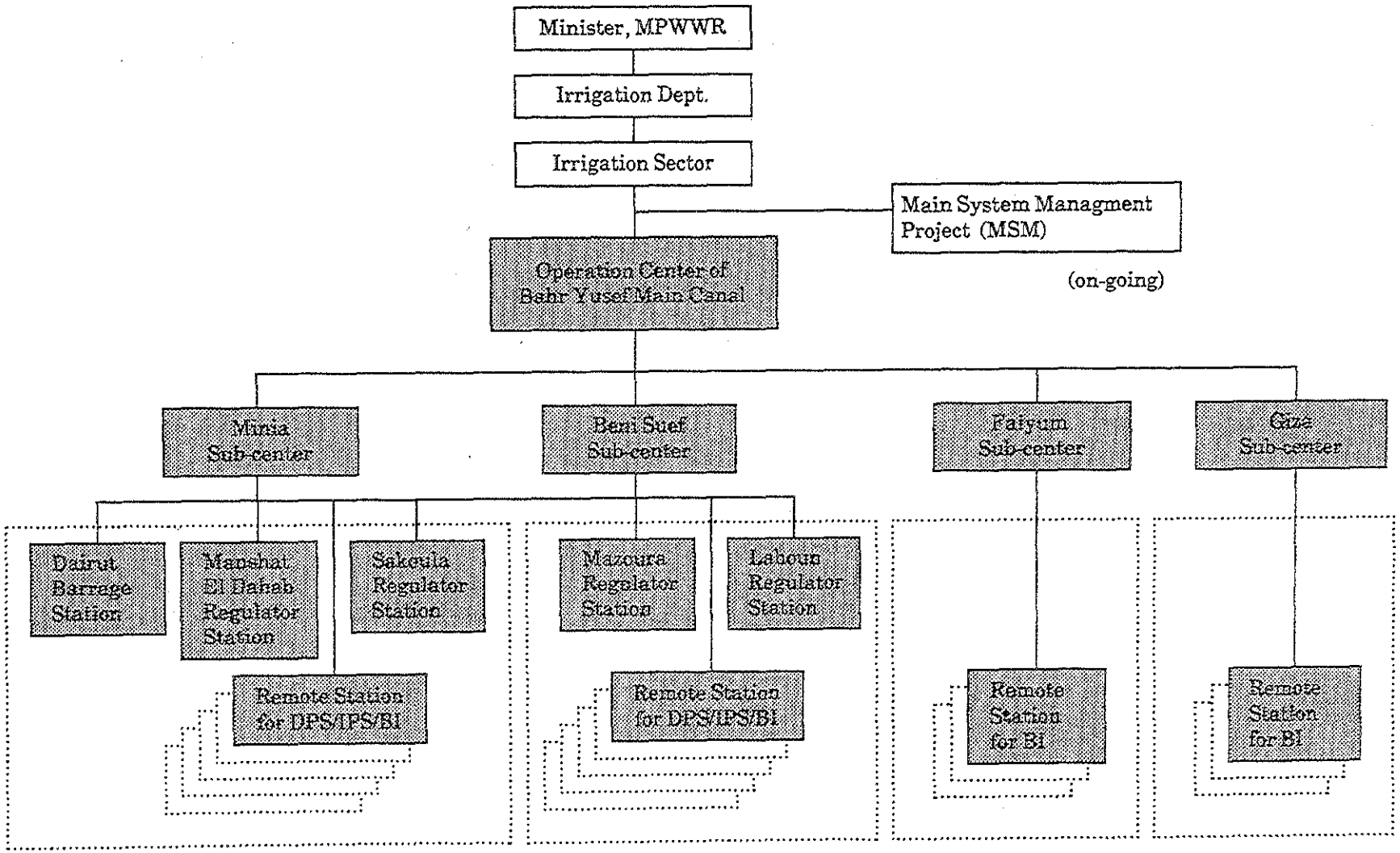


Figure 5-2 Implementation Schedule of Project

DESCRIPTION / PROJECT YEAR	PHASE - I				PHASE - II				PHASE - III				REMARKS
	1	2	3	4	5	6	7	8	9	10	11	12	
1. Improvement of Bahr Yusef Canal													
1.1 Remodelling & Trimming of Canal													
1.1.1 Improvement of Canal Section	———	———	———	———	———	———	———	———	———	———	———	———	
1.1.2 Improvement of Canal Couse									———	———			
1.2 Improvement of Barrage/Regulator													
1.2.1 Preparatory Work for Const.	———												
1.2.2 Dairout Barrage									———	———	———		
1.2.3 Manshat El Dahab Regulator					———	———							
1.2.4 Sakoula Regulator			———	———	———								
1.2.5 Mazoura Regulator							———	———					
1.2.6 Lahoun Regulator	———	———	———										
1.3 Improvement of Canal Structure													
1.3.1 Intake of Manshat El Dahab C.					———	———							
1.3.2 Intake of Harika Canal			———	———									
1.3.3 Intake of Saab Canal			———	———									
1.3.4 Intake of Hasan Wasef Branch	———	———	———										
1.3.5 Intake of Giza Branch	———	———	———										
1.3.6 Reconstruction of I.S. 3.0×3			———	———	———	———	———	———					
1.3.7 Reconstruction of I.S. 2.5×3					———	———	———	———					
1.3.8 Reconstruction of I.S. 2.0×5							———	———	———	———	———	———	
1.3.9 Rehabilitation of I.S. 1.5×8			———	———			———	———	———	———	———	———	
1.3.10 Rehabilitation of I.S. 1.2×21			———	———	———	———	———	———	———	———	———	———	
2. Improvement of Branch Canals			———	———	———	———	———	———	———	———	———	———	
3. Improvement of Pump Station (PS)													
3.1 Drainage Pump Station													
El Badraman PS			———	———									
Other 8 PSs					———	———	———	———	———	———	———	———	
3.2 Irrigation Pump Station													
Arab Beni Khalid, Beni Khalid PSs			———	———									
Kamadir, Terfa PSs					———	———	———	———					
Sakoula, Mazoura PSs									———	———	———	———	
4. Operation and maintenance													
O/M Facilities	———	———	———	———	———	———	———	———	———	———	———	———	
Enhancement of O/M		———	———	———									
Water Management		———	———	———	———	———	———	———	———	———	———	———	
Training & Education		———	———	———	———	———	———	———					
5. Improvement of On-farm Facilities													

