Appendix 3-1 Site Surveys by the Study Team for Natural & Environmental Conditions

Appendix 5-I BIOLOGICAL SAMPLING RESULTS

Appendix 6-1 Discharge Volume from the Upper/Middle Nile

Appendix 6-2 fluctuation of water depth along the Beheiry/Nobaria Canal

Appendix 6-3 Monthly Discharge Volume from Bolin Barrage into Nobaria Canal

Appendix 6-4 Water Distribution Network in Nobaria Canal

Appendix 6-5 Discharge Condition into the Damietta Branch

Appendix 6-6 Discharge Conditions to Ismailia canal the basis of MWRI Program II

Appendix 3-1 Site Surveys by the Study Team for Natural & Environmental Conditions

During the 1st Field Study period in Egypt from December 2001 to March 2002, the following field surveys were carried out in order to obtain basic data on natural and environmental conditions for the prospective sites for projects that will be envisaged in the later stage of this study.

- Cross Sectional Sounding Survey at Upper Nile River between Asyut and Cairo (under subletting to Nile Research Institute)
- Site Survey at Nobaria and Beheiry Canal Junction (under subletting to Arab Consulting Engineers)
- Site Survey along Nobaria and Beheiry Canals from Cairo to Alexandria (under subletting to Arab Consulting Engineers)
- Site Survey at & around the Maritime Lock in the Port of Alexandria (under subletting to Egyp Consult)

The details of each site survey work are presented as the following.

1. Cross Sectional Sounding Survey at Upper Nile River

The cross sectional sounding survey was conducted at 30 locations within 330km in the upper River Nile between Cairo and Asyut. The scope of survey work comprises of the following.

A1: Reference Line Survey (1,000 m length along Nile River)	30 areas
A2: Cross Sectional Survey & Sounding of Nile River	
(6 transverse lines of 1,000 m width/area, 30 areas)	180 km
A3: Survey Mapping	30 sheets

(1) Location of Surveys

The 30 locations to be surveyed in this site work were selected in cooperation with RTA based on identification of sites for deepening shallow water area by dredging in future in order to eliminate bottlenecks in waterways for navigation along Upper Nile River between Asyut and Cairo

Each survey location for about 1km wide selected for cross section sounding was assigned by RTA counterpart on available Nile River maps in a scale of 1 to 10,000 prepared in 1981 and checked with distance from High Aswan Dam (HAD) and El-Rodah Gauge Station in Cairo as follows:

Location of Cross Sectional Survey at Upper River Nile

No	Site Location	Site Distance in Km	
		HAD	El-Rodah
S01	El-Nekheela	516.0	411.0
S02	Sakour	525.0	402.0
S03	Assuyt Lock	544.3	382.7
S04	El-Tawaberiah	551.0	376.0
S05	Baheeg Island	559.0	368.0
S06	Hassan Atiah	579.0	348.0
S07	Beni Shoukear	584.0	343.0
S08	El-Mandarah	612.0	315.0
S09	Nazlet El-Awamer	615.0	312.0
S10	Sawada	628.0	299.0
S11	El-Sheikh Nemr Island	656.0	271.0
S12	Beny Hasan El-Shorouk	661.0	266.0
S13	Beni Mohamed Sharawy	672.0	255.0
S14	El-Zawiah	681.0	246.0
S15	Damaries	689.0	238.0
S16	El-Bergay	693.0	234.0
S17	El-Beho	707.0	220.0
S18	Matay	725.0	202.0
S19	Beni Mazar	736.0	191.0
S20	Abu Azeez	738.0	189.0
S21	Sharouna Island	751.0	176.0
S22	Awlad El-Sheikh	758.0	169.0
S23	Zawiat El-Godamy	763.0	164.0
S24	Mahmoud Eweas	793.0	134.0
S25	El-Dawaba	806.0	121.0
S26	Beni Sueaf Bridge	808.0	119.0
S27	El-Alalmah	818.0	109.0
S28	El-Koreimat	838.0	089.0
S29	Soul	848.0	079.0
S30	El-Saaf	883.0	044.0

(2) Reference Line Survey

A reference point/line survey was executed within the framework of coordinates in the World Geodetic System 1984 (WGS84) for about 1 km long along Nile River to determine survey lines for sectional topographic and sounding survey across the River. The distance between each cross section survey line was set at approximately 200 m and in perpendicular to the water flow direction. Coordinates at each survey location were set up by using advanced and suitable technology through Differential Geographic Positioning System (DGPS).

