11.6 Other Inland Waterways
-Rough Estimation of Dredging Volume along Cairo to Asyut, etc.-

(1) General

The Inland waterway network in Egyptian is primarily an irrigation system to serve for fertile lands of the Nile Valley and Delta. Therefore, MWRI is at first responsible for operation and maintenance of waterways and locks as well as for regulation of water discharges and the corresponding water levels. Since the physical inland conditions of inland navigation network are basically set by irrigation requirements, most navigable waterways in Egypt are still neither fully nor effectively utilized.

The problem of available water depths during different periods of the year represents one of major constraints which limit efficiency of barge fleet transportation. Irrigation uses water for strong requirements in summer seasons and high saving of water in winter season, but inland waterway transport by barge navigation needs sufficient water depth during whole year. Therefore, there is an inevitable strain in water supply needs between irrigation and inland waterway navigation and, because of the limitations of water resources, no substantial improvement for navigational water depth is expected even in the future. In addition, the water depth in inland waterway network changes all around year and hence it is not always possible to make use of all available load carrying capacity of barge fleet for inland waterway transportation.

Furthermore, possible measures to be taken for improvement of inland waterway are limited not only because of the above technical constraints due to its prime characters for irrigation but also importance financial consequents in inland waterway transport sectors due to the present stagnant situation or downward spiral in cargo transportation with a considerable loss of cargo. It is observed that the navigability of inland waterway is considerably affected by such local factors as the presence of sand deposits, shoals, occurrence of obstacles at or around bridges, locks and fairway stretches with an unfavorable alignment along certain stretches of the network.

The present inland navigation network consists of River Nile and an extensive canal system for irrigation flow in Delta area. Among others, major cargo transport networks of inland navigation include the following two lines of waterways that form the axis of network in most importance:

- River Nile from Aswan to Delta barrage
- Beheiry and Nobaria canal link between Delta barrage and the port of Alexandria

Rosetta and Damietta branches at Nile Delta area are only partly navigable during a short period of the year. But, the rehabilitation works for Damietta branch is presently under construction for locks and dredging works of fairway and is expected to provide new important axis of inland waterway to connect Cairo with the port of Damietta.

The rest of the inland waterway networks are occasionally used for cargo transport in relatively small quantities of goods (mainly construction materials) and is only accessible by small motorized vessels and sailing boats.

(2) River Nile from Aswan to Delta Barrage

1) Present Navigational Constraints

The construction of High Aswan Dam has imposed a great important impact on hydrological regime of downstream River Nile in major changes of:

1) Water levels between maximum and minimum water flow discharges which is completely controlled,
2) Sedimentation and meandering system of water flows.

As well-known, only about 2 to 3m difference of water change is observed after construction of High Aswan Dam whistle it is reported about 7- 8 m difference of water change before construction of the High Dam. The sedimentation on to the riverbed has occurred at upstream of High Dam and therefore a considerable reduction of the riverbed transport for the downstream water flow has been stemmed out from water discharge free from sediment materials. These changes may lead to a different meandering system of water flows in Upper River Nile, particularly in the downstream section from Aswan to Esna.

Upper River Nile from Aswan to Delta Barrage may be roughly divided into two main sections in view of its waterway navigability, i.e. the first section from High Dam to Asyut and the second one from Asyut to Cairo Delta barrage.

(a) Aswan to Asyut

In the first section of Upper River Nile, available water depth is generally sufficient to allow fully loaded barges of draft to 1.8 m to travel without many difficulties during the whole year except for Asyut lock where the water depth is roughly estimated less than 2 m in winter as described in Appendix.6-2.

There are situated 3 barrages with locks in this section, Esna, Naga Hammady and Asyut, which determinate navigation conditions on this part of Upper River Nile. At present, the locks of Esna and Nag Hammadi (new lock) do not represent any major obstacles in view of available water depth for fully loaded barges with drafts to 1.8m since there is ample draft clearance at the upstream/downstream of the locks during the whole year.

However, the lock of Asyut represents a major bottleneck, which may determine to a large extent the permissible draft on this river section or navigation passage by twin unit of barges. During low water period in winter season, the depth of water in the lock is 1.5 m only or less, according to the latest navigation announcement (The Study for Generating the Role of Cargo Transportation through

Inland Waterway of Egypt: Transport Planning Authority, MOT). When allowing a daily variation of 40 cm, the permissible draft is reduced to 1.1 m or less. In addition, this lock has a lock chamber dimensioned by 16 m wide but only 80 m long. This indicates that twin unit of barges of an overall length of some 100 m have to be untied.

This section of River Nile is crossed by numbers of bridges. Most bridges have sufficient air clearance of 13 m and pier span of minimum 20 m for barge passing. There are two swinging bridges (Nag-Hammadi railway and Sohag) and clear height of minimum 4m is sufficient to allow free passage of present barge fleet. But, the swing bridges have to be opened for passage of majority of the hotel ships operating on River Nile due to their higher empty air drafts.

(b) Asyut to Delta Barrage in Cairo

In the second stretch reaches from Asyut to Delta Barrage, there is no lock which may cause obstacles to navigation. But this stretch is frequently hampered by occurrence of shoals or sandbars particularly in transition parts between adjacent meanders. The exact numbers and locations are difficult to assess but, according to RTA technical sections, the present of shoals or bottlenecks in waterway navigation are indicated at 30 locations as listed in Appendix 3-1 where the cross sectional sounding survey was conducted in January to March, 2002 during the 1st Field Study in Egypt by the Study Team (refer to sub-section 3.5 (1)).

A number of bridges crossing this stretch of River Nile are mostly of fixed (overhead) type with clearance of some 10 m, which have sufficient clearance to allow navigation at all times. But, there are two numbers of critical bridges in Cairo area for barge passing, i.e. El Tahrir (allias Qasr El Nil) and Embaba railway bridges having air clearance of 4.5 m and 4.45 m (the most critical) respectively.

(c) Major Constraints in Upper River Nile

The River Nile has been used by sailing vessels from ancient times to present day. According to cargo transport data, considerable quantities of stones (mostly limestones) are transported from quarries in Samalut/Beni Khaled (near El Minya) to Tebbin in Cairo in amount of some 445,000 tons in the year 2000. Other major cargoes in Upper River Nile are molasses from several origins at Upper River Nile to Hawamdia in Greater Cairo (318,000 tons in 2000), phosphate from Sibaya to Shobura (294,000 tons in 2000) and petroleum products in regional transport in Upper River Nile region (208,000 tones in 2000).

Particularly in upper Egypt, traditional type of boats "felloukas" is still used in a limited scale for short distance transport, mainly of stones and agricultural products. Sailing vessels are not used for transport of cargo over long distance.

For effective use of waterway in Upper River Nile for inland waterway navigation, major constraints will be summarized as follows:

- **Hydrological and Morphological Characteristics of the River Nile**

The River Nile has changed drastically hydrological and morphological characters after river water discharges are regulated by means of High Dam. In particular, the riverbed silt content has changed markedly and the changes in process of de-gradation and the nature of siltation frequently result in different formation behavior of shoals and channels in the downstream riverbed. At present, MWRI restricts any construction and dredging activities in riverbed to a minimum and therefore a stable fairway has not yet been realized.

- **Inland Navigation and Irrigation System**

The water level and discharges of water flow from barrages is entirely regulated by MWRI since the completion of High Aswan Dam. In general, MWRI issue permissible draft figures which deems to guarantee relatively well navigation conditions on the river network. But, because of the fluctuating water releases at High Aswan Dam, permissible draft changes during the year along the whole waterways from Aswan to Alexandria.

While Upper River Nile is basically available for water draft of 1.8 m, the available water depths on downstream Nobaria Canal are regularly lower than officially published figures and permissible drafts of more than 1.8 m is only available during 3 months of the year with annual variation from 1.8 m to a min. of 1.2 m. Due to this fact of 1.8 m water draft availability during 3 months of the year and only between Aswan and Cairo, it seems inappropriate for vessels having a draft of 1.8 m or more to operate for very long distance transport unless the water draft problem is improved in future. Since the permissible water depth along Nobaria canal is estimated 1.8 m in this JICA Study, effective utilization of present inland waterway network would be obtainable through the transport mode by smaller size of barges having a less than 1.6 m draft for long distance transport to directly connect seaports with Upper Nile areas during the whole year.

For the River Nile, dredging and repair works can only be carried out under initiative of MWRI. This subordinate position of inland waterway transport sector will represent some critical bottlenecks or navigational constraints in view of proper maintenance and repair of fairway.

- **Physical Problems for Infrastructure**

A lack of buoys, beacons or any other navigational aids in shallow sections decisively leads to needs of well experienced maneuvering or discretion exerted by boat captain in navigation, otherwise it may be frequently required assistance of pilots employed by the water transport companies. Until now, no measures to improve the navigational conditions on the Nile by means of regulation of riverbed, buoys, beacons etc. have been implemented.

Night navigation is neither allowed by law as long as such facilities as aids for navigation are lacking nor possible because locks are only operated from sunrise to sunset. Asyut locks in

Upper Nile is only 80 m long x 16 wide and twin ship units are to be untied for passing and therefore does not meet specifications of the 1st class waterway.

After completion of High Dam and complete control of water discharges, the water level in River Nile changes very much less than before. Therefore, it is reported that existing quays at River Nile ports older than High Dam have much too high level for present water levels.

2) Rough Estimation of Dredging Volume along Cairo to Asyut

(a) Design Water Levels along Upper Nile

In order to assess navigability of Upper Nile River, the cross sectional sounding survey was conducted along Upper River Nile from Cairo to Asyut by JICA Study Team during the 1st Field Survey in January to March, 2002. The survey areas for approximately 1 km long were selected at 30 locations within 330 km Upper River Nile between Cairo and Asyut through identification of future possible sites by RTA for deepening shallow water area by dredging. The output survey maps with 6 cross sections per survey location along the River Nile obtained by the filed survey formulate the basis to roughly estimate the required maintenance dredging works.

Max. or Min. Water Level (Max. WL or Min. WL) for the reaches were defined from available past water level data at existing Gauge Stations along the 4th reach between Asyut and Delta Barrages as summarized in Table below. Yearly maximum or minimum water flow discharges along the reach were recorded for 6 years period from 1995 to 2000 at these Gauge Stations. Table below also indicates that maximum and minimum flow discharges during the said period are 181 and 40 million m3/day respectively (equivalent to 2,095 and 463 m3/sec respectively). These flow discharges correspond to maximum and minimum discharges of 270 and 60 million m3/day downstream of High Aswan Dam.

Table 11.6.1 Maximum & Minimum Water Levels at Gauge Stations

No.	Gauge Station	Location (Km)	Max. WL (m)	Min. WL (m)
GS01	Abo Teeg	406.500	52.20	48.80
GS02	Upstream Asyut	382.220	50.50	47.60
GS03	Downstream Asyut	382.220	47.72	43.70
GS04	El Mandarch	314.900	42.35	38.95
GS05	El Minya	239.450	35.96	32.40
GS06	El Shkch Fadel	191.750	31.80	28.50
GS07	Beba	148.100	27.45	24.50
GS08	Beni Sweif	118.400	25.90	22.55
GS09	El Korimat	87.850	23.30	19.95
GS10	El Leethy	53.300	20.82	17.38
GS11	El Roda	00.000	17.48	15.04

*Location (km) indicated by the distance from GS 11 El Roda

Table 11.6.2 Yearly Max & Min Discharge at Downstream Asyut Barrage

(million m3/day)

Year	Max. Discharge	Min. Discharge
1995	175	44
1996	170	45
1997	174	40
1998	181	42
1999	178	60
2000	180	52
Minimum Discharge	—	40
Maximum Discharge	181	—

Based on the above maximum and minimum water levels corresponding to relevant water flow discharges, Max and Min Water Levels for each survey location along the Reach are therefore determined through interpolating by distance of the survey site between up- and downstream Gauge Station as follows.

Table 11.6.3 Estimated LWL & HWL at Survey Sites

No	Site Location	Water Level	
		Max. WL	Min. WL
S01	El-Nekheela	49.07	52.47
S02	Sakour	48.58	51.88
S03	Assuit Lock	47.60	50.50
S04	El-Tawaberiah	43.26	47.22
S05	Baheeg Island	42.69	46.58
S06	Hassan Atiah	41.28	44.99
S07	Beni Shoukear	40.90	44.59
S08	El-Mandarah	38.96	42.36
S09	Nazlet El-Awamer	38.69	42.10
S10	Sawada	37.60	41.00
S11	El-Sheikh Nemr Island	35.14	38.63
S12	Beny Hasan El-Shorouk	34.70	38.21
S13	Beni Mohamed Sharawy	33.75	37.28
S14	El-Zawiah	32.97	36.51
S15	Damaries	32.28	35.83
S16	El-Bergay	31.95	35.48
S17	El-Beho	30.81	34.26
S18	Matay	29.34	32.69
S19	Beni Mazar	28.43	31.72
S20	Abu Azeez	28.25	31.52
S21	Sharouna Island	27.06	30.23

S22	Awlad El-Sheikh	26.41	29.53
S23	Zawiat El-Godamy	25.96	29.03
S24	Mahmoud Eweas	21.92	26.71
S25	El-Dawaba	21.34	26.04
S26	Beni Sueaf Bridge	21.25	25.93
S27	El-Alalmah	20.86	24.21
S28	El-Koreimat	20.00	23.35
S29	Soul	19.29	22.66
S30	El-Saaf	16.97	20.24

(b) General Methodology for Estimation

In estimating dredging volume along River Nile from Cairo to Asyut, Min Water Level can be used to check available water depth for navigation of River Nile in the following manner.

Step 1: to determine the required minimum water depth and width of fairway for safe navigation

Step 2: to draw possible navigation route of fairway at each survey site for about 1 km long in view of hydrographic feature and barge maneuverability at the site by means of aerographic map in a scale of 1:5000

Step 3: to calculate each cross section area (6 sections for each survey location) to be dredged in order to maintain pre-determined flow depth from Min. WL within necessary navigable width of fairway

Step 4: to sum up volume to be dredged at each survey location

Step 5: to sum up total volume of dredging for all 30 survey locations

Minimum water depth and width of the fairway required for navigation should be determined in consideration of safe and easy navigation for typical standard type of barge unit during whole year. According to RTA Navigation Guide, the first class navigation waterway requirements, which are adopted for Upper River Nile as well as two branches of Damietta and Rosetta in Nile Delta area, is;

Width of Channel: not less than 35m or two navigable lanes with each width of 12m
Maximum Draft: 1.8m
Minimum Water Depth: 2.5m

At present, the navigation channel at Damietta branch is under rehabilitation based on design criteria for channel dredging by 2.3 m water depth and 40 m channel width.

Standard and largest size of barge units (twin-ship barge of max. 102 m long, 7.5 m width, 1.8 m full loaded draft) may be adopted in this study. Besides, for determination of fairway criteria, it should be given a consideration that Upper River Nile is also used by passenger or tourist boats and possible new barge would be introduced for container transportation by inland waterway barges from seaports to the north of Cairo based at Ather El Nabi terminal, of which the beam dimension may be about 12m.

Considering the above and requirements given by RTA, the following two cases of minimum water depth required from Min. WL are considered in this study so that the dredged fairway is safely and easily navigable for the whole year basis.

CASE 1: minimum 2.3 m water depth for 100 m fairway width to provide normal clearance
CASE 2: minimum 2.5 m water depth for 100 m fairway width to provide sufficient allowance for safer clearance in draft of barges

First of all, a series of existing topographic survey maps along Upper Nile River in scale of 1:5,000 prepared by MWRI was used to generally draw possible course of navigational fairway at each survey location. Then, designing course of fairway at each projected area was studied in close examination of topographic and hydrographic features of each section area obtained by field survey. In this route designing of navigation fairway, utmost effort was exercised to maintain safe and easy navigation and to minimize the extent of required dredging in consideration of:

- To maximize radius bent for curved section of fairway as practical as possible
- To plan route of fairway along main course of river flow where water levels shows as deeper as possible
- To provide route of fairway along outer curves of river flow where water depth is normally sufficient

(c) Rough Estimate of Dredging Volume

The estimated volume of possible maintenance dredging for 1 km distance at each 30 location is summarized in the following Table for two cases of water depth requirement. Roughly estimated cost for maintenance dredging was obtained at L.E. 33.7 million for 2.4 million cubic meters dredging work (CASE 1: water depth of 2.3 m) and L.E. 39.6 million for 2.8 million cubic meters dredging works (CASE 2: water depth of 2.5 m) respectively as summarized below (For details, refer to Appendix 11-9).