Figure 5 - 3 Proposed Organization Structure for Operation and Maintenance of The Main System



(IPS : Irrigation pump station, DPS : Drainage pump station, BI : Branch intake)

CHAPTER 6. PROJECT EVALUATION

CHAPTER 6. PROJECT EVALUATION

6. 1 Economic Evaluation

6. 1. 1 General

Project justification can be divided into two, that is, economic justification from a standpoint of national economy and financial analysis from a viewpoint of private economy. In the economic justification, EIRR (economic internal rate of return) is accounted based on the economic project cost, O & M cost and benefits. In the economic justification, economic prices which are the border prices converted from financial prices (market prices) are used. Meanwhile, financial prices are used for the financial analysis of the typical farms. Standard conversion factor (SCF) is applied to convert financial price of the Project to economic price. The SCF is estimated from the statistics of imports and exports of the past six years. In case, EIRR will be more than 12%, which is the opportunity cost of capital used in the Ministry of Planning, the Project will be judged feasible economically. As for financial analysis, farm income of the selected typical farms, in the cases of with and without project, were comparatively evaluated.

6. 1. 2 Component of the Project and Benefits

The major component of the Project is to improve or construct five barrages/regulators on Bahr Yusef canal to realize more efficient water management throughout main and on-farm facilities. Therefore, the following benefits can be expected;

- increase of crop yield
- increase of crop intensity
- increase of crop production in the existing reclaimed areas
- creation of employment opportunity
- others

6.1.3 Price of Crops and Agricultural Input, and Project Cost

1) Prices of Commodity

The farm-gate prices of trade crops and inputs used for economic analysis are estimated based on the forecasted prices by the World Bank. Prices of other non-trade crops are accounted based on wholesale prices of the last five years. Following shows the financial and economic prices of the major commodities for project evaluation (for detail refer to Table M-4 to M-6 in Appendix M);