Vertical control for the survey was referred and tied to the water level measurements at main Gauge Stations located along Nile River in a known accuracy of elevation. All the measurements were separately interpolated by distance according to the longitudinal water level line derived from the existing upstream and downstream records at the Gauge Stations during field measurements. The onshore levels measured at each cross section are represented in terms of levels referred to Mean Sea Level (MSL) of the Mediterranean Sea (Irrigation Scale Meter).

(3) Cross Sectional Survey & Sounding of Upper River Nile

Cross section and water depth sounding survey was carried out at 6 lines perpendicular to Nile River flow in basically 200 meters intervals for 1 km distance for each specified location. Each cross section profile of River Nile was surveyed to connect reference points provided at both banks of River Nile. The water depth soundings at water area were taken by echo sounder on-board to measure actual water depths within the specified area in a suitable accuracy.

In this cross section survey for Upper Nile River, the following water surface levels were defined:

1) Actual Water Level during field survey (WL), which depends on the location of survey area along the River Nile and flow discharge through the reach during the field survey.
2) High Water Level (HWL), which corresponds to maximum flow discharge that was recorded during past years.
3) Low Water Level (LWL), which corresponds to minimum flow discharge that was recorded during past years

Along the 4th Reach located between Delta Barrage in Cairo and Asyut, there exist eleven (11) numbers of main Gauge Stations where the water level measurement is carried out. Actual Water Level (WL) at each survey location was determined by interpolation of water levels by distance between those of the existing up- and down-stream main Gauge Stations (GS) during field survey measurements.

High or Low Water Level (HWL or LWL) at the survey site was determined from the available past maximum or minimum water level data at these Gauge Stations for 6 years period from 1995 to 2000 as well. The record on yearly maximum or minimum water flow discharges at these stations along the 4th Reach located between Asyut and Delta Barrages are 181 and 40 million m3/day respectively (equivalent to 2094.9 and 463 m3/sec respectively) which correspond to the maximum and minimum discharges of 270 and 60 million m3/day downstream of the High Aswan Dam as summarized in Table below.

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

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	—

High and Low Water Levels for each survey location corresponding maximum and minimum discharge were therefore determined through interpolating by distance of the survey site between up- and down-stream Gauge Station as follows. These High and Low Water Levels at each survey site obtained through this procedure of distance interpolation were indicated on each cross section map. All the water depths measured at each cross section were represented in terms of levels referred to Mean Sea Level (MSL) of the Mediterranean Sea (Irrigation Scale Meter) as indicated in the cross section map.

Estimated LWL & HWL at Survey Locations

No	Site Location	Water Level	
		LWL	HWL
S01	El-Nekheela	49.07	52.47
S02	Sakour	48.58	51.88
S03	Assuyt 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

The Low Water Level can be used to check available water depth for navigation of River Nile and, knowing the required water depth for safe navigation, the area and volume required for possible dredging can be calculated for each cross section.

(4) Survey Maps

The following maps/drawings were prepared to show the results of surveys.

- General Location Map of Survey Sites
- Location Map for Each Survey Site in scale of 1:50,000
- Map of Survey Plan: 30 sheets
- Cross Sections of River Nile: 30 sheets

2. Site Investigation at Nobaria and Beheiry Canal Junction

Field survey and investigation work was carried out at Bolin for proposed new connection canal between the Rosetta Branch and the junction between Beheiry/Nobaria canals in order collect such natural and environmental conditions as topographic features along the proposed site, geo-technical conditions, waterbed quality and water quality.

The scope of site survey comprises of the following.

B-1: Topographic Survey (250 m wide, 2,000 m long)	50 ha
B-2: Subsoil Investigation (3 onshore borings with Site and Laboratory Tests)	90 meters
B-3: Waterbed Quality Survey (Sampling and Laboratory Testing)	2 locations/6 samples
B-4: Water Quality Survey (Sampling and Laboratory Testing)	2 locations/2 samples

(1) Topographic Survey

Topographic survey was carried out at Bolin area to obtain a topographic feature along possible future canal of 1.2 km long to connect the existing canal with the Rosetta Branch of the Nile River to cover total area of 250 m width and 2,000m length. The framework of Egyptian National Survey Grid was adopted for determination of coordinates in horizontal control of the survey. Differential Global Positioning System (DGPS) was used to fix coordinates of 11 control points to be referred to the Grid. The succeeding traverse network survey or offset survey was conducted based on temporary control points to define locations and positions of survey spots and existing structures, etc. The accuracy of the traverse network reached 1:42,000 for traverse and 4 mm/km for datum network.