Table 11.6.4 Cost Estimate on Maintenance Dredging from Asyut to Cairo (million L.E.)

			CASE 1	CASE 2
			Min. Depth = 2.3 m	Min. Depth = 2.5 m
			V=2.36 mil m3	V=2.78 mil m3
A	Dredging Cost		28.4	33.4
B	Indirect Cost	(A) x 15%	4.3	5.0
C	Sub Total	(A) + (B)	32.7	38.4
D	Engineering Cost	(C) x 3 %	1.0	1.2
	Total	(C) + (D)	33.7	39.6

3) Recommendation for Future Improvements

Long-term objectives for improvement may be targeted to extend role and reliability of inland waterway transport in Upper River Nile. As far as infrastructure is concerned, a reliable water transport system requires a waterway network which is navigable throughout the year for normal types of barges. In River Nile waterway, this requires a water depth of 2.3 m allowing a maximum draft of 1.8 m for navigation by twin unit type of barge. For this purpose, existing navigable waterways will have to be upgraded by means of possible rehabilitation of Asyut lock, periodic recurrent maintenance dredging and/or demarcation of fairway. It is reported that the investment preparation study for safe and night navigation on River Nile from Aswan to Cairo has been finalized in 2000 and the rehabilitation program for Asyut lock is being envisaged by the Government at present.

As far as permissible draft problems in River Nile exists, safe and easy navigation on this waterway can be guaranteed by means of recurrent dredging and a provision of navigation aids. In case of Upper River Nile for medium term development, it has to be carefully studied if possible navigation aids system to indicate bottleneck sections or places of obstacles along fairway could be effectively beneficial for better navigation. Once the fairway along Upper River Nile is indicated in some suitable way in future, safe and easy navigation will be possible by day and night and the night navigation could provide an opportunity to considerably improve their efficiency and performance of barge transport.

One of most importance for a well functioning inland waterway transport system is existence of river ports for cargo loading, unloading and temporary storage. Privately owned river ports located at Upper River Nile as well as public ports should be made operational for loading/unloading and temporary storage of cargoes in proper connection with those located in Nile Delta and sea ports as well.

(3) Other Major Waterways

1) Ismailia Canal

Ismailia Canal is a waterway to connect Cairo with Suez Canal through the lake of El Temsah in a length of 128 km. The canal has been closed to navigation since 60's but may have possibility to provide a direct link in inland cargo transportation with Cairo to Port Said via Suez Canal.

This canal has three (3) newly built locks of 17x116m at entrance, El Menaier Lock at 28 km and El Salhia at 75 km distance. Basically, the canal is wide and deep enough for barge navigation and no sharp bends are exists in the reach to 112 km. But, the canal locating in Ismailia city area becomes narrower and shallower. Furthermore, the last end of the canal has sharp bends and is provided very narrow locks and minor movable lifts or swing bridges, all of which would decisively interrupt the navigability of the canal.

MWRI maintains this reach of the canal for irrigation purposes and, at present, the phased development for widening/deepening the canal and a larger size lock (Sariakos lock at 12.8 km) is underway to make it navigable within future years. Therefore, this canal could be used for navigation to 112 km section by normal types of barges once dredging work shall be carried out and some old swing-bridges or small footway bridges inclusive of a large number of small boat ferry connections crossing the canal shall be removed.

There exists fertilizer factory at about 20 km in Abu Zaabel. The factory suitably locates beside Ismailia canal and needs to be supply with such raw materials as phosphate from Sibaya in Upper Nile, sulfur imported from the port of Alexandria, etc.

2) Rosetta Branch of the Nile between Cairo (Qanater) and Rosetta

At present, this waterway is basically navigable during winter closure period for 3-4 weeks when irrigation system in the Delta is cleaned for maintenance of canals in short period approximately one month in the beginning of each year and the excess water is discharged to this branch.

As regard the branch section between Delta barrage and Kafr El Zayat (120km), it is reported navigable with provision of permissible draft of approx. 1.4 m and navigable width in a variation of 150 – 300 m. But, the river from onward Kafr El Zayat is not navigable except during 3-4 weeks per year during winter closure period of irrigation canals.

3) Beheiry-Khandak/El Sharqi-Mohmoudia Canals

This 2nd class canal connects Cairo (Qanater) with Alexandria but contains too many low swing bridges. Moreover, the section of Mahmoudia Canal located within the city of Alexandria is not navigable under normal conditions at present.

4) Lake Manzala mainly between Port Said and El Matria

There is an isolated inland waterway transport on Manzala lake between mainly between Port Said and El Matria. At present, this waterway has no connection with the rest of the inland waterway system. Quantities of cargo transportation on this lake are quite modest.

5) Lake Nasser between Aswan and Wadi Halfa

This waterway is one of isolated inland waterways on the country's biggest lake Nasser and is mainly served for ferry-services between Aswan and Wadi Halfa (Sudan). It is considered one of ideal waterways in view of sufficient water depth and width, non-existence of such artificial obstacles as locks and bridges. There exist 3 river ports for transportation of cargoes, fish catches and passengers between Egypt and Sudan. Wadi El Nile River Authority uses this waterway for servicing tourism ships.

Chapter 12 Initial Environmental Examination (IEE)

12.1 Introduction

The target area of master plan for the Development of Inland Waterway Transport System is the Nile Delta area with the target year of 2020. The master plan is intended basically at facilitating modal shift in the inland transport of import-export related cargo so as to increase the share of cargo transported via water mode, using barges. Currently, road transport with trucks accounts for more than 90% of the cargo, the predominant mode, while water accounting for only about 1% being the least used mode of transport. Railway mode accounts for the remainder of the cargo transport.

Essentially, the master plan is aimed at providing the necessary facilities in the Nile Delta area so as to realize modal shift in inland cargo transport from that of road to inland waterways thereby reducing the predominant share the road transport mode of cargo holds under current situation. It is further noted that that since the principal cargo targeted is import-export related, the inland transport system development is to effectively link the major sea-ports of Egypt, namely, Alexandria, Damietta and Port Said (all located in the Mediterranean coast of Nile Delta), with inland population centers like Cairo using the navigation canals and river reaches of Nile River. Since the principal system of water transport is barges, the intended modal shift of cargo transport would be basically from that of road based trucks to waterways based barges.

A detailed description of the facilities of the master plan aimed at realizing the modal shift in cargo from that of road to waterways of Nile River and its associated navigation canals is illustrated in details in foregone Chapter 11.

It is further emphasized that the facilitation of river transport mode of cargo as per this Master Plan is more environmentally sound in comparison to that of road transport mode and hence could be regarded as a component of long-term environmental improvement plan of transportation sector in Egypt as well. The environmental soundness of river transport in comparison to that of road transport is realized due to its higher energy efficiency and hence reduced fuel consumption and the associated reduction in GHG (greenhouse gas) and other air pollutant emission.

The most significant GHG linked to global warming is carbon dioxide (CO_2), which is inherently emitted as the principal gaseous end product of all fossil fuel based energy consumption. Other potential air pollutants of fossil fuel based energy consumption, the emission of which is somewhat controllable unlike CO_2, include CO (carbon monoxide), HC (hydrocarbon), NO_x (nitrogen oxides) and PM (particulate matter). Accordingly, it is evident that increased energy efficiency of transport, which is very much dependent on direct use of fossil fuel (petroleum) energy, has important potential dual benefits of economics (reduced fuel quantity and hence cost) and environment (reduced emission of GHG and other air pollutants).

It is noted that from the viewpoint of energy efficiency and hence its potential economic and environmental benefit realization of cargo (freight) transport, either waterway or railway is preferred in comparison to road. Accordingly modal shift aimed at reduction in road share of transport with corresponding increased share in either waterway or railway could be promoted, even though this Master Plan is specifically aimed at increasing the share of waterway transport. In other words, both waterway and railway could be considered as complementary energy efficient modes to be developed so as to reduce the road mode of cargo transport.

Since navigable waterways of Nile river and its associated navigation canals in the Nile Delta area could link all 3 major sea-ports (Alexandria, Damietta and Port Said) of Egypt with all major inland population centers as well and industry and agriculture that are centered basically in the Nile delta and Nile valley areas, waterway is a naturally available mode of transport in addition to being environmentally sound. In this respect the importance of development of waterway transport as an environmentally sound mode is identified in two important national policy documents published by EEAA on mitigation of climate change and also for UNFCCC (United Nations Framework Convention on Climate Change). These documents are as follows:

- "Initial National Communication on Climate Change" of June 1999 prepared for UNFCCC
- "National Action Plan on Climate Change" of August 1999.

In fact the above "National Action Plan on Climate Change" has identified measures/actions to be implemented by the relevant governmental organizations of Egypt for a variety of sectors like energy supply, energy demand, agriculture and waste management so as to mitigate climate change. Accordingly, under the sector of energy demand, "*Improving and Expanding River and Railway Transport*" is identified as an item of action plans to be implemented by the Ministry of Transport (MOT). This master plan could be regarded as the action plan for river transport expansion and improvement focused on import-export cargo transport in the Nile Delta area until the year 2020.

12.2 Components of the Master Plan

The master plan for the development of Inland Waterway Transport System in the Nile Delta area is basically composed of the development of two major waterway systems in order to link effectively only two of the three targeted major seaports of Alexandria, Damietta and Port Said with Cairo and further upstream Nile river reaches in Upper Egypt.

All three alternative waterway links of Port Said port with Cairo are assessed as economically not viable in the foreseeable future, at least until the target year of the Master Plan of 2020, principally due to low forecast cargo demand growth for Port Said Port. The three alternative waterway links for Port Said Port are as follows:

1. Iamailiya Canal cum Suez Canal link between Nile at North Cairo and Port Said Port
2. Manzala Canal link between Damietta at Nile and Port Said Port
3. Mediterranean coastal sea link between Damietta and Port Said Port

The salient features of selected two waterway systems for linking Alexandria and Damietta ports with Cairo and further inland as per this master plan are briefed below.

(1) Alexandria Port to Cairo system

Development plan for this waterway system includes improvement of the existing navigation canals of Nubaria and Beheri that links Alexandria port with the Nile river reach at immediate downstream of Cairo and also the development of direct link between Nubaria canal and the Rosetta branch of Nile (Rosetta-Nile) at Boulin, the junction between Nubaria canal and Beheri canal. This new direct navigation link at Boulin is for creating a waterway transport system to serve the industrial estate at Karf El Zayet, located at about 20 km downstream of Boulin in Rosetta-Nile. Accordingly, Boulin would become a trilateral junction of Nubaria canal, Beheri canal and Rosetta-Nile. The most significant improvement measure planned is the rehabilitation of the Maritime Lock at the Alexandria Port outlet of the Nubaria canal to facilitate access by high capacity barges to the port. This improvement of maritime lock is a common element for the entire system including the planned direct link between Nubaria canal and Rosetta-Nile at Boulin.

(2) Damietta Port to Cairo system

The plan for the development of this waterway system basically involves the improvement of the Damietta branch of the Nile River (Damietta-Nile), which alone will constitute as the direct waterway link between Damietta port and Cairo. In fact RTA is currently executing the improvement works of the Damietta branch to facilitate navigation of high capacity barges as dealt with in Chapter 11. Accordingly no further improvement works are deemed necessary as per this master plan.

Finally for increasing the efficiency (scale merit) of cargo transport by barge, suitable high capacity barge system is planned both for bulk cargo and containerized cargo. The planned capacity of typical bulk cargo barge is 1380 MT (metric tons) and that of container barge is 96 TEU. It is noted that barges do not transport currently containerized cargo, hence there is no container barge, and while typical capacity of current bulk cargo barge is 700 MT. Moreover, the container barge is introduced in conjunction with the development of a new container cum general (break-bulk) cargo terminal at Ather El Nabi, located near the head office of RTA in Cairo.

12.3 Environmental Effects

The long-term environmental impacts/effects consequent to the implementation of the master plan under the operational condition of the planned waterway cargo transport system is illustrated below, distinguished between potential beneficial effects and adverse effects, to form the IEE of the master plan. This IEE of the master plan is generally referred to as SEA (strategic environmental assessment). The mitigation measures for potential adverse effects are also dealt with as appropriate.

12.3.1 Beneficial Effects

(1) High operational energy efficiency of waterway transport

The most significant long-term benefit of the waterway transport system with barges is its environmental soundness in operation due to its higher energy (fuel) efficiency and the associated reduction in the emission of GHG and other air pollutants in comparison to that of road-based trucks, as also pointed out in section 12.1. In general, fuel efficiency of a barge increases with increased capacity, implying that a higher loading efficiency of barge also translates into higher fuel economy and environmental performance. However, in this case of navigation in the Nubaria canal, the principal canal linking Alexandria port with Cairo, due to its prime function as irrigation canal the available water draft in winter season, during which the irrigation demand is minimum, is limited to 1.6 m. This and other constraints like canal width, bridge clearance imposes limit on the capacity of barge suited for safe navigation. The proposed typical barge capacities of 1380 MT (bulk cargo barge) and 96 TEU (container barge) are the optimum ones that allows for safe navigation in the Nile delta waterway system.

As the quantification for comparison of energy efficiency, and hence the emission of GHG and other air pollutants, among the 3 inland modes of cargo transport, namely, road (trucks), railway and waterway (barge), unit fuel consumption, defined as the quantity of fuel required to carry unit load of cargo to unit distance, was estimated under the following basic assumptions.

- The transportation distance for all 3 modes is 228km for transport between Alexandria port and Cairo (Ather El Nabi port) while it is 268km for waterway and 210km for both road and rail for transport between Damietta port and Cairo
- Engine power of current barge is 400HP (horse-power) and that of planned barge is 600HP and their fuel consumption per HP-hr is 0.15 liters (L)

- Load carrying capacity of current twin unit (bulk cargo) barge is 700MT (metric tons) while that of planned high capacity (bulk cargo) barge is 1380MT and the planned container barge is 96TEU
- Load carrying capacity of typical truck is 2TEU (containers) or 20MT (bulk cargo) and that of rail is 60TEU or 1120MT
- Fuel efficiency of truck is 2.6km/L and that of rail is 0.14km/L (7L/km)

Accordingly, the unit fuel consumption measured as L/MT-km (bulk cargo) and L/TEU-km (containers) for each case is determined as follows:

- Current twin barge: 0.0091 L/MT-km
- Planned bulk cargo barge: 0.0059 L/MT-km
- Planned container barge: 0.0847 L/TEU-km
- Railway (bulk cargo): 0.0062 L/MT-km
- Railway (containers): 0.1167 L/TEU-km
- Road truck (bulk cargo): 0.0192 L/MT-km
- Road truck (containers): 0.1923 L/TEU-km

From the above figures of unit fuel consumption it is evident that both the current and planned barges (both of bulk cargo and container barges) are more than twice as energy efficient to that of road truck. Still, railway is more energy efficient than current barge in transporting bulk cargo. In fact concerning this aspect even the planned high capacity bulk cargo barge is only slightly more energy efficient than that of railway. Concerning the transport of containers, the planned high capacity container barge is relatively more energy efficient than railway. In overall, the planned high capacity barge is the most energy efficient with railway being comparatively somewhat less energy efficient. Accordingly, it is important to utilize high capacity barges with high loading as much as possible so as to realize fully the potential economic and environmental benefits of modal shift from that of road trucks to waterway (river) barges. Unfortunately, multipurpose beneficial use of Nile water with irrigation use being most important imposes limit on available water draft resulting in capacity limitation of barge.

The above unit fuel consumption values were used to determine the corresponding unit emissions of GHG (CO_2 is assumed as the only significant representative GHG linked to fuel energy based transport) and other air pollutants of CO, HC, NO_x and PM. These unit emission values, defined as the quantity of constituent emitted while carrying unit load of cargo to unit distance, were estimated assuming an emission factor of 3.08 g-CO_2 (GHG) per g-fuel (ref. Transport and the Global Environment, UNEP, 2001) and other typical emission factor values for the air pollutants as given in Table 12.3.1.

It is noted that the typical emission factors of Table 12.3.1 were derived based on available data only for truck performance in Europe, France and Pakistan. Still in the absence of suitable data for the other transport modes of railway and waterway (barge), these typical emission factors were assumed as applicable for all three-transport modes. The Unit Emission values determined based on these assumptions is given in Table 12.3.2. These unit emission values further demonstrate in quantity terms the environmental soundness of waterway transport principally in comparison to road-based trucks and also to some extent railway.