Commodities	Financial	Economic
Wheat	464 LE/ton	906 LE/ton
Cotton	1,467	1,957
Maize	442	587
Sugarcane	56	78
Rice	396	437
Orange	677	1,301
Fertilizers		
N	0.95 LE/kg	1.73 LE/kg
P205	1.08	1.21
K20	0.79	1.11

2) Project Cost

Project cost is estimated at 850.1 million LE in financial value. Meanwhile, the economic project cost is composed of foreign currency, and local currency portions which have to be converted by the standard conversion factor (SCF) of 0.877. Consequently, the total economic project cost is estimated at 808.8 million LE. For the economic evaluation 1,066.4 million LE including improvement of on-farm irrigation facilities of 670,000 feddan was used (refer to Appendix M).

6.1.4 Evaluation of the Existing Facilities

The existing barrages/regulators have maintained their function by grouting and repairing gates after construction. However, considering their ages of more than 90 years, it can be judged that they don't have any economic value.

6.1.5 Project Evaluation

Agricultural benefits are derived by improving both irrigation facilities and on-farm water management. Incremental benefits are the difference between with and without project, which is estimated using economic prices. Consequently the incremental benefit from the Project was estimated at 242.8 million LE/year and EIRR of the Project was accounted at 13.1%, then the Project is judged economically feasible.

6.1.6 Sensitivity Analysis

Taking into consideration the unexpected factors, which may occur in the future, sensitivity tests about the following matters was made;

	EIRR
① 10% increase of project cost	12.2
② 20% increase of project cost	11.5
③ 10% reduction of benefit	12.0
④ 20% reduction of benefit	10.8
⑤ combination of ① and ③	11.2
⑥ combination of ② and ④	9.4