Vertical control for the survey was referred and tied to the water level measurements at Bolin Lock given by Irrigation Scale Meter. Irrigation Scale Meter is tied to the National Datum Line, which is equal to the Mean Sea Level (MSL) of the Mediterranean Sea.

A set of topographic maps was prepared at a scale 1:1,000 to cover the survey area as shown in Figure A3.1.2 (1). The area to be covered by the map was provided with indications of locations and positions of the Nile River, channel & canal, other manmade and natural visible features including lock, miter gates, buildings, bollards, existing roads and side walkways, land use or other such plane profiles on riverfront structures as riverbank, canal sidewall, etc.

(2) Subsoil Investigation

Three (3) onshore boring works were carried out along the proposed new connection canal, including in-situ Standard Penetration Tests (SPT), laboratory testing and analysis on the samples taken from bored boles. The objectives of the subsoil investigation are to characterize the site subsoil, to define geo-technical conditions relevant to foundation design and construction of new connection canal and lock.

The location of bore hole was set by applying Differential Global Positioning System (DGPS) to determine the points of coordinates to be referred to the Egyptian National Survey Grid and the ground elevation was measured and referred to MSL of the Mediterranean Sea.

Coordinates & Ground Elevation of Boring Location at Bolin

	Coordinates (Kilometer Grid)		Ground Elevation
	N	E	(+/-MSL)
BH No.1	889,241	591,915	+11.87
BH No.2	889,185	591,412	+11.54
BH No.2	889,275	590,878	+11.81

The site boring works were executed using mechanical rotary boring machines with ground level protection by use of 2 m long casing tube and bentonite mud till completion of boring operation. During boring operation at the Site, Standard Penetration Test (SPT) was executed at basically 1 m depth of boring to obtain numbers of blow per 30 cm of penetration at the site. All the boring works were executed up to 30 meters depth from the ground level.

Totally 45 subsoil samples consisting of disturbed samples (33 samples) by split sampler or relatively undisturbed clayey samples (12 samples) by thin-walled tube sampler were collected. Undisturbed samples were preserved from being disturbed or losing moisture according to ASTM-D1587-83 at the site and all the samples were transported to the laboratory in Cairo for testing. The physical tests on specific gravity, unit weight, moisture content and grain size analysis were conducted at the laboratory on the subsoil samples extracted from the bored holes.

Major profiles of subsoil conditions at the site with indication of laboratory test results are summarized as follows as shown in attached Figure herewith:

- Subsurface layer seems fill soil consisting of silty clay, fine sand and plant roots for about 2 m depth from the ground surface.
- About 4 to 8 m thick clay layer deposit exists under the subsurface layer, but this layer is medium stiff to hard silty clay of brown or yellowish brown color with some fine sands having SPT value ranging from 11 to 42 and 18 in average.
- Medium dense to dense fine silty sand layer deposit succeeds below the clay layer with gradual increase of N value to reach 50 at the depth of around 17 m.
- Each layer deposits in almost horizontal with no drastic change of profile along longitudinal direction of the new canal alignment. But, the thickness of upper clay layer is decreasing from the location of Borehole No.1 (near Rosetta Branch) towards Borehole No.3 (near junction of Beheiry and Nobaria Canals)

(3) Waterbed & Water Quality Survey

The waterbed soil and water quality survey and the subsequent analysis of the material quality were conducted to identify the soil/water contamination level at the canal and the Nile River area adjacent to the proposed new canal. The laboratory test analysis was done and the results of laboratory analysis on soil/water material are presented in the Chapter 5.