Table 12.3.1 Emission Factors of Diesel Fuel Trucks

Air Pollutant	Emission Factor (grams of pollutant / liter of fuel)						
	EUROPE		FRANCE		PAKISTAN		Typical Emission Factor
	Truck (3.5~16tons)	Truck (>16tons)	Truck (19tons)	Semitrailer (40tons)	Truck	Heavy Pick-up	
Carbon monoxide (CO)	23.1	12.2	12.0	7.2	23.9	13.5	16.0
Hydrocarbon (HC)	3.5	6.8	2.6	3.1	5.8	6.8	5.0
Nitrogen oxides (NO_x)	33.2	39.2	46.4	26.7	36.0	11.6	41.0
Particulate matter (PM)	9.2	3.6	1.6	3.4	7.5	15.4	4.0

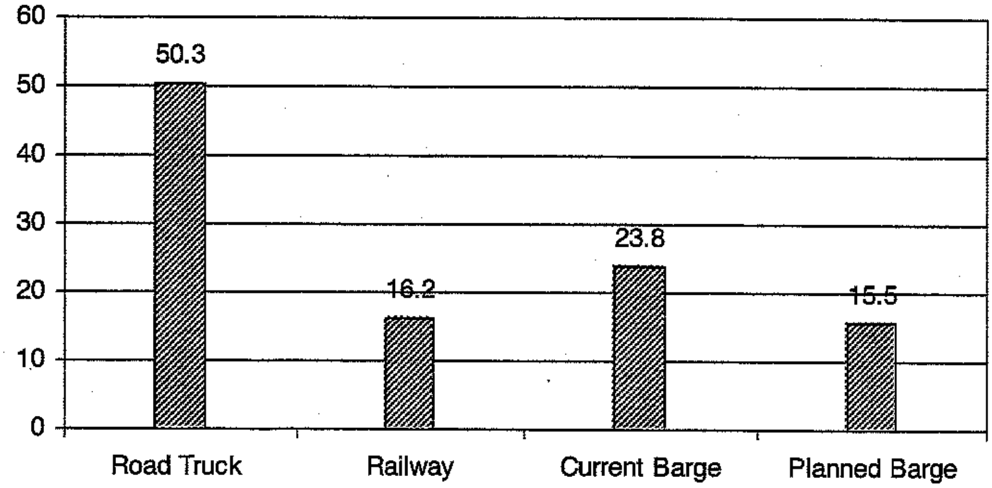
Note: Specific gravity of fuel (diesel) is assumed as 0.85

Source: Air Pollution from Motor Vehicles, World Bank (1996)
Transport and the Global Environment, UNEP (2001)

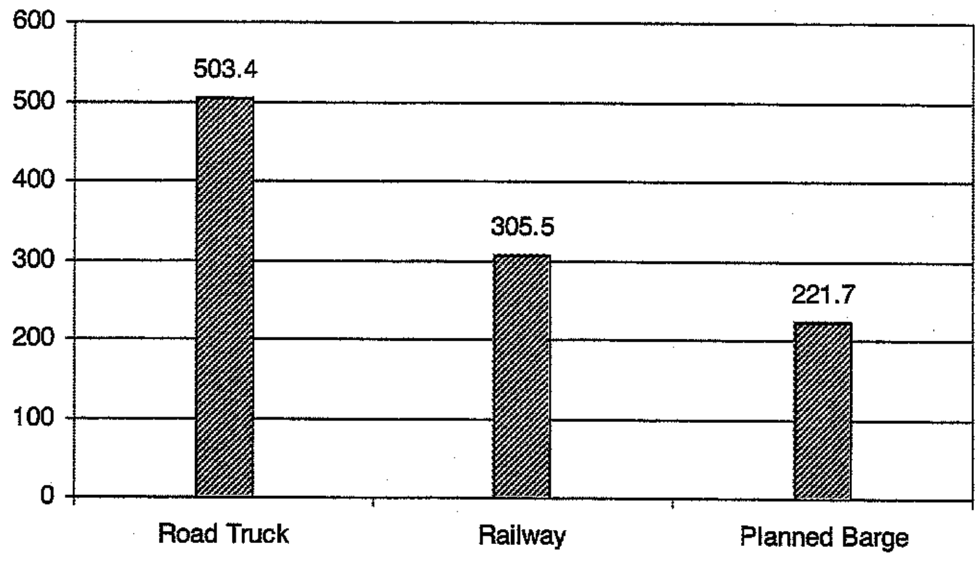
Table 12.3.2 Mode Specific Unit Emissions (Air Pollutants and GHG)

Constituent	Unit Emission						
	Bulk Cargo (grams/MT-km)				Containers (grams/TEU-km)		
	Road truck	Railway	Barge		Road truck	Railway	Planned barge
			Current	Planned			
CO	0.31	0.10	0.15	0.09	3.08	1.87	1.36
HC	0.10	0.03	0.05	0.03	0.96	0.58	0.42
NO_x	0.79	0.25	0.37	0.24	7.88	4.79	3.47
PM	0.08	0.03	0.04	0.02	0.77	0.47	0.34
GHG (CO_2)	50.3	16.2	23.8	15.5	503.4	305.5	221.7

The unit emission values of GHG (CO_2) shown in the above Table 12.3.2 are graphically illustrated in Fig.12.3.1 of below (Note: MT–Metric Tons).



Bulk Cargo (gCO_2/MT-km)



Containers (gCO_2/TEU-km)

Figure 12.3.1 Unit Emissions of GHG

Finally based on the total estimated quantity of fuel consumption for the transport of representative cargoes targeted by this Mater Plan (M/P), namely those of import-export cargoes of Alexandria Port and the cargo destined for the planned Ather El Nabi Port in Cairo from Damietta Port, the reduction in the quantity of air pollutants and GHG

(CO_2) emissions under the conditions of without and with M/P is estimated as shown in Table 12.3.3.

The Table 12.3.3 also shows the current fuel consumption (year 2000) and the relevant quantity of emission of air pollutants and GHG on mode basis for all three-transport modes of road (road truck), rail (railway) and water (barge) in addition to the future condition in 2020 under the cases of without and with M/P.

As evident from Table 12.3.3, the net annual reduction in the quantity of fuel consumption in 2020 consequent to this M/P is 11,205 MT (88, 500-77,295), accounting for 12.7%. Since the air pollutants and GHG emissions are assumed to be proportional to the fuel consumption their reductions would also be 12.7%. The corresponding net annual reduction in GHG (CO_2) emission is 34,511 MT (272,580-238,069).

Nevertheless, if the reduction in quantity of fuel consumption and hence the relevant reduction in the emission of air pollutants by trucks is considered as the prime environmental benefit, since trucks ply roads with high population exposure in comparison to railway and water barge, the reduction by the M/P represents a very significant 23.5% (reduction in fuel consumption: 86,124-65,906 = 20,218 MT or 23.5%).

It is emphasized that the estimation of future quantities in 2020 shown in Table 12.3.3, under both with and without M/P, is made under the important assumption of no future development in railway to realize further modal shift of cargo from road trucks than the current situation (2000). Since this Master Plan is basically aimed at facilitating modal shift of cargo from road trucks to waterway, any potential modal shift of cargo from road trucks to railway in future is considered as beyond the scope of this M/P and hence has not been taken into account.

Still, as evident from Table 12.3.2 and also Fig.12.3.1, in overall, railway is only slightly less energy efficient than waterway and hence also a preferred mode in comparison to road trucks as also pointed out in Section 12.1.1. Hence it is recommended to undertake the necessary studies and action plans to realize modal shift in cargo transport from road to railway as well. In effect both waterway and railway be complementary preferred modes in comparison to road trucks and hence to be developed as also identified by the "National Action Plan on Climate Change" of August 1999 as noted in Section 12.1.1.

Table 12.3.3 Environmental Benefit of Master Plan as Reduction in Emission of Air Pollutants and GHG

Item	Transport mode	Current condition (2000)		Future condition in 2020				
				Without M/P		With M/P		Reduction
		Mode basis	Total	Mode basis	Total (A)	Mode basis	Total (B)	(A-B)
Fuel consumption (MT/year)	Road	36,001		86,124		65,906		
	Rail	1126	38,791	999	88,500	999	77,295	11,205
	Water	1664		1377		10,390		
CO (Kg/year)	Road	677,539		1,620,854		1,240,351		
	Rail	21,191	730,047	18,801	1,665,570	18,801	1,454,692	210,878
	Water	31,317		25,915		195,540		
HC (Kg/year)	Road	211,686		506,409		387,527		
	Rail	6621	228,091	5874	520,380	5874	454,495	65,885
	Water	9784		8097		61,093		
NO_X (Kg/year)	Road	1,736,688		4,154,622		3,179,305		
	Rail	54,318	1,871,278	48,192	4,269,240	48,192	3,728,711	540,529
	Water	80,271		66,427		501,214		
PM (Kg/year)	Road	169,565		405,644		310,417		
	Rail	5304	182,706	4705	416,835	4705	364,060	52,776
	Water	7837		6486		48,937		
GHG (CO_2) (MT/year)	Road	110,883		265,262		202,991		
	Rail	3468	119,476	3077	272,580	3077	238,069	34,511
	Water	5125		4241		32,001		

(2) Reduced frequency of trucks on roads

The modal shift in cargo transport from road trucks to waterway (river) barge consequent to the implementation of this master plan would result inherently in reduction of cargo truck frequency on roads accompanied with increased frequency of river barges. Under the same assumptions on the capacity of a typical truck as used for the estimation of unit emissions shown in Table 12.3.2 and also Fig. 12.3.1 (capacity of bulk cargo truck is 20 MT and that of container truck is 2 TEU) the total annual frequency of trucks plying the principal Alexandria Port-Cairo route in the year 2020 under the condition of without M/P is estimated as 901,000 while under that of with M/P as 717,000. This accounts for annual reduction in truck frequency by a number of 184,000 units or about 20% by 2020, which is considered as very significant.

The reduction in road truck frequency has the following overall benefits:

- Realization of improved road traffic safety, since potential accidental damage, in particular in case of a loaded truck, would decrease with the reduction in road truck frequency.
- Reduction in requirement of road and road bridge maintenance, and hence the cost of maintenance, consequent to the reduction in truck loading on to these facilities. It is noted that loaded trucks, in particular under high-speed condition, account for very significant wear and tear on roads and damage of road bridge piers.
- Marginal improvement in ambient air quality along the roadsides consequent to the reduction in the quantity of air pollutants emitted by trucks. This air quality improvement is assessed only as marginal, since cargo trucks plying on a desert road like the one of Alexandria-Cairo desert road mostly pass through uninhabited (unpopulated) desert areas. Moreover, even in case of cargo trucks passing through highly populated areas such as the inner roads of Nile Delta area (like the Agriculture road of Alexandria-Cairo) and Cairo Metropolis, the contribution of air pollutants emitted by trucks is considered as not that significant in comparison to that emitted by other miscellaneous vehicular traffic, in particular passenger traffic. Still the reduction in the emission of air pollutants by road trucks consequent to this master plan is estimated as 23.5% as noted under item (1) of above.

12.3.2 Adverse Effects

(1) Navigational safety concern

In contrast to the increased road safety due to the reduction in road trucks as indicated in item (2) of above, both the increased frequency of barge traffic as well as the high capacity of barge with deep draft as per this master plan have important navigational safety concerns in the relevant waterways of Nile River and the navigation canals. In this respect the current (2000) annual frequency of barge traffic is estimated as 3124 units while under the condition of with M/P it estimated to increase up to 12,782 units by 2020, an increase of more than 4 fold (4.1 times). Significant navigational safety risks of this very significant increase in barge frequency are potential accident with another water vessel and grounding of a high capacity barge due to inadequate water draft (navigation depth).

The required navigational safety enhancement measures such as navigation aids to facilitate night navigation including the barge design conforming the obtainable safe draft depth are incorporated in the master plan as in-built mitigation measures as described in Section 11.3 of Chapter 11. Still, Nile River is the lifeline of Egypt providing the water for every conceivable beneficial use for virtually the entire population of the nation. Accordingly, while making every effort to mitigate an accidental risk, it is also imperative to ensure that even in case of an inevitable accident, it would not significantly affect the lifeline beneficial uses of the water such as potable source and irrigation. In order to ensure that an accident does not at least affect the water quality to the extent of endangering the important beneficial uses, in principle, all transport of dangerous cargo in barges is banned. Nevertheless, in case an industry is in need of transport of dangerous cargo by barge as with the case of transport of sulfur (sulfur is a dangerous cargo) for the industrial estate of Karf El Zayet, as considered in the cargo demand forecast, special permit for such transport shall be obtained from RTA. For the issuance of special permit for transport of a dangerous cargo by barge, RTA shall ensure provision of additional safety (protection) measures by barge cargo transport operator depending on the perceived accidental risk of the dangerous cargo concerned. Such additional protection measure may include institution of double hull barge for the transport of a dangerous cargo so as to minimize the risk of cargo spillage into waters even in the event of an inevitable accident.

It is further noted that IMDG Code (International Maritime Dangerous Goods Code) of IMO (International Maritime Organization) already categorizes the dangerous cargo in maritime (water) transport into 9 classes. The 9 classes are as follows:

- Explosives
- Gases compressed, liquefied or dissolved under pressure
- Flammable liquids
- Flammable solids or substances
- Oxidizing agents and organic peroxides
- Toxic and infectious substances
- Radioactive materials
- Corrosives
- Miscellaneous dangerous substances and articles

Accordingly, all types of cargo falling into the above 9 classes need to acquire special permit from RTA for waterway (barge) transport. It is imperative that the port authorities of all relevant sea-ports (Alexandria and Damietta) and those agencies responsible for managing the river ports as well as RTA shall ensure that dangerous cargoes are neither loaded or unloaded in the barge terminals nor transported along the Nile River and its navigation canals without due permits. In particular, all barge operators are made well aware of this restriction and the requirement of possession of special permit for the transport of dangerous cargo.

Finally periodic and regular conduct of bathymetric survey and hence the conduct of required maintenance dredging to ensure design safe navigation depth (design water draft) in the designated navigational routes of the river (Nile) and the navigation canals by RTA is emphasized as the most important mitigation measure against potential grounding of a vessel.

(2) Waste management aspects of barge (vessel) operation

Increased number and frequency of barge operation also involves increased generation of barge operation related wastes that need to be managed properly so as not to pollute the Nile River course as well as the navigation canals. As pointed out above Nile River and its canal waters is the lifeline of Egypt and hence mitigation of potential waterway pollution due to barge operation has a very important significance.

Bilge waste (waste oil) arising from the engine room of barge is the most significant oil pollutant that needs to be properly collected and stored on-board and discharged in a port terminal for subsequent land based waste management measures. In this respect adherence to the Annex-I of MARPOL 73/78 as the international maritime waste oil management requirement of IMO is duly incorporated in the barge design as given in Section 11.3 of Chapter 11.

Still provision of waste oil storage on-board in bilge tank is only a design mitigation measure that alone would not ensure that illegal dumping of waste oil into the Nile and its canal waters by a barge would not occur. It is imperative that RTA, as the management agency responsible for inland waterway transport, ensures that all vessels, not just a barge of this master plan, shall duly dispose waste oil in port terminals. In fact this requirement is applicable for all wastes arising on-board of a vessel including solid waste (garbage). The Annex-V of MARPOL 73/78 also similarly regulates proper management of garbage due to vessel operation.

In this respect it is recommended that all port terminals shall accept the wastes disposed from vessels (and barges) free of charge or for a subsidized low fee, in other words the waste reception charge being mostly incorporated into other fees as an indirect charge, as an incentive to discourage illegal dumping of wastes into Nile and its canal waters.

Moreover, a very high penalty fee on vessels caught of dumping wastes into waters could be applied. This financial incentive scheme to encourage proper waste management by vessels shall be complemented with inspection of vessels by RTA on the adequacy as well as actual implementation of on-board waste storage measures, including the overall operational worthiness of a vessel. This mitigation measure on waste pollution due to vessel operation is workable only when port terminals are equipped with the necessary waste reception facilities. Still, the required waste reception facilities are not elaborate. For example, some oil drums would suffice as the reception facility for waste oil.