Table 6-1 Calculation of EIRR

(UNIT : 000 LE)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						12 %		14 %		20 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1	65590.00	0.00	65590.00	0.00	-65590.00	65590.00	0.00	65590.00	0.00	65590.00	0.00
2	65590.00	0.00	65590.00	0.00	-65590.00	52287.98	0.00	50469.43	0.00	45548.62	0.00
3	73098.00	0.00	73098.00	0.00	-73098.00	52029.74	0.00	49339.18	0.00	42302.14	0.00
4	73098.00	0.00	73098.00	0.00	-73098.00	46455.15	0.00	43280.03	0.00	35251.80	0.00
5	80293.00	7963.00	88256.00	-5990.00	-94246.00	50078.91	-3398.89	45837.62	-3111.03	35468.18	-2407.25
6	80293.00	7963.00	88256.00	-2273.00	-90529.00	44713.35	-1151.58	40208.48	-1035.55	29556.83	-761.23
7	80293.00	7963.00	88256.00	6476.00	-81780.00	39922.63	2929.42	35270.62	2588.07	24630.70	1807.34
8	92553.00	7963.00	100516.00	29262.00	-71254.00	40596.86	11818.47	35237.07	10258.14	23376.90	6805.43
9	90614.00	17137.00	107751.00	72017.00	-35734.00	38856.22	25970.14	33134.58	22146.00	20882.95	13957.43
10	90614.00	17137.00	107751.00	107844.00	93.00	34693.08	34723.02	29065.46	29090.55	17402.47	17417.49
11	90614.00	17137.00	107751.00	151883.00	44132.00	30975.97	43662.93	25496.05	35938.56	14502.07	20441.73
12	90613.00	17137.00	107750.00	179588.00	71838.00	27656.88	46095.99	22364.77	37275.58	12084.95	20142.11
13	23278.00	25146.00	48424.00	216711.00	168287.00	11097.59	49664.82	8816.64	39456.95	4525.92	20254.77
14	23278.00	25146.00	48424.00	224789.00	176365.00	9908.57	45996.55	7733.91	35901.56	3771.61	17508.16
15	23278.00	25146.00	48424.00	230914.00	182490.00	8846.94	42187.40	6784.14	32350.74	3143.01	14987.69
16	23278.00	25146.00	48424.00	233907.00	185483.00	7899.06	38155.55	5951.00	28745.69	2619.17	12651.64
17	0.00	25146.00	25146.00	239262.00	214116.00	3662.40	34847.39	2710.78	25792.81	1133.42	10784.41
18	0.00	25146.00	25146.00	239953.00	214807.00	3270.00	31203.61	2377.88	22690.64	944.52	9012.97
19	0.00	25146.00	25146.00	241253.00	216107.00	2919.64	28011.33	2085.86	20011.93	787.10	7551.50
20	41970.00	25146.00	67116.00	242821.00	175705.00	6957.76	25172.68	4883.58	17668.44	1750.68	6333.82
21	0.00	25146.00	25146.00	242821.00	217675.00	2327.52	22475.61	1605.00	15498.64	546.60	5278.19
22	0.00	25146.00	25146.00	242821.00	217675.00	2078.15	20067.52	1407.90	13595.31	455.50	4398.49
23	0.00	25146.00	25146.00	242821.00	217675.00	1855.49	17917.44	1235.00	11925.73	379.58	3665.41
24	0.00	25146.00	25146.00	242821.00	217675.00	1656.69	15997.72	1083.34	10461.18	316.32	3054.51
25	0.00	25146.00	25146.00	242821.00	217675.00	1479.19	14283.68	950.30	9176.48	263.60	2545.43
26	0.00	25146.00	25146.00	242821.00	217675.00	1320.70	12753.29	833.59	8049.55	219.67	2121.19
27	0.00	25146.00	25146.00	242821.00	217675.00	1179.20	11386.87	731.22	7061.02	183.05	1767.66
28	0.00	25146.00	25146.00	242821.00	217675.00	1052.86	10166.85	641.42	6193.88	152.55	1473.05
29	0.00	25146.00	25146.00	242821.00	217675.00	940.05	9077.55	562.65	5433.23	127.12	1227.54
30	0.00	25146.00	25146.00	242821.00	217675.00	839.33	8104.96	493.56	4766.00	105.93	1022.95
31	0.00	25146.00	25146.00	242821.00	217675.00	749.40	7236.58	432.94	4180.71	88.28	852.46
32	0.00	25146.00	25146.00	242821.00	217675.00	669.11	6461.23	379.78	3667.29	73.57	710.39
33	0.00	25146.00	25146.00	242821.00	217675.00	597.42	5768.96	333.14	3216.92	61.30	591.99
34	0.00	25146.00	25146.00	242821.00	217675.00	533.41	5150.86	292.23	2821.87	51.09	493.32
35	0.00	25146.00	25146.00	242821.00	217675.00	476.26	4598.98	256.34	2475.32	42.57	411.10
36	0.00	25146.00	25146.00	242821.00	217675.00	425.23	4106.24	224.86	2171.34	35.48	342.59
37	0.00	25146.00	25146.00	242821.00	217675.00	379.67	3666.28	197.24	1904.69	29.56	285.49
38	0.00	25146.00	25146.00	242821.00	217675.00	338.99	3273.47	173.02	1670.78	24.64	237.91
39	0.00	25146.00	25146.00	242821.00	217675.00	302.67	2922.74	151.77	1465.60	20.53	198.26
40	41970.00	25146.00	67116.00	242821.00	175705.00	721.29	2609.59	355.34	1285.61	45.67	165.21
41	0.00	25146.00	25146.00	242821.00	217675.00	241.29	2329.99	116.79	1127.73	14.26	137.68
42	0.00	25146.00	25146.00	242821.00	217675.00	215.44	2080.35	102.44	989.24	11.88	114.73
43	0.00	25146.00	25146.00	242821.00	217675.00	192.35	1857.46	89.86	867.75	9.90	95.61
44	0.00	25146.00	25146.00	242821.00	217675.00	171.74	1658.45	78.83	761.19	8.25	79.67
45	0.00	25146.00	25146.00	242821.00	217675.00	153.34	1480.76	69.15	667.71	6.88	66.40
46	0.00	25146.00	25146.00	242821.00	217675.00	136.91	1322.10	60.65	585.71	5.73	55.33
47	0.00	25146.00	25146.00	242821.00	217675.00	122.24	1180.45	53.21	513.78	4.77	46.11
48	0.00	25146.00	25146.00	242821.00	217675.00	109.15	1053.97	46.67	450.69	3.98	38.42
49	0.00	25146.00	25146.00	242821.00	217675.00	97.45	941.05	40.94	395.34	3.32	32.02
50	0.00	25146.00	25146.00	242821.00	217675.00	87.01	840.22	35.91	346.79	2.76	26.68
TOTAL	1150315.00	1055948.00	2206263.00	9693047.00	7486784.00	599868.29	658660.06	529672.18	479496.16	388567.38	208023.83