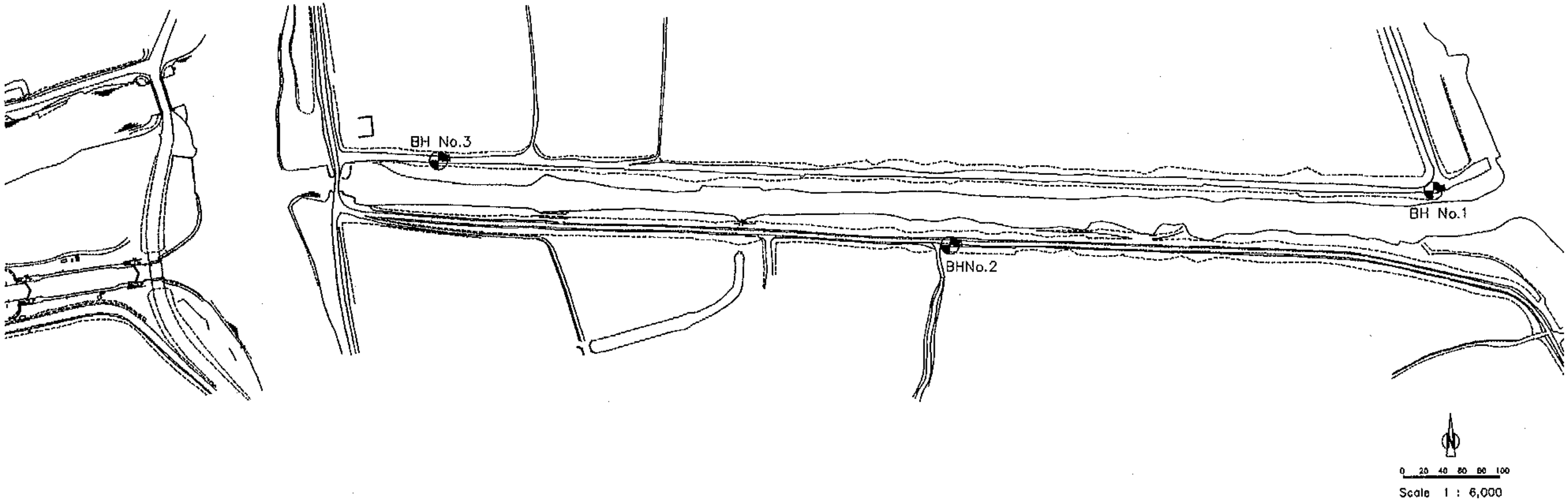


Figure A3.1.1 Topographic Survey Map along New Connection Canal

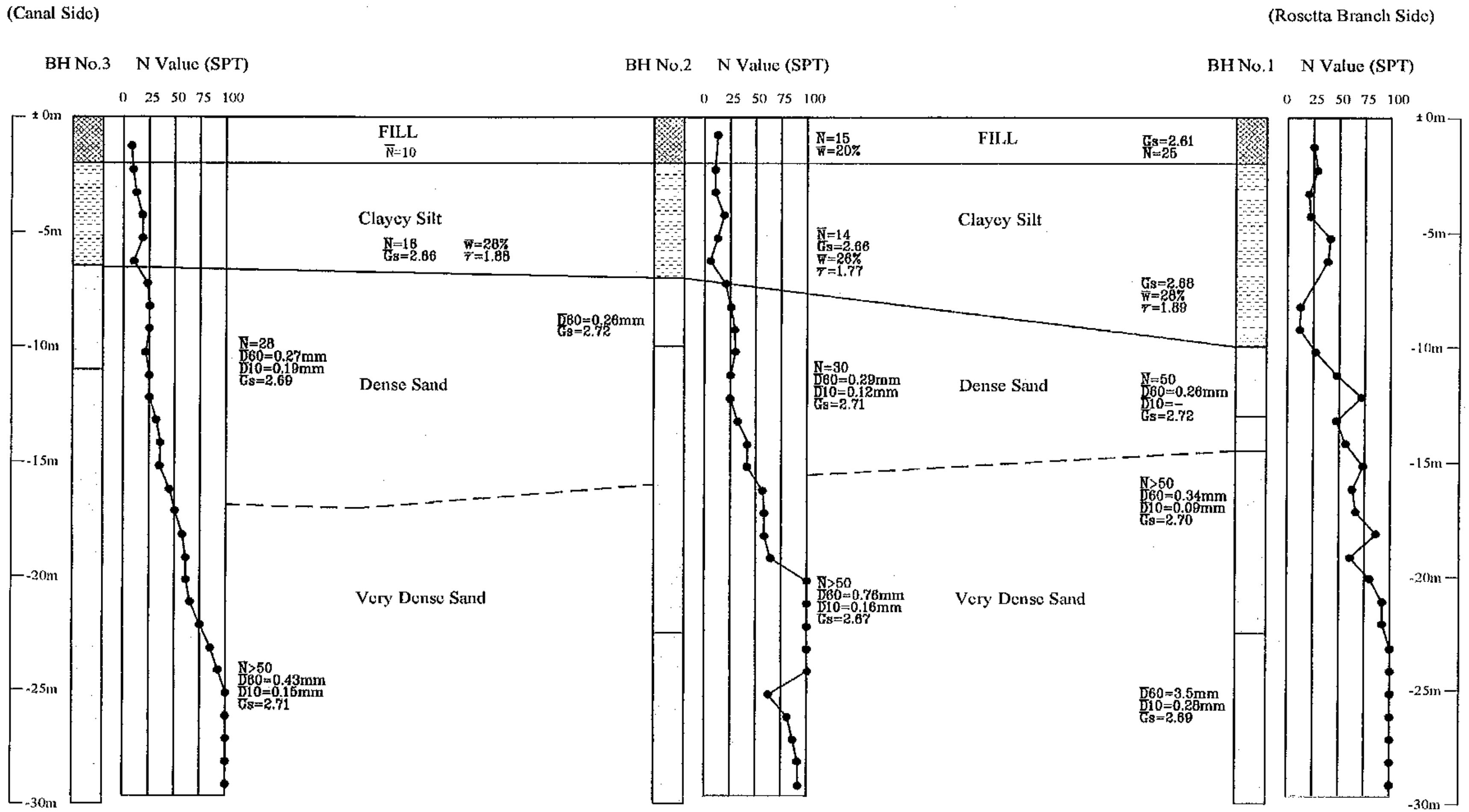


Figure A3.1.2 Subsoil Profile along New Connection Canal

3. Site Investigation Along Nobaria and Beheiry Canal

The site investigation was conducted along Noboria and Beheiry Canals to cover the following scope of works.

C1: Cross Sectional Survey & Sounding (120 m width section at 1 km interval)	200 sections
C2: Cross Sectional Survey & Sounding at Existing Locks (120m wide section, 12 sections for each lock, 6 rocks)	72 sections
C3: Topographic Survey at Existing Locks (120 m width, 600 m length at each locks)	6 locks (area)
C4: Water Sampling and Testing (at 4 locations)	4 samples

(1) Cross Section Survey & Sounding

Cross section survey and water depth sounding along Nobaria and Beheiry Canals was carried out to obtain a 120 m wide cross sectional feature of canal with water depth at 200 sections which was positioned in an approximately 1 km interval for the whole area of 200 km long.

Each cross section survey line was located using advanced and suitable technology by Differential Geographic Positioning System (DGPS) for determination of coordinates to be connected to the Egyptian National Survey Grid. Vertical control for the survey was referred and tied to the water level measurements at the existing locks in the known accuracy of elevation along the Canal (Irrigation Scale Meter). All onshore levels measured at each cross section are represented in terms of levels referred to the Mean Sea Level (MSL) of the Mediterranean Sea.