It is also noted that the high capacity barge designed to carry containerized cargo is equipped with ballast tank, imparting the impression of generation of ballast waste. In fact a barge under the ballast condition is not expected to occur that often. Ballasting a barge (fill-up of water in the ballast tank) would be required to increase the draft depth only when it is deemed that the available air clearance across a bridge is insufficient to allow for safe passage. All such critical bridge crossings are located in the fresh water reaches of Nile and the associated navigation canals and none in the saline water reaches near the coast. Accordingly, only fresh water is required for ballasting and hence it's deballasting into watercourse could be accomplished anywhere as suited and it would not cause any significant adverse effects on the receiving water environment.

12.4. The Scope of EIA Study for Proposed Project

There are two major new project components envisaged in the master plan to improve the inland waterway transport system in the Nile Delta area. They are a new connection navigation canal project in Boulin to facilitate direct navigation between Nubaria canal and Rosetta branch of Nile (Boulin Project) and improvement of the Maritime Lock of the Nubaria canal link to the Alexandria port so as to facilitate direct port access for the planned high capacity barge (Alexandria Project). It is noted that the planned new container cum general cargo terminal at Arther El Nabi in Cairo is also a major project component. However, for the purpose of environmental assessment this project is considered as an on-going project since the planned terminal (river port) is only an improvement to the already planned container terminal by RTA at the same location. RTA has already carried out the EIA study for this container terminal project recently in 2000. Accordingly, this project is no longer considered as a new project requiring any further detailed environmental consideration and hence environmental impact assessment (EIA).

Herewith are annexed the screening and scoping for the 2 major projects conforming the format of JICA scoping and screening.

However, it is noted that in general this screening and scoping method as the means of determining whether EIA is necessary for a project is not used recently in most EIA guidelines including that of EEAA Guidelines and therefore the forms for scoping and screening have been eliminated in most modern EIA guidelines (also in EEAA guidelines). Moreover, total reliance on such a form is not advisable since it may result in the likely omission of some important impact consideration. Still they are useful as an initial guidance. In fact such guidelines as those of JICA and JBIC are intended for use only when a recipient country does not have sufficient guidelines of its own for the conduct of EIA study. However, Egypt has the relevant laws, regulations and EIA guidelines that are much detailed than the JICA/JBIC guidelines and hence could be used as the sole ones.

Nevertheless, the simplicity of JICA/JBIC guidelines is very relevant at least as an initial guidance for studying potential environmental effects of a project. Accordingly, these annexed forms are incorporated essentially for the purpose of reference. Nowadays, many EIA guidelines including the one of Egypt determine objectively projects requiring EIA based on such factors as scale of project, location of project and others. In this respect the locations of these project along the Nile river and its major canals is the basic reason for the necessity on the conduct of EIA for these projects (Nile river is lifeline of Egypt) as noted in Section 5.2.1 of Chapter 5.

Finally, the EIA studies conducted for these two projects (Boulin and Alexandria projects), based on the EIA guidelines of EEAA, are dealt with in Chapter 15.

Format for screening-Bolin Project

No.	Environmental Item	Description	Evaluation *1	Remarks (reasons)
Social Environment				
1.	Resettlement	Resettlement due to an occupancy (transfer of rights of residence/land ownership)	**[Y]**[N][?]	Land acquisition is involved
2.	Economic activities	Loss of bases of economic activities, such as land, and change of economic structure	[Y][N]**[?]**	Potential loss in farmland by land acquisition
3.	Traffic and public facilities	Impacts on schools, hospitals and present traffic conditions such as the increase of traffic congestion and accidents	[Y][N]**[?]**	Potential iinterference to normal traffic due to construction traffic
4.	Split of community	Community split due to interruption of area traffic	**[Y]**[N][?]	Canal splits community
5.	Cultural property	Damage to or loss of value of churches, temples, shrines, archaeological remains or other cultural assets	[Y][N]**[?]**	Archaeological remains, a possibility
6.	Water rights and rights of common	Obstruction of fishing rights, water rights, rights of common	**[Y]**[N][?]	Irrigation water rights, a significant consideration
7.	Public health condition	Degeneration of public health and sanitary conditions due to generation of garbage and the increase of vermin	[Y][N]**[?]**	An issue of construction site management
8.	Waste	Generation of construction wastes, surplus soil and general wastes	**[Y]**[N][?]	From construction site works and dredging works
9.	Hazards (risk)	Increase in danger of landslides, cave-ins, etc.	[Y][N]**[?]**	Construction safety management issue
Natural Environment				
10.	Topography and geology	Changes of valuable topography and geology due to excavation or filling work	[Y][N]**[?]**	A project design and dredged material management issue
11.	Soil erosion	Topsoil erosion by rainfall after reclamation and deforestation	[Y]**[N]**[?]	No effect (rainfall is insignificant)
12.	Groundwater	Contamination caused by damage and filtrate water in excavation work and lowering of groundwater table due to overdraft	[Y]**[N]**[?]	No effect (no interference to groundwater)
13.	Hydrological situation	Changes of river discharge and riverbed condition due to landfill and drainage inflow	[Y][N]**[?]**	Change in Boulin canal flow to be studied
14.	Coastal zone	Coastal erosion and change of vegetation due to coastal reclamation and coastal changes	[Y]**[N]**[?]	No effect (No coast nearby)
15.	Fauna and flora	Obstruction of breeding and extinction of species due to changes of habitat conditions	[Y][N]**[?]**	May not be significant, still to be verified
16.	Meteorology	Changes of temperature, precipitation, wind, etc. due to large-scale land reclamation and building construction	[Y]**[N]**[?]	No effect (Project is not that large scale)
17.	Landscape	Change of topography and vegetation due to reclamation. Deterioration of aesthetic harmony by structures	[Y][N]**[?]**	A project design issue
Pollution				
18.	Air pollution	Pollution cause by exhaust gas or toxic gas from vehicles	**[Y]**[N][?]	Construction vehicles
19.	Water pollution	Pollution cause by inflow of silt, sand and effluent from factories, etc.	**[Y]**[N][?]	Dredging works of canal
20.	Soil contamination	Contamination caused by dust and asphalt emulsion	**[Y]**[N][?]	During construction works
21.	Noise and vibration	Noise and vibration generated by vehicles	**[Y]**[N][?]	During construction works
22.	Land subsidence	Deformation of land and land subsidence due to the lowering of groundwater table	[Y]**[N]**[?]	No effect (no interference to groundwater)
23.	Offensive odor	Generation of exhaust gas and offensive odor by facility construction and operations	[Y][N]**[?]**	Construction and dredging works
Overall evaluation : Necessity for implementation of IEE and/or EIA			**[Y]**[N]	EIA study is required, also according to Egypt law (Law No.4/1994)

*1 Y: Yes

N: No

?: Unknown (To be confirmed)

Checklist for Scoping-Bolin Project

No.	Environmental Item	Evaluation	Reasons
Social Environment			
1	Resettlement	B	Land acquisition of agricultural area is involved, though no resettlement
2	Economic activities	C	Agriculture land acquisition may affect local economy
3	Traffic and public facilities	C	Potential interference of construction traffic with regular traffic
4	Split of community	B	Canal construction causes split of community
5	Cultural property	C	Existence of archeological treasures, a possibility
6	Water rights and Rights of common	B	Irrigation water rights is a significant issue
7	Public health condition	C	Construction site worker related public health management
8	Waste	B	Generation of construction waste
9	Hazards (risk)	C	Construction site safety management
Natural Environment			
10	Topography and geology	C	Soil geology would effect dredged material management aspects
11	Soil erosion	D	No effect due to insignificant rainfall
12	Groundwater	D	No effect since project is not related to groundwater
13	Hydrological situation	C	Potential effect of project on flow through Boulin Canal to be studied
14	Coastal zone	D	No effect since there is no coastal zone nearby
15	Fauna and flora	C	No significant long-term adverse effect is anticipated, still to be verified
16	Meteorology	C	Project has no effect though meteorology may effect construction works
17	Landscape	C	Project design has to take this into consideration
Pollution			
18	Air pollution	B	Use of construction machinery, vehicles may cause air pollution
19	Water pollution	B	The dredging works may cause water pollution
20	Soil contamination	C	Depends on the quality of dredged material
21	Noise and vibration	B	Use of construction machinery and vehicles may produce noise and vibration
22	Land subsidence	D	No effect since project is not related to groundwater
23	Offensive odor	C	Dredged material may produce offensive odor

Note 1: Evaluation categories:

A: Serious impact is expected

B: Some impact is expected

C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

D: No impact is expected. IEE/EIA is not necessary.

Note 2: The evaluation should be made with reference to the "explanation of item" (Table 4-5)

Format for screening-Alexandria Project

No.	Environnemental Item	Description	Evaluation *1	Remarks (reasons)
Social Environment				
1.	Resettlement	Resettlement due to an occupancy (transfer of rights of residence/land ownership)	[Y][N]**[?]**	Land acquisition may be involved
2.	Economic activities	Loss of bases of economic activities, such as land, and change of economic structure	[Y]**[N]**[?]	No significant loss is anticipated
3.	Traffic and public facilities	Impacts on schools, hospitals and present traffic conditions such as the increase of traffic congestion and accidents	[Y][N]**[?]**	Potential iinterference to normal traffic due to construction traffic
4.	Split of community	Community split due to interruption of area traffic	[Y]**[N]**[?]	No effect (no split)
5.	Cultural property	Damage to or loss of value of churches, temples, shrines, archaeological remains or other cultural assets	[Y][N]**[?]**	Archaeological remains, a possibility
6.	Water rights and rights of common	Obstruction of fishing rights, water rights, rights of common	[Y][N]**[?]**	Fishing rights may exists
7.	Public health condition	Degeneration of public health and sanitary conditions due to generation of garbage and the increase of vermin	[Y][N]**[?]**	An issue of construction site management
8.	Waste	Generation of construction wastes, surplus soil and general wastes	**[Y]**[N][?]	From construction site works and dredging works
9.	Hazards (risk)	Increase in danger of landslides, cave-ins, etc.	[Y][N]**[?]**	Construction safety management issue
Natural Environment				
10.	Topography and geology	Changes of valuable topography and geology due to excavation or filling work	[Y][N]**[?]**	A project design and dredged material management issue
11.	Soil erosion	Topsoil erosion by rainfall after reclamation and deforestation	[Y]**[N]**[?]	No effect (rainfall is insignificant)
12.	Groundwater	Contamination caused by damage and filtrate water in excavation work and lowering of groundwater table due to overdraft	[Y]**[N]**[?]	No effect (no interference to groundwater)
13.	Hydrological situation	Changes of river discharge and riverbed condition due to landfill and drainage inflow	[Y]**[N]**[?]	No change in canal flow
14.	Coastal zone	Coastal erosion and change of vegetation due to coastal reclamation and coastal changes	[Y]**[N]**[?]	Existing coast is Alex. Port area, an industrial area, hence effect not significant
15.	Fauna and flora	Obstruction of breeding and extinction of species due to changes of habitat conditions	[Y][N]**[?]**	May not be significant, still to be verified
16.	Meteorology	Changes of temperature, precipitation, wind, etc. due to large-scale land reclamation and building construction	[Y]**[N]**[?]	No effect (Project is not that large scale)
17.	Landscape	Change of topography and vegetation due to reclamation. Deterioration of aesthetic harmony by structures	[Y][N]**[?]**	A project design issue
Pollution				
18.	Air pollution	Pollution cause by exhaust gas or toxic gas from vehicles	**[Y]**[N][?]	Construction vehicles
19.	Water pollution	Pollution cause by inflow of silt, sand and effluent from factories, etc.	**[Y]**[N][?]	Dredging works of canal and coastal port waters
20.	Soil contamination	Contamination caused by dust and asphalt emulsion	**[Y]**[N][?]	During construction works
21.	Noise and vibration	Noise and vibration generated by vehicles	**[Y]**[N][?]	During construction works
22.	Land subsidence	Deformation of land and land subsidence due to the lowering of groundwater table	[Y]**[N]**[?]	No effect (no interference to groundwater)
23.	Offensive odor	Generation of exhaust gas and offensive odor by facility construction and operations	[Y][N]**[?]**	Construction and dredging works
Overall evaluation : Necessity for implementation of IEE and/or EIA			**[Y]**[N]	EIA study is required, also according to Egypt law (Law No.4/1994)

*1 Y: Yes

N: No

?: Unknown (To be confirmed)

Checklist for Scoping-Alexandria Project

No.	Environmental Item	Evaluation	Reasons
Social Environment			
1	Resettlement	C	Land acquisition may be involved, though no resettlement
2	Economic activities	D	The project will benefit port service industry (D in evaluation means no adverse effect)
3	Traffic and public facilities	C	Potential interference of construction traffic with regular traffic
4	Split of community	D	Canal already exists and hence any split is also in existence
5	Cultural property	B	Existence of archeological treasures is possible since Alexandria is an ancient city
6	Water rights and Rights of common	C	Fishing water rights may be a significant issue
7	Public health condition	C	Construction site worker related public health management
8	Waste	B	Generation of construction waste
9	Hazards (risk)	C	Construction site safety management
Natural Environment			
10	Topography and geology	C	Soil geology would effect dredged material management aspects
11	Soil erosion	D	No effect due to insignificant rainfall
12	Groundwater	D	No effect since project is not related to groundwater
13	Hydrological situation	D	No effect since project would not alter canal flow characteristics
14	Coastal zone	D	No adverse effect is anticipated since the coastal zone is Alex. Port waters, industrial area
15	Fauna and flora	C	No significant long-term adverse effect is anticipated, still to be verified
16	Meteorology	C	Project has no effect though meteorology may effect construction works
17	Landscape	C	Project design has to take this into consideration
Pollution			
18	Air pollution	B	Use of construction machinery, vehicles may cause air pollution
19	Water pollution	B	The dredging works may cause water pollution
20	Soil contamination	B	Dredged material in port waters is probably contaminated
21	Noise and vibration	B	Use of construction machinery and vehicles may produce noise and vibration
22	Land subsidence	D	No effect since project is not related to groundwater
23	Offensive odor	C	Dredged material may produce offensive odor

Note 1: Evaluation categories:

A: Serious impact is expected

B: Some impact is expected

C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

D: No impact is expected. IEE/EIA is not necessary.

Note 2: The evaluation should be made with reference to the "explanation of item" (Table 4-5)

12.5. Conclusion of IEE

Implementation of the master plan has important long-term environmental benefit mainly due to the environmentally sound nature of waterway transport, consequent to its high-energy efficiency and the subsequent reduced emission of GHG and other air pollutants. However, mitigation of potential adverse effects has added significance due to the unique value of Nile River water being the lifeline of Egypt. Still, potential adverse effects are evaluated as manageable, in particular with restriction on transport of dangerous cargo, so as not to affect the cargo transport oriented navigational use, which is also a component of multipurpose beneficial use of Nile River course.

Chapter 13 Short-term Development Plan of IWT for 2010

13.1 General

Main purpose of the short-term plan is to prepare first phase plan for the improvement of the IWT infrastructures and operational / managerial system by RTA for the target year 2010.

In the master plan, the Study proposed several improvement measures to promote IWT for the target year 2020, and evaluated the economic feasibility of such proposal. As a result, the following projects were judged economically justifiable.

- Alexandria-Cairo IWT project: Improvements of canals (inland waterways)
  Installation of navigation aids
  Extension of Maritime Lock
  Construction of a public river port (Ather El Nabi Port)
- New Bolin Canal project :Construction of new lock and barrage
  Development of new canals

Therefore, the short-term plan also examines such two projects and formulates as first phase plan, taking account of cargo demand, traffic volume in 2010, and urgency of each component-projects.

This chapter firstly outlines short-term projects that are expected to be completed for 2010, and basic design/cost estimation for each component-project as "engineering study" are described in later sub-sections.

The short-term plan takes up the following three projects.

- Alexandria-Cairo IW improvement project:
  Improvements of canals (IWs), Installation of navigation aids and Extension of Maritime Lock
- Construction of a public river port (Ather El Nabi Port)
- New Bolin Canal project:
  Construction of new lock and barrage, Development of new canals

In the short-term plan, a new public river port is taken up as one project separately of Alexandria-Cairo IW project, for the following reason.

- Difference of project scheme: New river port is expected to be developed and operated by a concession contract scheme, while others will be developed and operated by RTA directly.

In addition, improvements of operational and managerial system will be required in order to successfully manage such projects, its improvements by RTA are also summarizes in this chapter.