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.10 (12%),
INTERNAL RATE OF RETURN (IRR) = 13.1 %

6. 2 Financial Analysis

6. 2. 1 Objectives

Along with the public capital, private capital will also be invested in the Project. For example, costs for on-farm facilities which have to be maintained by farmers themselves have to be charged to farmers. So, financial analysis based on financial prices is necessary from the viewpoint of private economy, and usually an analysis on farm economy, in the case of with and without project, is made.

6. 2. 2 Typical Farms

As the averaged farm sizes and crop composition vary in each governorate, financial analysis is done by each governorate concerned. Farm economy in each governorate will be improved as follows (refer to Appendix M);

Governorate	Minia	Beni Suef	Faiyum	Giza
Averaged farm size (fed/farm household)	1.38	1.58	2.45	1.43
Farm income (LE/farm household/year)				
without project	1,470	1,760	3,240	4,740
with project	1,970	2,090	4,280	5,130

6.3 Socio-Economic Impact

The implementation of the Project creates not only tangible benefits such as increase in agricultural production but also many socio-economic impacts, which is intangible benefits. For example, living standard will be raised with increase of farm income, and conditions of daily nutrition sanitation in the regions, will be improved. And difference in income among the regions will also be corrected. From a technical and administrative viewpoint on irrigation project, the Project will be a model case for improving deteriorated irrigation facilities which can be often observed in the whole Egypt, and for improving water management throughout main irrigation facility and on-farm level.

Drain water in Faiyum flows into the Lake Qarun which is located at western part of the Project Area, and also tail reach of the irrigation system of Bahr Yusef canal in Faiyum governorate. Water level of the Lake is maintained by evaporation from the surface of the lake. Therefore, increase of drain water into the Lake results in rising water level, causing submergence in residence areas and farm lands along the coastal area of the Lake. On the other hand, decrease of water level of the Lake will result in increase of salt content of lake water, causing damage to fishing productivity. Fluctuation in the amount of drain water depends on operation and control of Lahoun regulator and distribution of irrigation water to Faiyum area. Thus it can be expected that improvement of Bahr Yusef canal will give considerable impacts to socio-economy and social environment in the tail reach of the command area in the region.

CHAPTER 7. DEVELOPMENT OF PRIORITY PROJECT

CHAPTER 7. DEVELOPMENT OF PRIORITY PROJECT

7.1 Identification of Priority Components

Rehabilitation and Improvement of Bahr Yusef Canal Project (RIPBY) is comprises of various project components with a large volume of works. Major project components of the RIPBY are to rehabilitate and improve the superannuated canal structures such as barrage, regulators, pump stations, branch canal intake structures, etc. Rehabilitation of structural stability and improvement of operation on the facilities is considered as an urgent countermeasures for recent severe situation of water resources in the Nile River.

Implementation of the Project is scheduled based on identification of the project components in engineering and socio-economic priority. Purpose of ranking the project components is to develop a framework for the initial evaluation and ranking of various project components for formulation of the RIPBY with effective implementation programme.

In developing a framework for the ranking of project components for rehabilitation and improvement project prioritization, certain basic assumption were made on the objectives of the planning.

Avoiding risks of failure on the existing facilities among the various project components is a primary concern during the planning stage. Hence, priority in the implementation of the project components . is to be given to the existing facilities, which on the basis of certain suitable indicators, are considered to be high risk of failure.