The water depth soundings at Canal water were taken by suspended weight or echo sounder on-board to measure present water depths in a suitable accuracy. The location of sounding line was set by means of Differential Global Positioning System (DGPS).

The water depths measured at each cross section were represented in terms of the level referred to the Mean Sea Level (MSL) of the Mediterranean Sea and the water level measured were reduced to the projected low water level along the Canals based on the measurement record at each lock as an average of the past five (5) years by the Ministry of Water Resources and Irrigation as follows for indicating in the cross sectional map. Low water level at each section was separately interpolated by distance according to the longitudinal water level line derived from the existing upstream and downstream records on low water level at each lock.

Low Water Level at Locks along Beheiry/Nobaria Canals

Lock No	Lock Name	Low Water Level (+ or – MSL)	
		Upstream	Downstream
1	Kanater	16.2	14.0
2	Khataba	12.0	10.9
3	Boulin	9.2	8.70
4	Bostan	7.2	7.05
5	Ganallis	4.8	4.60
6	Nahda	2.9	-2.50
	Lake Maryut		-2.50

(2) Cross Sectional Survey & Sounding at Existing Locks

Cross section survey and water depth sounding was carried out at six (6) existing locks along Nobaria (4-locks) and Beheiry Canals (2-locks) to obtain 12 cross sectional features of 120 m width at an 50m interval for the front 250 m area and the rear 250m area of each existing lock.