13.2 Alexandria/Cairo IW Project

13.2.1 *Project Components*

In the conceptual plan, it is considered that this IW (Alexandria-Cairo) should be regarded as industrial arteries for supporting the growth in national economy, which connects the Capital region with the largest seaport. Moreover, the master plan proposed several improvement measures for solutions to existing constraints in this IW. Short-term plan is formulated in the framework of such improvement measures.

As mentioned previously, this IW project composes of "IWs Improvement Project", "Navigation Aids Project" and, "Small Maritime Lock Extension Project" and such component projects for 2010 are summarized as follows:

13.2.2 Project Description

(1) Improvements of IW

The Master Plan proposes that improvements of Inland Waterway (IW) itself should be required in order to secure safe and smooth navigation both by future large-sized barges and existing barges.

Its requirements for navigation of large-sized barge to be introduced are almost same as the standard of a first class waterway, namely, required minimum width is estimated at 35 m and minimum depth is determined at 2.0 m (see Chapter 11.3.2.(3)). On the basis of such requirements, the Study examined deepening/widening works in this IW (Alexandria/Cairo IW).

At this moment, a lot of shallow or narrow areas remain in this IW, and such bottleneck areas can hinder existing barges from safe and full-loaded navigation. Therefore, existing barges (units) cannot utilize its major advantage of mass-transport due to draft-control (limitation).
From this viewpoint, this short-term plan proposes that the project is needed in order to improve safety and efficiency of existing barge traffic, and strongly required to facilitate entering services of new large-sized barges.

➢ **Project Profiles**

As mentioned previously, improvements of this IW (Alexandria/Cairo IW) should be concentrated on the following two stretches, on the basis of the cross sectional sounding survey along Beheira and Noubaria canals and recent WL (water level) records.

- Between Janaklees Lock (61 km Lock) and Nahda Lock (100 km Lock)
- Stretch from Nahda Lock to Maritime (End) Lock in the Maryut Lake

In this short term plan, its dredging project is examined In consideration of the following aspects:

- To minimize effects on existing water flows or water level controls
- To minimize land acquisition areas

As described in a later "Engineering Study", short-term plan proposes that dredging works are simultaneously designed with bank protection (revetment) improvements In order to minimize dredging or excavation volume.

As a result, total dredging volumes of afore-mentioned two stretches are approximately estimated at 250 thousand m3 and 95 thousand m3, respectively (see Section 13.5 for detail).
Therefore, it is highly improbable that above volume of deepening/widening works will result in some effects on water flows or water level controls at this stage.

(2) Installation of Aids to Navigation in the canals

1) Identification and removal of obstacles to navigation

In addition to the hydrographic survey conducted by the study team, for the installation of aids to navigation in the short-term plan (target year 2010), RTA has to firstly carry out a detailed bathymetric survey of both canals in order to identify remaining shallow/narrow water areas, shipwrecks and other obstacles such as construction debris as well as topographically dangerous sections of the canals. RTA should also carry out a survey for reconfirmation on the air clearance of bridges and the distance between abutments to ensure that proposed barges could navigate safely under the bridges. After surveying works are completed, RTA will be required to dredge the canals to secure adequate depth/width, and install aids to navigation in the canals.

Obstacles and topographically dangerous sections are shown in Table 13.2.1 and Table13.2.2 respectively.

Table 13.2.1 Obstacles and Criteria

Obstacles	Brief description
①sunken ships	Water depth is less than −2.0m due to sunken ships
②construction debris	Water depth is less than −2.0m due to construction debris
③interval of abutments	Channel width is less than 35m due to abutments
④intakes for irrigation	Water depth is less than −2.0m due to intakes
⑤air clearance of bridges	Air clearance runs short for safe navigation of barges.

Table13.2.2. Topographically dangerous point and Criteria

Dangerous sections	Brief description
①shallow water area	Water depth is less than −2.0m due to sedimentation etc.
②narrow water area	Channel width is less than 35m due to bank erosion etc.
③sharp bends	Channel is meandering or sharply bending.

2) Selection of prioritized sections of canals

When the barriers in both canals preventing safe navigation are removed, daytime navigation would become possible. However, navigation only in the daytime limits the amount of cargo that can be transported. For efficient transit through the canals, night navigation is required and this entails the installation of aids to navigation. Unfortunately it would be rather difficult for RTA to install a large number of navigation aids in a short time because of its limited annual budget.

However a marginal number of navigation aids to facilitate safe night navigation of existing barges should be installed as soon as possible.

Meanwhile it is said that an Egyptian company would like to commence night navigation by container-carrying barge in the near future. According to the study team's projection, it would take about three years to construct a full-fledged container terminal at Ather El Navi. Night navigation by container-carrying barge could thus commence three years after the kickoff of construction of container terminal at Ather El Nabi area. Accordingly, additional aids to navigation should be installed by that time.

The study team proposes that the following sections be given priority for the installation of aids to navigation. It should be noted that dredging alone could not solve problems associated with the sections mentioned below.

○ Sharp bends/ curving parts of the canal
○ Narrow channels of about 35 meters
○ Entrance of the locks
○ Around abutments
○ Around intakes

3) Type of aids to navigation

There are many types of aids to navigation such as lighthouse, lighted beacon, bridge light and light buoy. In this IWT project, the purpose of aids to navigation is to clearly demarcate both sides of the channel day and night. Buoy systems are used in many ports. Buoys are usually floating and connected to seabed by chains. But if a buoy system is used, the width of the channel may be narrowed. Since the channel is already quite narrow in this project, such a system would not be appropriate. Therefore, RTA has to install fixed type aids to navigation. Furthermore, these aids have to generate light so that watchmen can recognize them visually from on the barge at night. The installation of aids to navigation will be done according to the IALA-A system in Egypt.

The study team recommends one specific type of navigation aids, a "beacon" be used from the view point of durability, maintenance and fixation. The beacon is composed of three parts: top-mark, lantern and light beacon.

Beacons will be placed on the flat plate supported vertically by a steel pipe driven into the riverbed. And distance-display (which shows the distance on the LED screen from starting point at Cairo/Alexandria in km/sea mile) is to be vertically fixed to the steel pipe so that ship operators can know their position.

4) Installation interval

In this IWT project, the study team recommends that in the straight sections of both canals, aids to navigation should be placed every 500 meters, taking into account the RTA's annual budget constraint, river fog throughout the year and other examples in Egypt. However the study team does not recommend installing two aids to navigation on both sides of the same location of the canal. If one aids to navigation is installed on the right hand side of the channel, the next one is to be placed 500m away from first one and installed on the left hand side of the channel in order to reduce the number of aids to navigation to be installed. This means that the aids to navigation will be installed every 500 meters in a zigzag pattern. But the installation pattern and intervals will vary at the above-mentioned sections of the canal. In some sections, aids to navigation have to be installed on both sides of the fairways. In other sections aids to navigation have to be installed at intervals of less than 500m.

5) Number of beacons to be installed

Since Nobaria and Beheira canals are both artificial water ways, the straight sections occupy more than 50% of the entire length of canals. If lateral lighted marks are installed every 500m in straight sections as described above, the number of lateral lighted marks is easily calculated. Meanwhile, the beacons to be installed in curving sections are basically to be installed on both sides of the fairways approximately every 250m, however, distribution and intervals of navigation aids would vary depending on the curvature radius of the curving sections. The placement intervals in each section are shown in Table13.2.3

Table 13.2.3 Installation sections and placement intervals of aids to navigational

Section	Installation point and its interval
①Straight sections	Beacons are installed every 500m in a zigzag pattern
②Meandering sections	Beacons are basically installed every 250m Distribution and intervals vary as occasion arises.
③Sharp bends	Extra beacon to be installed
④Canal's Connecting Point	Extra beacon to be installed
⑤Locks	Extra beacon to be installed
⑥Bridges	Light fixture is needed

The total number of beacons needed in this IWT project is around 550 units including spares. (See Appendix-13.1 for the breakdown of Nos. beacons)

6) Structure of beacons and its technical specification

Beacons consist of steel pole with a platform and access ladder to the lantern, solar panels and battery. It should be noted that aids to navigation are very intriguing for local residents. In some countries, there are often reports of theft immediately after the beacons have been installed, therefore anti-theft measures should be taken.

Technical specification of beacons proposed by the study team is as follows.

1. Model : LIGHT BEACON
2. Beacon Body
   - Over Height : approx. 0.89m
   - Focal Plane Height : approx. 0.84m
   - Mass : approx. 30kg (without Power Source)
   - Main Material : Aluminum Alloy
   - Paint Color : Green / Red
3. Lighting Equipment
   - Light Source : High intensity LED
   - Light Color : Green / Red
4. Power Source
   - Solar Cell Module : Fully sealed low self-discharge lead-acid battery,
     : Maintenance free type

7) Installation of buoys

In case that there are obstacles outside the fairways, RTA has to install buoys to indicate the locations of these obstacles. In this case, beacons can be used, but sooner or later obstacles should be removed by the owners or by RTA. Then the aids to navigation will be also removed. Buoys are easily removed but it is more difficult in the case of beacon piles. That's why buoys are installed to show the location of removable obstacles.

8) Installation of aids to navigation in the Nile mainstream

In this IWT project, the proposed barges will navigate on the Nile mainstream from Ather El Nabi port to downstream for about 40km before entering the canal connecting Cairo and Alexandria.

The main stream of the Nile, which flows through the heart of Cairo City, is wide and deep enough for proposed barges' sailing; having many prominent landmarks such as buildings, bridges, and mosques on both banks. Furthemore, the river surface in the urban area is almost as light as daytime even at night. Consequently, installing aids to navigation every 500m is not necessary excluding specific areas around the connecting point to Beheira Canal.

9) Installation of bridge lights

Where the fairway runs under the bridges, bridge lights are usually needed for safe navigation. In this IWT project, the intervals of abutments are so narrow that two barges are not able to run in the opposite direction under the bridge at the same time. Therefore signal lights are needed to control the traffic of the barges running under the bridges. The signal lights notify the barges' operators whether or not the barge is able to continue to sail forward under the bridge. If the signal light is red, one barge has to stop at a certain distance before bridge and wait until another barge coming from the opposite direction emerges from the bridge and passes by.

But there are around 30 bridges crossing the Nile mainstream and two canals between Cairo and Alexandria It may not be necessary or even advisable to install bridge lights on all of these bridges because some of them are too short or too small to install a complete set of bridge lights. The cost of installing bridge lights should also not be overlooked. If signals were to be remote-control type, a large investment would be required; if the work were done manually, labor costs would increase. Moreover, barges would be forced to waste a lot of time.

Meanwhile when regular transportation of containers start, barge operation schedule and timetables will be formulated. In addition to this, barge-to-barge communication will allow barge operators to know the time that they will encounter one another. For example, when there are two barges navigating in the opposite direction toward the same bridge, operators of both barges can forecast the time that they will reach the bridge based on their present location and speed, and then contact each other and determine which barge has priority. The barge that is expected to reach the bridge first has the right to go through under the bridge, while the barge that is expected to reach the bridge second will wait at a certain distance before the bridge. In this way, orderly barge traffic under the bridge will be kept smooth without bridge lights. However, a lighting fixture is needed to indicate the piers of both sides of the fairway.

10) Installation of extra beacons.

At the connection point of Nobaria and Beheiry canal, one of the two canals connects with the other at an angle of around 90 degrees. Accordingly the operation of proposed barges is quite difficult and corners of canals need to be clearly recognized by watchmen on barges especially at night. Therefore, extra beacons are necessary in the vicinity of the corners.

In addition, the width of locks is not wide enough to easily accommodate the proposed barge, making it difficult for ship operators to enter the barge into the locks properly at night. Consequently sufficient lighting fixture and beacons are needed at and around the locks.

11) Introduction of Communication Facilities on Barges

11)-1 General

In future, container-carrying barges will frequently encounter one another as they navigate the canals. Although these barges are not as large as oceangoing vessels, their dead weight is still close to 1,500 tons. Therefore they are unable to make small adjustments in narrow canals in a short time and require a certain length of stopping distance. Consequently, safe navigation depends on the availability of information on other vessels in the area. Firstly, ship operators on the barge have to know the location of an approaching ship. Secondly, they have to decide whether to draw aside and wait for the oncoming ship to pass or proceed forward. In this instance, intercommunication among ships is vital.

11)-2 Crossing of two barges

The width of the proposed barges in this IWT project is 12 meters, and the width of fairways is only about 35 meters, so the distance between shipboards of two vessels is only about 11 meters when two container barges pass each other. In addition, during strong winds, the chance of collision increases. Generally speaking, the extent of damage would vary depending on the relative speed of both ships. The less the relative speed, the less the extent of damage will be. Therefore, when two barges encounter one another, one ship should stop and allow the other to pass at a lower speed. Another option is to make a special zone as turnout for ships.

Usually the vessels for Cairo from Alexandria are fully loaded, while the vessels for Alexandria are loaded with empty containers. When a light ship collides into a mooring heavy ship, the damage to cargo and crew on board is slight compared to the damage that occurs when a heavy vessel collides with a mooring light vessel.

In addition, it is said that the ships going down the water way do not easy steerage, which makes it difficult for these ships to stop or to stand aside. Therefore, it would make sense for barges bound for Cairo to stop and allow barges bound for Alexandria to pass.

Some might argue, however, that barges bound for Alexandria should stop and allow barges bound for Cairo to pass from the viewpoint that cargo should be delivered to consignees as soon as possible. However, total loss time by stopping during a round trip is the same amount for every container barge, and thus priority should be given to safety.

11)-3 Barge to Barge Communication

As mentioned above, by knowing the location of approaching barges, ship operators will be able to make appropriate adjustments for crossing in a timely manner. Therefore communication devices are needed on the barges. As maritime communication systems on coastal going vessels, international VHF radiotelephones or cellular phones are widely utilized throughout the world. However, VHF communication systems are not only expensive but their communication range is very small as well. Therefore, VHF communication systems are not suitable for this IWT project. Cellular phones, on the other hand, are already widely prevailing in Egypt and can be used for communication between Cairo and Alexandria. Therefore, a cellular phone is suitable for not only barge-to-barge communication but can also be used to contact Cairo headquarters/Alexandria container terminals should a problem arise. Cellular phones should thus be mandatory for all container-carrying barges.

(3) Extension of Small Maritime Lock

In the master plan (Chapter 11.3.2 (3)), the extension of small maritime lock are taken up as one of the projects in the Study. This project is a comprehensive solution to existing constraint, which is an inadequacy of locks' chamber length to accommodate twin-units, due to the insufficient dimension of lock itself and due to the shortage of the air clearance under the bridge.

At first, this sub-section summarizes the necessity and urgency of this project for the year 2010, and secondary outlines the project profiles.

➢ **Necessity and Urgency of the Extension Projects**

(Necessity)

In the short-term development plan, it is proposed that small maritime lock be extended for going into service of new-single barge from the following aspects.

The study proposed that efficient transport of target cargoes have a great importance of IWT sector. Moreover, containers cargoes are expected to be one of the majority commodities of such target cargoes and sawn timber is also chosen as target cargoes.

In addition, the study examined that such containers and bulk transportation by new-single type barge (length of 100 m, width of 12 m) will be most economical and efficient than other types (see Chapter 11.2).

Regarding such containers and timber transportation by barges, existing maritime locks have the following constraints:

♣ Small Maritime Lock (existing)	:	Chamber length to accommodate barge is only 55 m. All twin-units type needs uncoupling/re-coupling operation, at the upper and lower stream of the lock. It is not passable for new single barge
♣ Big Maritime Lock (existing)	:	Chamber length to accommodate laden barges with high stack is restricted to only 65 m, although its length for barge with low height is about 102 m. Twin-units type with high stack needs uncoupling/re-coupling operation, at the upper and lower stream of the lock. It is not passable for new single barge with high stack.

Thus, existing maritime locks have constraints on efficient operations of twin-units, and will hinder new single barge from its passing.

In order to achieve most efficient and economical transportation by new single barge, it is essential to extend small Maritime Lock. Needless to say, twin-units with high stack can avoid the uncoupling/ re-coupling operation when its lock is extended.

(Urgency)

As quoted from chapter 10, cargo volumes and barges (units) to be passed through Maritime Lock in 2010 are shown in the following table. Table 13.2.4 indicates cargo volumes by barges with high stack, and barges laden with low height, respectively.