Planning is considered a magnitude of the command area controlled and influenced by the facilities concerned as a beneficiary from the project components due to the irrigation facilities.

Conveniency in the construction site, access to the site, availability of acquisition of the Right-of-Way for construction and also impact to the agriculture, socio-economy and environmental aspects.

The following are the proposed indicators in the ranking of project components:

I. Indicators of the Existing Facilities

I. 1	Durability	- Level of deterioration - Appearance of damages by abrasion/crack
I. 2	Function	- Original function - Applicability to the recent requirement
I. 3	Operation	- Easiness of operation - Accuracy of operation
I. 4	Risk of failure	- Probability of risk - Influential range in socio-economy and agriculture

II. Indicators of the Beneficiary

II. 1	Command area	- Command area to be controlled - Command area to be influenced
II. 2	Water resources	- Increase/decrease of availability in summer / winter season
II. 3	Efficiency of water utilization	- Increase/decrease - Potentiality

III. Indicators of the Implementation

III. 1	Conveniency of the construction	- Scale of the construction - Easiness of the preparatory works - Availability of construction site
III. 2	Accessibility	- Construction site - Grade of the access road
III. 3	Right-of-way	- Easiness on acquisition - Consensus of villagers
III. 4	Impact	- Agriculture - Socio-economy - Environment

The proposed methodology in ranking the project components would arrange the observed values of indicators from highest to lowest. Values given to each indicator are as follows;

Highest rank	:	5 points
Middle rank	:	3 points
Lowest rank	:	1 point
Not concerned	:	0 point

Moreover, a weight of subtotal of the indicators is considered as 50% for the subtotal of Indicator-I and 25% each for the subtotal of Indicators - II and III. It is an intention to give more priority to the indicators of the existing facilities, which is major works of the Project.

The following indicators are considered to assess the ranking rate of the pump stations:

Building	-	Pump house
	-	Civil works
Facilities	-	Electric facilities
	-	Mechanical tools
Equipment	-	Pump
	-	Motor
Appurtenant structures	-	By-pass
	-	Screen
Water source	-	Availability
Area served	-	Magnitude of the area

The proposed methodology for ranking of the pump stations is to arrange the observed value of each indicator from higher to lowest. Values given to each indicator based on the present condition is such that highest rank is given 5-point in bad / poor condition, 3-point in poor condition, 1-point in fair condition, and 0-point in not necessary of any rehabilitation. And, the above each item is weighted based on the importance of pump operation. Especially, since conditions of pump including motors are the most important item, weighted rate is given the highest of 40% among items and other items are 10% each.

7. 2 Ranking in the Project Components

The observed values for the project formulation are finally grouped into four class intervals; namely in A, B, C and D. The priority of the project components is determined taking into consideration such other conditions as administrative and regional matters, and financial availability.

According to the results of the ranking the project components in respect of formulation of the implementation programme for the project, five barrage/regulators are placed in the high rank of class-A, followed by drainage and irrigation pump stations. All major facilities of the project components are ranked as class-A. Both large and small scale intake structures are placed in class-B, while improvement and trimming of the canal sections and straightening the canal course are placed in rather low rank of class-C and D, respectively (refer to Appendix N-1).

The result of the ranking is summarized as follows:

Class-ranked	Project Components	Ranking Rate
A-ranked Group	Lahoun Regulator	27.25
	Sakoula Regulator	26.25
	Manshat El Dahab Regulator	25.75
	Mazoura Regulator	25.75
	Drainage Pump Station	25.75
	Irrigation Pump Station	23.75
	Dairout Barrage	23.25
B-ranked Group	Hassan Wasef Intake	20.75
	Giza Intake	20.75
	Large Scale Intakes	15.75
C-ranked Group	Small Scale Intakes (Width > 1.5 m)	13.75
	Branch Canal	12.25
D-ranked Group	Improvement of Canal Sections	10.75
	Improvement of Canal by Shortcut	6.75

There exist nine drainage pump stations in the command area of Bahr Yusef canal and eight irrigation pump stations. As reported in the previous paragraph, both drainage and irrigation pump stations are ranked in the class-A priority. Considering number of pump stations, ranking among the pump stations is made for phasing the implementing programme of the pump stations. In this assessment, the ranking is separately made on drainage pump stations and irrigation pump stations.