The survey and water depth sounding of canal was executed under the same manner and method as those adopted in Cross Section Survey and Sounding along the Canals except for narrow water area where a combination of echo sounder and suspended weight measurement was adopted for water depth sounding.

The result of survey was presented in a series of maps indicating cross section profile for each lock.

(3) Topographic Survey at Locks

Topographic survey at six (6) existing canal locks along Nobaria and Beheiry Canals was carried out to obtain a topographic feature at and around the existing lock to cover the area of 120 m wide and 600m long including the front and the rear 250 m of the lock facility.

The survey was executed within the framework of coordinate and elevations as described above Cross Section Surveys. The result of survey was presented in topographic feature maps in a scale of 1:1,000 for each lock.

(4) Water Quality Survey

The water quality survey and the subsequent analysis of water quality were carried out to identify the water contamination level in the water at the canal areas. Four (4) locations were selected for water samplings at the canal water, Alexandria port basin and Maryut Lake respectively. The test analysis was done at Shore Processes Laboratory in Alexandria ant the results of the subsequent analysis of water samples are discussed in the next Chapter 5 in this report.

4. Site Investigation at Maritime Lock in Alexandria Port

The site investigation was conducted at the Maritime Lock in the Alexandria Port in order to obtain the basic data on natural and environmental conditions at and around the existing lock for possible formulation of improvement project for the lock. The scope of site investigation shall comprise of the following.

D1: Topographic Survey (200 m wide, 500 m long)	10 ha
D2: Subsoil Investigation with Site and Laboratory Testing	
1 - onshore borings	30 meters
2 - offshore borings	40 meters
D3: Seabed Quality Survey (Sampling and Laboratory Testing)	3 samples

(1) Topographic Survey

Topographic survey at and around Maritime Lock in the Port of Alexandria was carried out to obtain a topographic feature along the existing Maritime Lock to cover the area of 200 m wide and 500m long.

The framework of Egyptian National Survey Grid was adopted for determination of coordinates in horizontal control of the survey by the use of DGPS. The succeeding plane table or offset survey shall be conducted based on temporary benchmarks to define locations and positions of survey spots and existing structures, etc.

Vertical control for the survey was referred and tied to the known accuracy of elevation based on the existing official benchmark BM No. 1151 located at Alexandria city, of which elevation is 12.118 above MSL of the Mediterranean Sea.

A topographic map to cover the survey area was prepared at a scale 1:1,000 with indication of the locations, positions and identification of lock facilities, channel line and all manmade and natural visible features including buildings, existing roads and side walkways, railway lines and such profiles on channel-front structures as canal bank and sidewall, slopes of embankment, alignment of waterfront structures adjacent of lock, etc.