Table 13.2.4 Number of Passing Barges (Units) through Maritime Lock in 2010

Height(*) of laden baeges (Units)		Cargo Volume Allocated to IWT (2010)	Number (**) of Units per year
High Stack Cargo	Container (Up-stream)	60 '000TEU	683
	Container (Down-stream)	60 '000TEU	683
	Timber (Up-stram)	101 '000MT	85
Low Stack Cargo	Sub-total (Up-stream)	1,303 '000MT	1,156
	Sub-total (Down-stream)	795 '000MT	1,070
	Total number of units per year (Up-stream)		2,994
	Total number of units per year (Down-stream)		2,994

Note: (*) "High Stack Cargo" is defined as height of laden units being more than 3.5 m.

(**) Refer to Appendix-13.2 for detail

The forecasted traffic volume in 2010 is annually 60 hundred units from/to the Greater Alexandria Port, and this forecast is approximately twice or three times as many as existing traffic volume through Alexandria/Cairo IW. Among others, it is estimated that the number of laden units with high stack amounts to over 14 hundred units annually (see Table 13.2.4).

It is assumed that such high stack cargoes are likely transported by twin-units (barges), without this extension project. However, in this case, above-mentioned high stack twin-units should need uncoupling/re-coupling operations, and operations of tug-boat also will be required for the towing a dumb barge. Needless to say, these twin-units with high stack will be forced to operate above superfluous works into the drastic increase in other barges with low height such as dry bulk barges.

On the other hand, it is no easy matter to permanently provide water areas for such time-consuming operations because water areas adjacent to the Maritime Lock are narrow and limited. Therefore, there is a strong possibility that such twin-units operation will reach to the limit sooner or later within the target period of 2010, in consideration of the increase in traffic volume and the efficiency of barge transportation through this Alexandria/Cairo IW. In the light of the above aspects, it is essential to extend the small Maritime Lock immediately.

➢ **Project Description**

As described in the master plan, offshore extension of the small Maritime Lock is proposed in consideration of the avoidance of the limitation of air clearance under bridge when entering lock.

In the short-term plan, it is proposed that designed chamber size meets the standards of a first-class waterway, namely effective chamber length to accommodate barges is more than 102 m, and its width is 16 m. The later section 13.5 indicates engineering study including structural design, construction work schedule and cost estimation.

13.2.3 Lock Operation (24-hour Operation)

(1) Responsibility for Lock control from MWRI to RTA

At present there are 13 Locks (including those under construction) in Noubaria, Beheira Canal and Damietta Branch.

Among them MWRI controls 3 Locks. To control all canals in uniform manner, the 3 locks now operated by MWRI should be placed under control of RTA.

In addition, it is essential that all locks be equipped with communication systems to enable communication with passing barges.

(2) 24-hour Lock Operation

To facilitate 24-hour lock operation, RTA should organize a three-shift system.

To introduce a three-shift system, an additional 140 workers are required.

The Study Team recommends Headquarters' staff would be transferred to the lock offices of local branches.

To put it concretely it could fill up supplements for retired persons gradually within after 10 years.

13.3 Ather El Nabi Public River Port

13.3.1 Project Description

(1) Cargo Throughput and Calling Barges for Short-term Development Plan

Ather El Nabi public river port should handle all containers and general cargoes. Cargo volumes and number of calling barges to be handled at the port in 2010 are shown in Table 13.3.1-2.

Table 13.3.1 Cargo Throughput at Ather El Nabi Public Port in 2010

Unit: 000MT

Cargo Item \ Sea Port		Greater Alexandria		Damietta	Total
		Alexandria	Dekheila		
Inbound	Timber	103	—	25	128
	Cement	89	—	—	89
	Iron/Steel Products	52	—	—	52
	Containers (000 TEUs)	20	40	9	69
Outbound	Containers (000 TEUs)	20	40	9	69
Total	General Cargo	244	—	25	269
	Containers (000 TEUs)	40	80	17	137

Table 13.3.2 Number of Calling Barges at Ather El Nabi Public Port in 2010

Cargo Item \ Sea Port		Cargo Volume per Barge	Greater Alexandria		Damietta	Total
			Alexandria	Dekheila		
Inbound	Timber	1,378 (MT/barge)	75	—	19	94
	Cement	1,378 (MT/barge)	65	—	—	65
	Iron/Steel Products	1,378 (MT/barge)	38	—	—	38
	Containers	96 (TEU/barge) (88 for Dekheila)	209	455	94	758
Outbound	Containers	ditto	209	455	94	758
Total	General Cargo	1,378 (MT/barge)	178	—	19	197
	Containers	96 (TEU/barge) (88 for Dekheila)	209	455	94	758

(2) Required Port Facilities for Short-term Development Plan

1) Container Terminal

a) Required Dimensions of Berths

The required dimensions of the container berth are 115m in length and 1.8m in depth.

b) Required Number of Berths

The required number of container berths in 2010 is calculated to be one (1) (See Appendix-XI).

In addition to the loading/unloading berths, a berth for a waiting barge is required for navigation safety and efficient cargo handling. Therefore 2 berths, whose total quay length is 230m, are required in 2010.

c) Required Number of Container Stacking Ground Slots

Total required number of ground slots is shown in Table 13.3.3 (See Appendix-XI).

Table 13.3.3 Total Required Number of Ground Slots

Container Status	Required Number of Ground Slots (TEU)
Inbound Container Stacking Slots	320
Outbound Container Stacking Slots	202
Empty Container Stacking Slots	157
Total Required Number of Ground Slots	679

d) Required Container Terminal Area

The average required terminal area for one ground slot is assumed to be 70 m2. Based on this assumption, required container terminal area for 679 TEUs ground slots is estimated to be around 5 ha.

e) Required Area of Container Freight Station (CFS)

Required area of container freight station (CFS) is calculated at 3,000 m2 (See Appendix-XI).

2) **General Cargo Terminal**

a) Required Dimensions of Berths

The required dimensions of the general cargo berth are 115m in length and 1.8m in depth.

b) Required Number of Berths

The required number of general cargo berths is calculated to be two (2) (See Appendix-XI).

Since berth occupancy ratio of general cargo berths is estimated at 45%, an additional berth for a waiting barge is not required. Therefore 2 berths, whose total quay length is 230m, are required in 2010.

c) Required Areas of Sheds and Open Yard

Required areas of sheds and open yard are calculated at 2,700 m2 and 6,000 m2 respectively (See Appendix-XI).

(3) Required Cargo Handling Equipment for Short-term Development Plan

1) Container Terminal

a) Quay Side Crane

The required number of quay side movable cranes for handling containers is calculated at two (2) (See Appendix-XI).

b) Rubber Tire Mounted Gantry Crane (RTG)

The required number of RTGs is calculated at 5 units on the assumption that containers loading/unloading will be stacked once in the marshalling yard (See Appendix-XI).

c) Prime Mover (Tractor / Trailer)

The required number of yard tractor-trailers is calculated at 6 units (See Appendix-XI).

2) General Cargo Terminal

a) Quay Side Crane

The required number of truck cranes in total is 4 units (2 cranes x 2 berths).

b) Forklifts

The required number of forklifts is calculated at 8 units (See Appendix-XI).

(4) Summary of Required Facilities and Equipment for Short-term Development Plan

The required facilities and equipment for a public river port in 2010 are summarized in the following table.

Table 13.3.4 Summary of Required Facilities and Equipment for Short-term Development Plan

Container Terminal (Terminal Area : 5ha)	
Berth	2 Berths (Length 230m ; Depth 1.8m)
Container Yard (TEUs)	Ground Slots 679 TEUs (Inbound / Outbound 522 ; Empty 157)
Quay Side Equipment	Movable Crane [2]
Cargo Handling Equipment	RTG [5], Tractor and Trailer [6], etc
Other Facilities	CFS (3,000m2), Administration Building, Maintenance Shop, Gate, etc.
General Cargo Terminal (Terminal Area : 1.5ha)	
Berth	2 Berths (Length 230m ; Depth 1.8m)
Storage Facilities	Shed (2,700m2), Open Yard (6,000m2)
Quay Side Equipment	Truck Crane [4]
Cargo Handling Equipment	Forklift [8] etc.

Note) [number]

(5) Layout Plan of Ather El Nabi Port

The northern area of RTA owned land from Monib Bridge, which is the site of the container terminal planned by RTA, is around 8ha. This area can provide the required land of 6.5ha for the short-term development plan. Most part of the existing quay is also included in this area. Therefore, this area is proposed for the initial development site.

In the master plan, this whole area will be dedicated to the container terminal in order to cater for the increased container cargo volume. Therefore, the general cargo terminal should be moved in the long-term. For planning of the layout of the port facilities in the short-term, it must be taken into consideration that the general cargo terminal facilities in the short-term are to be converted into part of the container terminal in the future. The general cargo berths are to be converted into container berths, while the shed is to be converted into CFS.

The layout plan for short-term development is shown in Fig. 13.3.1.1

(6) Navigation Facilities

Branch Canal should be used under one-way traffic towards upstream (entering from the northern end and leaving from the southern end) for the easiness of maneuvering of the barges and stability of mooring barges.

The waterway in the canal must be dredged to maintain a depth of 1.8m under the lowest water level with 24 meters width, which is required for one-way navigation of the 12 m wide barges. In front of the berths, 35 meters width is required including the mooring barge space. At the north bend, the width of the waterway should be increased up to 35 - 40 m for smooth and safe maneuvering of the barges.

The proper navigation aid facilities at both ends of the canal and columns of the bridges should be installed for navigation safety. Fenders for the columns at the bridge of the northern end may be required.

(7) Access Road

Main roads for Ather El Nabi Port are Cornish El Nile Street and Ring Road. Since the gate of the port is planned at the north-east corner of the site, the port area would be connected with Agriculture Maadi Road. While the access from/to Cornish El Nile Street is basically smooth, the access from/to Ring Road is not convenient and smooth under the existing ramp location. Moreover general traffic volume in this area is already large. It is required to establish an effective road network in this area to accommodate both port related and general traffic.

In order to improve the access condition, in particular approaching Ring Road, and to separate port related and general traffic, development of direct flyover connection to Ring Road and a new access road connecting with Cornish El Nile Street near the southern end of the Branch Canal should be considered.

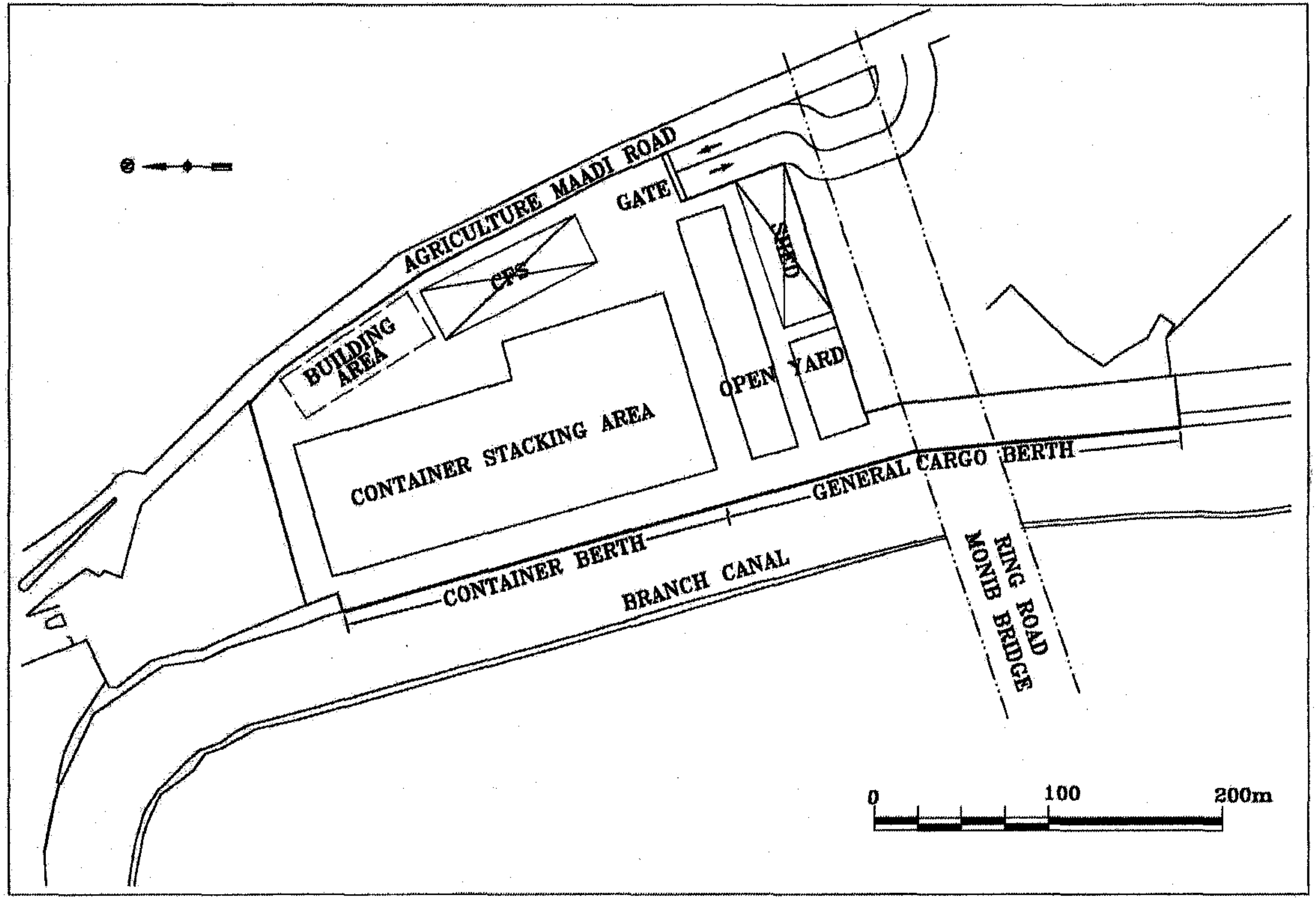


Figure13.3.1 Layout Plan of Ather El Nabi Port

13.3.2 Terminal Operation

(1) Operation System

Table 13.3.5 Comparison of Operation Systems

System	Superstructure		Maintenance		Operation	
	RTA	Private	RTA	Private	RTA	Private
RTA direct Operation	*		*		*	
Entrust to Private corp.	*		*		*	
Lease to Private corp.	*		*	*		*
Concession Contract		*		*		*

In the first three operation systems (RTA direct operation, Entrust to private operator and Lease to private operator) in the above table, a severe strain would be placed on RTA's finances. Furthermore RTA does not have the know-how to effectively operate a container terminal. Therefore it is thought that the "Concession method" is the best way for terminal operations to be conducted at Ather El Nabi Port.

Under a concession contract, private companies are able to operate a terminal independently and efficiently, and as they also bear responsibility for superstructure and maintenance, the financial burden of the government would be greatly reduced.

A concession is the grant of specific privileges by RTA (Government). The concession system has been the backbone of port operations in a number of countries. Concessions have been generally successful if only because their main advantage is that governments relieve the financials of the grantor. Either the concessionaire pre-finances the whole operation, operates and maintains the facilities and recovers its investments through tariffs, or it sets asides all reserves necessary for the replacement of facilities and equipment included in the concession.

A second benefit from concessions is that they establish a strong legal relation between grantor and concessionaire with candidates for concessions being carefully screened and pre-selected.

(2) Responsibility for the facilities

Sector	Classification	Facilities
RTA	Infrastructure	Quay, Yard Pavement, Dredging Canal, Access Road, Utility Supply, Navigation Aids
Private Operator	Superstructure	Terminal Buildings, Fence and Gate, Cargo Handling Equipment

(3) Operation time 24 hours

(4) Operator

It is desirable that a single operator should manage both the Container Terminal and General Cargo Terminal from the point of view of efficient land use.

However plural operators may be acceptable provided conditions are profitable.

13.4 New Bolin Canal Project

13.4.1 Project Components

In the conceptual plan, one of the key strategies is to capitalize on its advantage in the field of "long-haul transport". Especially, improvements of "long distance route" between the Valley area and the Delta area, that will serve to step up efforts to transport cargoes economically from the Upper Egypt to industrial areas in the Delta.

The master plan proposes the construction of new canal linking Beheiry canal and Rosseta Branch. This new navigation route makes it possible to transport materials directly from Upper Egypt to Central Delta as well as directly connecting Central Delta and Alexandria Port with IW. This also makes it possible to exploit one of the advantages of barges, namely "long-haul transport".

In the master plan, it is proposed that this project should include construction works of new lock and barrage, excavation of existing spillway from Beheiry canal to Rosetta Branch and other required works.