The result of the ranking of the pump stations for phasing the implementation of rehabilitation and improvement on the drainage and irrigation pump stations are summarized as follows:

Class-ranked	Drainage Pump Station	Ranking Rate
Drainage Pump Station (D.P.S.)		
A-ranked Group	El Badraman D.P.S.	8.5
B-ranked Group	Tona El Gabel, D.P.S.	7.5
C-ranked D.P.S.	Sakoula d.P.S.	5.5
	Mazoura D.P.S	5.5
	Abu Raheb D.P.S.	4.8
D-ranked Group	Kabkab D.P.S.	2.5
	Beni Mazar D.P.S.	2.3
	Dier El Sankoria D.P.S.	2.3
	Manshat El Dahab D.P.S.	2.1
Irrigation Pump Station (I.P.S.)		
A-ranked Group	Arab Beni Khalid I.P.S.	7.6
	Beni Khalid I.P.S.	7.6
C-ranked Group	Sakoula (4) I.P.S.	6.6
	Mazoura (0) I.P.S.	6.6
	Terfa (1) I.P.S.	6.2
	Kamadir I.P.S.	6.0
C-ranked Group	-	
D-ranked Group	Terfa (1) New I.P.S.	2.8
	Mazoura (0) New I.P.S.	2.0

Among the drainage pump stations, the first priority for rehabilitation and improvement is given to El Badraman pump station, followed by Tona El Gabel pump station. For the irrigation pump stations, Arab Beni Khalid and Beni Khalid pump station are placed at the highest priority, and followed by Kamadir, Terfa (1), Sakoula (4), and Mazoura (0) pump stations (refer to Appendix N-1).

In the implementation programme of the Project are scheduled based on the ranking rate of the project components. Lahoun regulator together with intake structures of Hassan Wasef and Giza are to be implemented in the first half of the Phase-I Project, because the group of these structures are handled the most significant role on the irrigation water distribution covering about two third of the whole command area of Bahr Yusef canal. The Sakoula regulator and related structures ranked as second priority in class-A is to be implemented in the second half of the Phase-I Project.

7.3 Rehabilitation and Improvement Plan of Priority Project

The rehabilitation and improvement of the irrigation facilities shall be implemented as far as preparation of the project implementation is made, particularly for the finance as a countermeasures for severe water resources. It is proposed that the project components to be included in the first half of the Phase-I project are programmed as follows:

1) Preparatory Works for Construction of Major Facilities

Among the various project components, high priority-ranked five barrage/regulators will be reconstructed in parallel with operation of the existing structures. The construction of the said works will be executed by using large size construction equipment and materials due to limited period and sites for construction.

Considering availability and economy on the construction method for barrage/regulators, large scale construction equipment and materials will be procured by the Project and utilized for the construction of all major structures by rotation basis (refer to Appendix N-2).

Equipment and materials are programmed as follows:

1.1 Construction Equipment	:	Bulldozer, Shovel, Crawler Crane, Vibro Hummer, Diesel Generator, others
1.2 Construction Materials	:	Steel Sheet Pile, H-Shape Steel, Channel Steel, Sheet Pile Cap, Tie-Rod, Steel Foot Plate, Steel Stages, others

2) Construction of Canal Structures

2.1 Lahoun Regulator	:	Intake	:	Vent 5.50 m × 2
		Gate	:	Double Wheel Gate 5.50 m × 3.15 m × 2 2 sets
		Accessory	:	Screen, Handrail, others
		Detour	:	Bridge 30 m length, 8 m width Access road 150 m
2.2 Giza Intake	:	Intake	:	Vent 4.00 m × 4
		Gate	:	Double Wheel Gate 4.00 m × 2.40 m × 2 4 sets
		Accessory	:	Screen, others
2.3 Hassan Wasef Intake	:	Intake	:	Vent 4.00 m × 3
		Gate	:	Double Wheel Gate 4.00 m × 2.65 m × 2 4 sets
		Accessory	:	Screen, others