In the short-term plan, firstly, project profiles for 2010 are summarized in this sub-section, and the later section 13.5 indicates engineering study including structural design, construction work schedule and cost estimation.

13.4.2 Project Description

At first, passing barges (units) are assumed in order to examine size of related facilities. As quoted from chapter 10, cargo volumes and barges (units) to be passed through proposed new Bolin lock in 2010 are shown in the following table. Figure 13.4.1 and Table 13.4.1 indicates cargo volumes by transportation route by commodities, respectively.

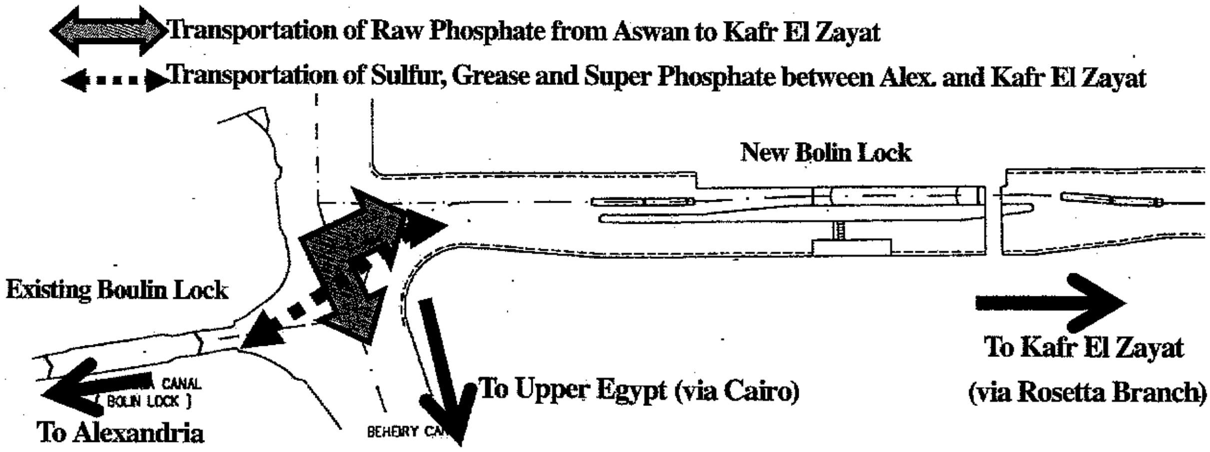


Figure 13.4.1 Illustration Map of Transportation Route through New Bolin Canal & New Lock

Table 13.4.1 Number of Passing Barges (Units) through New Bolin Lock in 2010

IW Route		Cargo Item	Cargo Volume Allocated to IWT (2010)	Number of Barges (units) (Cargo volume per barge)	(Number of barges per year)
Down-stream (Upper Egypt to Kafr El Zayat)		Raw Phosphate	258 '000MT	/430 MT (or 714 MT)=	600 (362)
Up-stream	(between Alexandria and Kafr El Zayat)	Sulfur	103 '000MT	/430 MT (or 714 MT)=	240 (145)
		Grease	26 '000MT	/430 MT (or 714 MT)=	61 (37)
Down-stream		Super Phosphate	102 '000MT	/430 MT (or 714 MT)=	238 (143)
		Total number of units per year		(Up-stream)	1,139 (687)
		Total number of units per year		(Down-stream)	1,139 (687)

*Figures in parentheses are the number of units by 714 MT barge

In the short-term plan, it is assumed that small-sized self propelled barge (approx. 450 DWT) or existing-sized twin-unit (approx. 750 DWT) will enter services in this transport route, namely larger-sized new barge be not commissioned between Upper Egypt and the central Delta, on condition that improvements of IW in Middle/Upper Nile would not be completed within the target year 2010.

➢ New Canal

In this sub-section, prime conditions such as facilities' requirements are summarized, and engineering study including structural design, construction work schedule and cost estimation are indicated in the later section 13.5.

As mentioned previously, the size of passing barge is assumed as follows:

- Small-sized self propelled barge; length of 40 to 45 m, width of 7 to 7.5 m and draft of 1.6 to 1.8m.
- Existing-sized twin-unit ; length of 100 m, width of 7.5 m and draft of 1.6 to 1.8m.

According to above perspective on the barge size, primary requirements are estimated as follows:

- Depth and Width; Water Depth is designed at 2.3 m under LWL on the basis of required keel clearance (KC) = 50 cm. Because current velocity is expected to be larger than Noubaria canal in consideration of a maximum discharge water.

  Fairway width is designed at 35 m corresponding to larger-sized new barge (beam of 12 m) beyond 2010. Because excavation/dredging works of existing spillway need land acquisition and bank protection works.

- Width of bend; Fairway width of the bends at junction of Baheria and new Boulin canals and at junction of Rosseta branch side are more than 60 m.

- Waiting (berthing) spaces: Waiting spaces are provided at the upper and lower stream of the new lock. The length of its spaces is 150 m to accommodate one twin-unit or one larger-sized new barge

- **New Lock**

In the short-term plan, it is proposed that designed chamber size meets the standards of a first-class waterway, namely effective chamber length to accommodate barges is more than 102 m, and its width is 17 m. Here, width of chamber is designed at 17 m despite of its width of 16 m in Alexandria /Cairo IW. Because this proposed lock is expected to be a key infrastructure both in Alex./Central Delta route and Upper Egypt/Central Delta Route, and improvements of locks in Upper Egypt are steadily progressing and its width are uniformed at 17 m except for Asyut Lock.

- **Dredging of Rosetta Branch**
  - Depth and Width; Water Depth is designed at 2.3 m under LWL on the basis of required keel clearance (KC) = 50 cm. Its design depth and KC of "Damietta Project" are applied similarly to Rosetta Branch.

    Fairway width is designed at 25 m corresponding to existing barge with width of 7.5 m.

Here, the short-term plan proposes that first stage should carried out initial dredging in order to secure IW width of 25 m, and its width is approximately corresponding to 3 times B (Beam of barge). Future widening along Rosetta IW will be examined or determined taking account of sedimentation records and users needs in future.

13.5 Basic Design and Cost Estimate for Short Term development Plan

13.5.1 Project Components for Short Term Development

The projects proposed in the master plan for Improvement of Inland Waterway System for the year 2020 are given the priority to be implemented in the short term development plan for the target year 2010 as discussed in the previous Sub-Chapter. This section presents the engineering studies and cost estimate thereon for implementation.

Project Component A: Alexandria/Cairo IW Project, including
A1-Improvement of IW by Dredging and Bank Protection
A2-Navigation Aids System along Canals from Alexandria to Cairo
A3-Extension of Alexandria Maritime Lock
Project Component B: Ather El Nabi Public River Port Project, including
B1-Container & General Cargo Terminal
B2-Procurement of Cargo Handling Equipment
Project Component C: New Bolin Canal Project, including
- New Bolin Canal
- Improvement of Rosetta Branch by Dredging

13.5.2 Basic Design of Each Project Components

(1) Design Principle

1) Code of Design

In principle, the Egyptian design codes of practice are purposed to provide a basis for comprehensive understanding for carrying out investigation and design. The design of structures depends upon designer's professional judgment and such design codes of practice in developed countries as European countries or United States are equally applied in most cases in designing structures in Egypt. In considering these currently prevailing situations of design practice in Egypt, the basic design for Inland Waterway Transport facilities proposed in this study will be done on the basis of Japanese design and construction standards since these are deemed equivalent to one of the codes of practice internationally recognized.

2) Service Life of Construction Components

Among others factors related to design of facilities are the service life of construction component and works, for which the following service life in common practice will be taken into account for designing the project components:

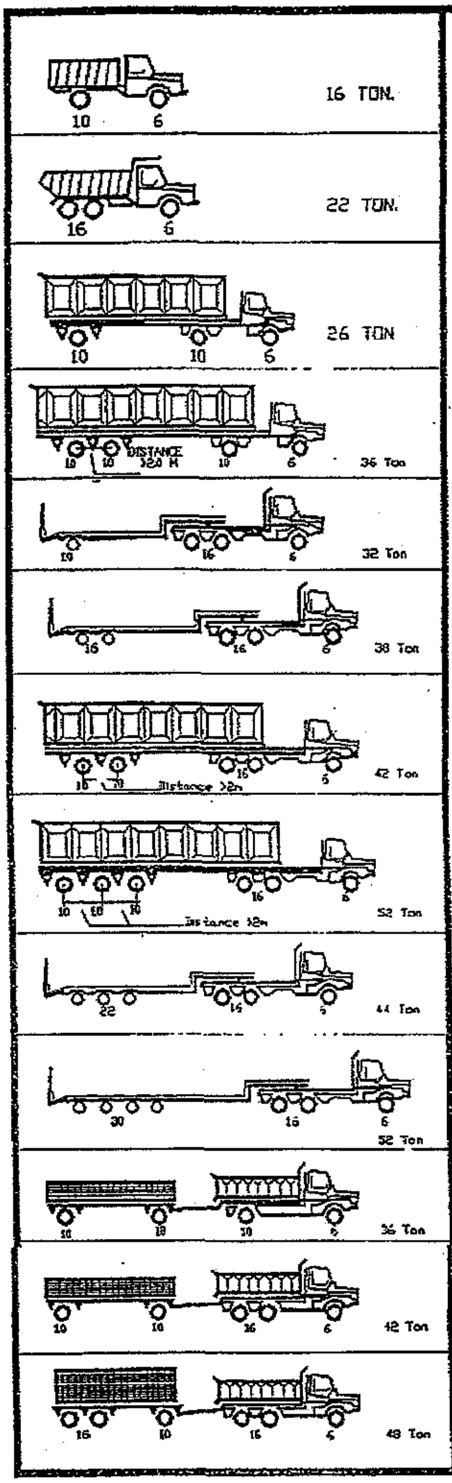
Work Categories	Service Life (Years)
Civil Works	
- Irrigation Facility:	75
- Navigation Lock:	50
- Navigation Aids Facility:	30
- Port Facility	50
ME Equipment for Lock & Barrage:	30
Cargo Handling Equipment	
- Major Equipment	20
- Minor Equipment	10

3) Design Load of Common Types of Truck and Trailer

Inland waterway cargo transportation will be properly connected with terminal seaports or river ports for unloading from or loading onto barges. A factor that is decisive in designing port structures is live load intensity such as those of mobile trailer trucks or other cargo handling equipment, etc. Among others, cargo loads will be determined based on the planning requirements how cargo handling operation will be carried out at proposed port for loading/unloading cargo operation at quayside, cargo transfer and stocking at back-of-port yard.

Table 13.5.1 shows common categories of truck and trailer truck, of which loads will be mostly expected to apply at port terminal yard and transportation road.

Table 13.5.1 Truck and Trailer Loads



Instructions

1-Load on The Front Single Axle 6 Ton
Load on The Rear Single Axle 10Ton , on Condition That The Axle Must be Consisted of 4 Tires

2-Load on The Front Single Axle For Trailer 10 Ton on Condition That The Axle Must be Cosisted of 4 Tires

3-Equivalent Load on The Narrow Double Axle 16Ton on Condition That Every Axle Must be Consisted of 4Tires And The Distance between two Axles< 2m

4- Equivalent Load on The wide Axle = 10 Tons for axle on Condition That The every Axle must be Consisted of 4 Tires and The Distance between two Axle > 2m

5- Equivalent Load on Treble Axle (narrow)= 22 Ton On condition that the every axle must be consisted of 4 tires

6- The permisible allowance of transported weight is within 10 % for all kinds of vehicles .

7- The width of vehicle does not exceed 2.60 m

8- The length of vehicle does not exceed the following lengths :-
- For vehicles have two axles or more ≯ 12 m
- For semi trailler ≯ 18 m
- For truck with trailler ≯ 20 m

9- The maximum height of vehicle including loads does not exceed 4m from the ground surface and the clearance between the bottom of vehicle and ground surface does not less 28 Cm .

Source: General Authority for Roads, Bridges & Inland Transport

(2) Basic Design Criteria

Design criteria for inland waterway transport facilities are generally discussed in Chapter 11: Master Plan on Inland Waterway System in the Nile Delta for the year 2020, and the same criteria will be equally applicable to this basic design for the facilities proposed in the short term development plan as follows:

Objective Barge:	present twin-ship unit of 102 m long, 7.5m wide and 1.8 m draft (In due consideration of new barge of 12 m wide & 100 m long)
Canal:	35 m width, minimum 2.3 m water depth and 6 m air clearance (except for Rosetta Branch navigable waterway which is only used by present twin-ship unit of 102 m long, 7.5m wide and 1.8 m draft so far)
Nobaria Canal:	35 m width, minimum 2.0 m water depth for Dredging
New Lock:	116 m long, 17 m width, 2.3 m water draft (except for expansion of existing Small Maleh Lock at Alexandria having 116m long x16m width)

(3) Project Component A: Alexandria/Cairo IW Project

1) Dredging and Bank Protection

Basically, a continuous bank protection will be unnecessary for Nobaria canal although some minor bank erosion, which should be covered under OM expenses, is anticipated. But, some canal sections at the upstream stretch of Nahda lock shows physical constraint in its width for deepening and widening canal section by dredging work. Proposed dimensions of canal dredging are:

Width: 35m at level of canal bottom
Water Draft: 2.0m under minimum water level
Side Slope for dredging: 1 vertical to 2 horizontal

Where the canal section indicates physical constraints in suitably providing the above side slope for dredging due to narrowness of the existing canal width, a bank protection is provided in line with the dredging work. Appendix 13-1 presents the cross sections of canal indicating proposed dredging and bank protection profiles at 1 km interval along Beheiry/Nobaria canal. The dredging volume and the length of bank protection estimated herein is summarized as follows:

Dredging & Bank Protection Along Beheiry/Nobaria Canal

Sector	Distance from Qunatar Lock (km)	Dredging (cu.m)	Bank Protection (lin.m)
Sector 1	0-41	0	0
Sector 2	42-80	0	0
Sector 3	81-108	0	0
Sector 4	109-138	9,947	0
Sector 5	139 – 178	250,768	19,000
Sector 6	178 – 200	94,695	2,000
Total		355,410	21,000

The bank protection is recommended to extend to the bottom level of navigable water depth 2 m measured from minimum water level along the canal so as to preclude possible future undermining. The proposed type of bank protection is a wall in slope 1: 0.5 protected by grouted stones placed upon bedding stone layer. The site works include temporary dikes for dewatering the area where a series of such site works for bank protection as excavation of riverbed, placing of stones and/or mortal stabilization onto bedding stone layer are carried out.

Typical section profiles of canal dredging together with bank protection are presented in Figure 13.5.2. Based on the same assumptions as given in the master plan, the annual amount of maintenance dredging will be roughly estimated 29,107 m3/year.

2) Navigation Aids

Various types of navigation beacons and traffic lights at bridges are provided as described in the previous sub-chapter.

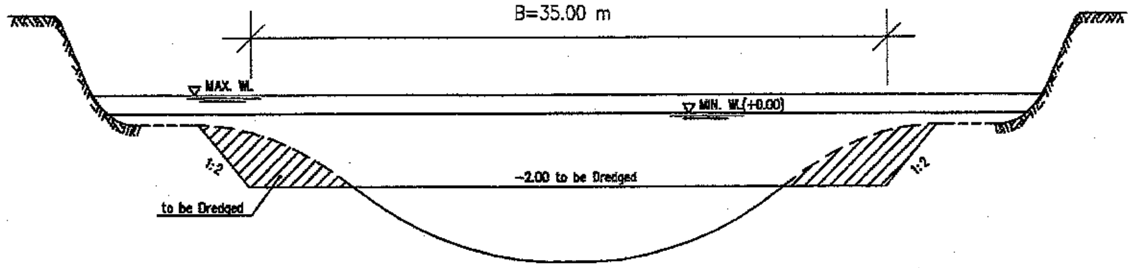
3) Extension of Alexandria Maritime Lock

The small Maleh lock is extended offshore to provide sufficient lock chamber length of 116 m in order for present twin unit barge of 102m long, 7.5 m wide and 1.8m draft or one unit of proposed new barge of wider beam to pass this lock with sufficient vertical air clearance. The present type of lock structures and gate operation system will be applied for offshore extension work.

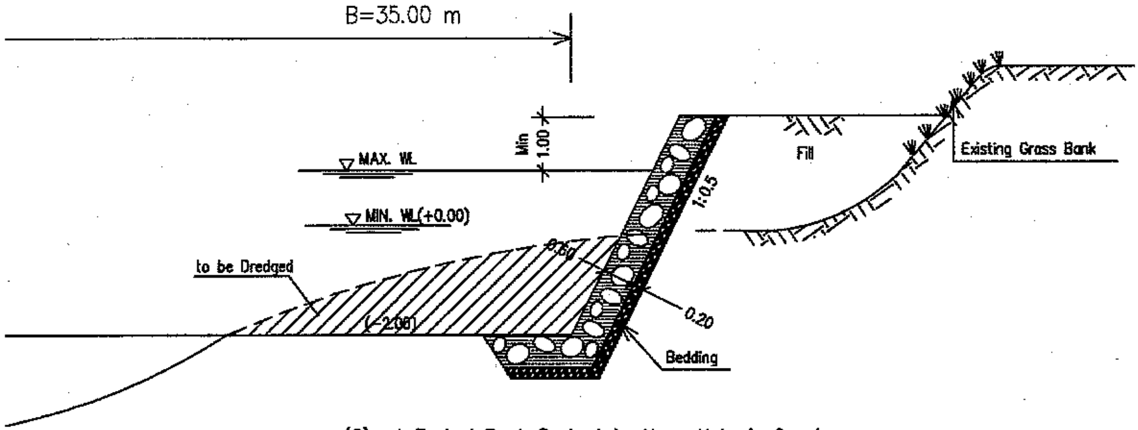
In order to extend offshore, the portion of seaside lock head where the lock chamber bottom elevation is positioned at –3.00m at present must be completely demolished and is deepened to MSL -5.50m. New lock head will be constructed at the offshore tip of lock extension. The existing lock bed and the half of side vertical wall is demolished while the remaining side wall could function as a part of temporary shield wall during construction and, after completion, is united as a part of the new concrete.

The part of existing lock, which is subject to demolition work for extension, is shown in Figure 13.5.3 and the offshore extension of the lock is presented in Figure 13.5.4.

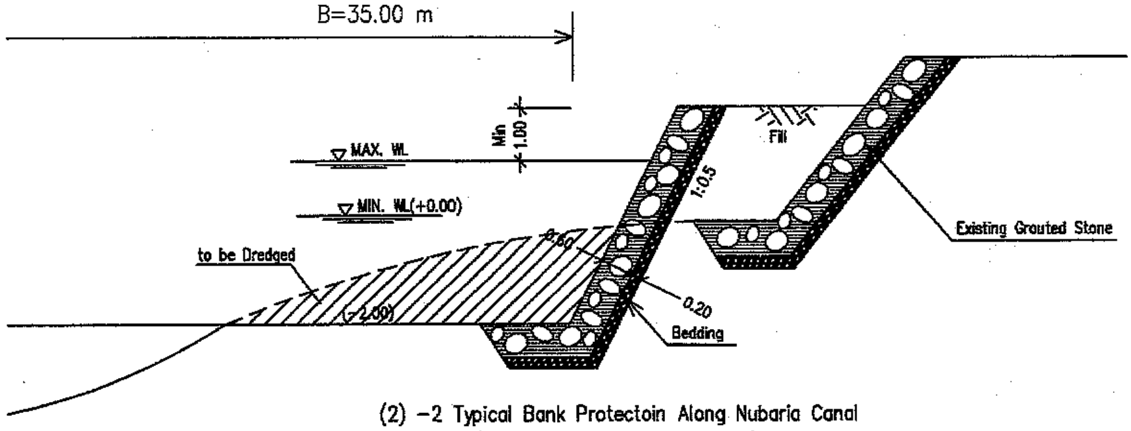
Subsoil investigation, which was carried out by the Study Team, shows that the subsoil at and around the existing lock consists of sand pieces formation of about 3 m thick from the elevation of about MSL–4 m till the depth -7m where very hard sandstone layer having more than 100 N value is encountered. The sand pieces layer contains silty clay interlayer and therefore shows low N value of 6 to 9 but the bottom of this layer indicates N value over 100. Although the site subsoil condition raises no serious problem for foundation of lock, the site excavation work required under the proposed lock and the piling construction for temporary shield wall for dewatering during lock construction must be carefully schemed.



(1) Typical Section of Dredging



(2) -1 Typical Bank Protectoin Along Nubaria Canal
(Non Existing Bank Protection)



(2) -2 Typical Bank Protectoin Along Nubaria Canal
(With Existing Bank Protection)

Figure 13.5.2 Typical Sections of Dredging and Bank Protection

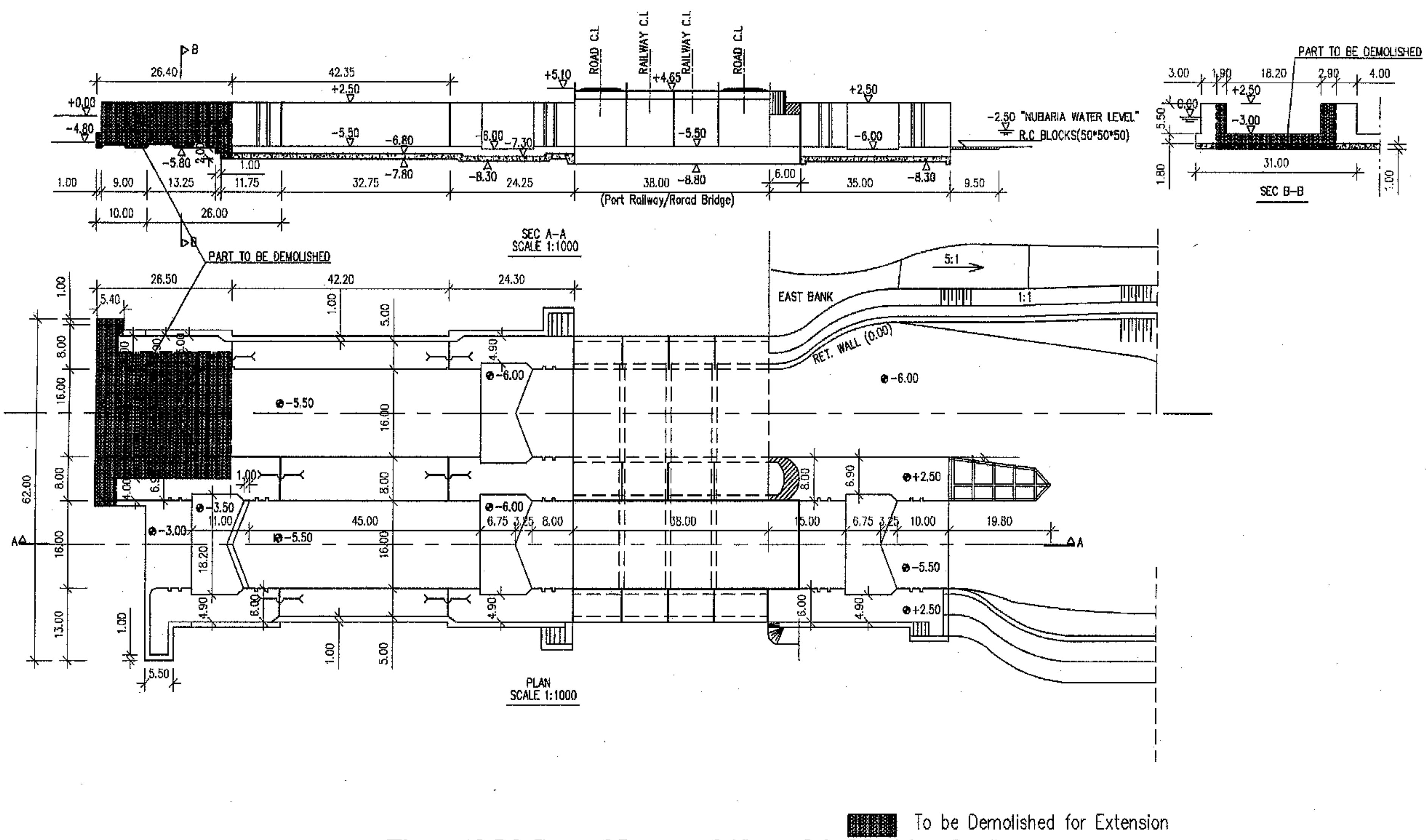


Figure 13.5.3 General Layout of Alexandria Maritime Lock

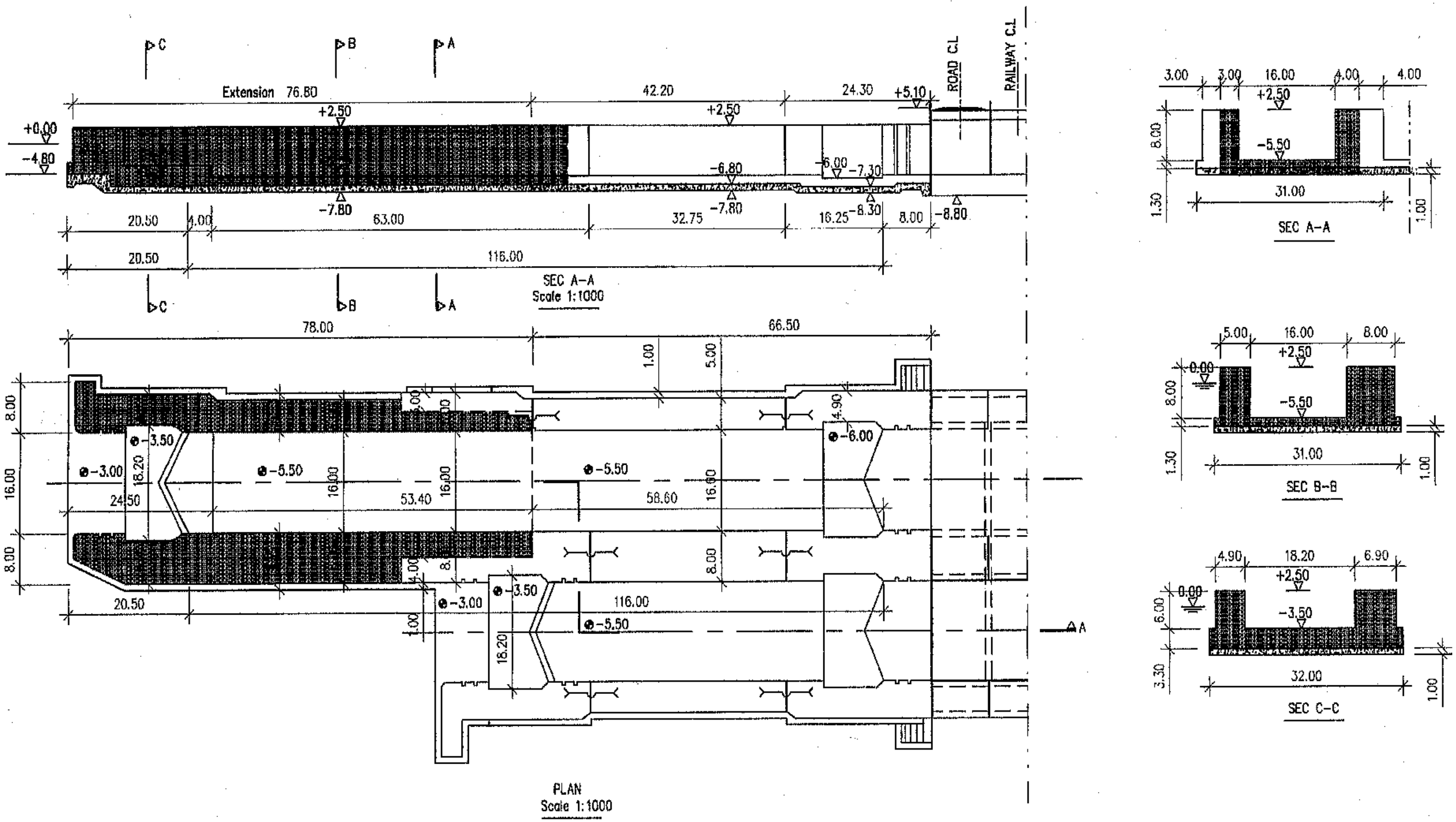


Figure 13.5.4 Extension of Alexandria Maritime (Small) Lock

4) Engineering Study

The water level along canals in Nile Delta area is entirely regulated through water discharges at barrages under control by MWRI. As a consequence, inland navigation waterway is interrupted in places by the existence of barrage/locks along the waterway. The locks along waterways result in loss of time due to time waiting and delays of barge operation for passing locks, all of which contribute to low overall operational efficiency of barges operation.

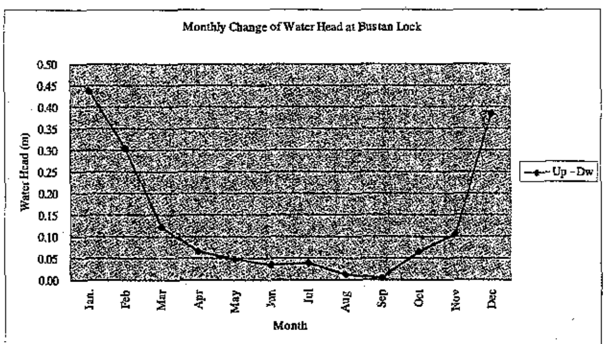
As regard the water draft along Nobaria Canal, the data obtained by the Study Team indicates the following important aspects:

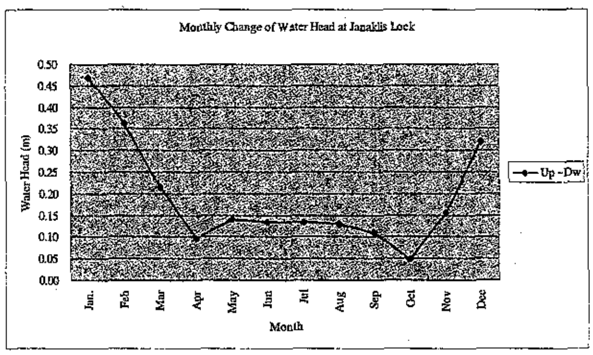
a) Nahda lock at 179 km shows quite high retaining water level.

b) Canal section upstream of Nahda lock show inadequate water draft around the year. The cross section survey conducted at 1 km interval along Beheiry/Nobaria canal indicate many shallow spots in Nobaria Canal at Sector 5 (139 km to 178 km between Janaklis and Nahda locks) and Section 6 (179 km to 200 km between Nahda and Alexandria end locks) during low water season.

c) There are 4 locks along Nobaria Canal and, among others, the retaining water level (the water level difference between up- and down-stream of lock) at km 108 (Bustan) lock and km 139 (Janaklis) lock indicates very small, which is about 0.1 to 0.4 m and 0.1 to 0.7 m, respectively based on the available data.

Retaining Water Height (Difference between Up- & Down-stream Average Water Level)at Bustan & Janaklis Locks





These above facts lead us to primary question if the existence of barrages for control of water discharge at these locations must be needed for irrigation. Therefore, it is recommended that a hydraulic study of Nobaria canal should be made at least along canal sections between the locks at 81 km and km 179 taking requirements for irrigation water expected at each intake and water levels etc. into account. Based on such study on hydraulic aspects of irrigation and navigation along this canal, future water control by barrages and in consequence a lock system for navigation should be reviewed in view of the number and location of locks in necessity, water levels at up-and down-stream of each lock for the whole year basis.

In line with the above hydraulic study, future renovation of Nahda lock should be investigated in order to improve the navigability of Sector 5 (139 to 178 km reach) in view of possible solution for shallow water level problem at the reach section by possible raising the upstream water level of Nahda lock.

Furthermore, as long as water draft problems exists along Nobaria canal, a safe and easy navigation on this waterway can only be guaranteed by means of recurrent dredging and navigation aids. Therefore, it should be investigated thoroughly how a permissible draft of 1.6 m or 1.8 m can be realized or maintained along Nobaria canal in combination with a regular sounding program in order to provide the basis for future maintenance dredging by section of each location. In this respect, in-depth and recent canal sounding data is not available except for data and information obtained by the Study Team at locks and along the canal, which was obtained in rough interval of 1 km.

The above sets of hydraulic studies and sounding survey for the canal are included in the engineering service cost as itemized in the following and should be implemented in close liaison with MWRI.

- Survey and Sounding for at least 30 km long upstream section of Nahda Lock
- Hydrological and Hydraulic Studies of Nobaria Canal
- Study and Detailed Design for Dredging & Bank Protection
- Tender Documents for Dredging and Bank Protection