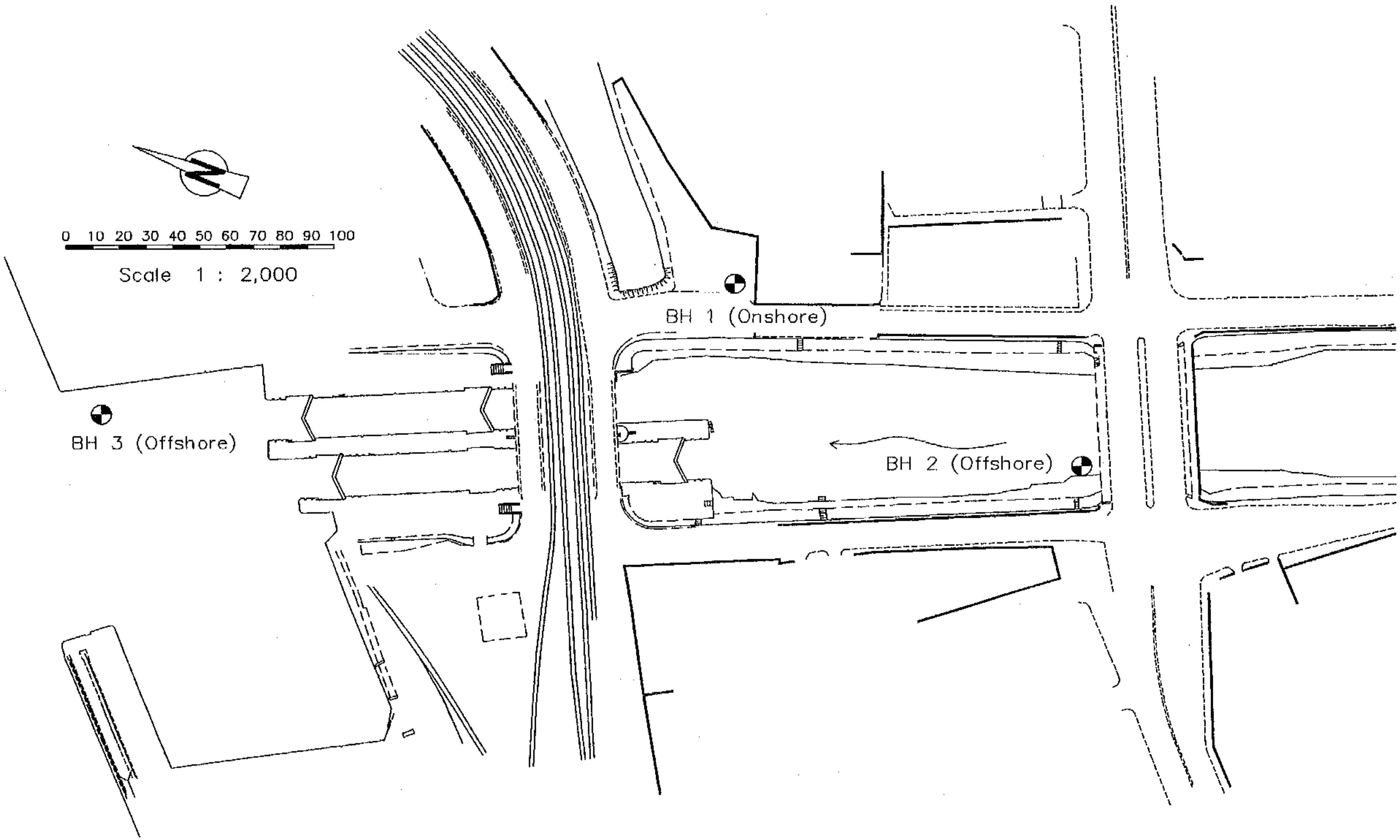


Figure A3.1.3 Topographic Survey Map at Alexandria Maritime Lock

(2) Subsoil Investigation

The objectives of the subsoil investigation are to characterize the site subsoil, define their geo-technical conditions relevant to foundation design and construction for possible extension of existing lock. One (1) onshore and two (2) offshore boring works was carried out at locations near the existing maritime lock. The location of boring hole was set by applying Differential Global Positioning System (DGPS) to determine the point of coordinates.

The site boring works was executed using mechanical rotary boring machines. During boring works, bored hole was properly protected by a combination of casing tube till completion of boring operation and Standard Penetration Test (SPT) at an interval of 1 meter boring was done to obtain numbers of blow per 30 cm of penetration at the site. Fifty five (55) numbers of disturbed samples and relatively undisturbed clayey samples collected by thin-walled tube sampler were collected and properly preserved from being disturbed or losing moisture according to ASTM-D1587-83 and transported to the laboratory in Cairo. The boring works was executed up to 30 meters depth from the ground level for onshore boring and 20 meters from the seabed for offshore boring respectively.

Physical tests at laboratory were conducted on subsoil samples extracted from the bored holes as summarized in the following table and the subsoil profile at the site with indication of laboratory test results is presented in Figure A3.1.4 (2). Overall view on the subsoil condition at the site will be summarized as follows:

- There exists fill layers at onshore area (BH-1), which consists of the surface fill of about 2 m thick and very dense fine grained sandstone pieces extended to 6 m below ground surface. A very dense sandstone layers having more than 100 SPT value follows the sand stone piece layer extended to 17 m below ground surface. No weak or soft deposit exists at the projected onshore area.

- Under the canal bed subsoil of basalt and limestone pieces with sand or dense silty sand layer, very dense sandstone pieces layer or sand layer deposit to the depth of 14 m approximately. This layer shows SPT value ranging 43 to over 100 and deposits upon the bearing stratum composed of sandstone layer.

(3) Seabed Quality Survey

The seabed quality to identify soil contamination level was carried out for the seabed soils in the Alexandria port basin where new extension lock is envisaged to offshore from the existing Maritime Lock. The results of subsequent analysis of seabed soil are presented in the next Chapter 5.

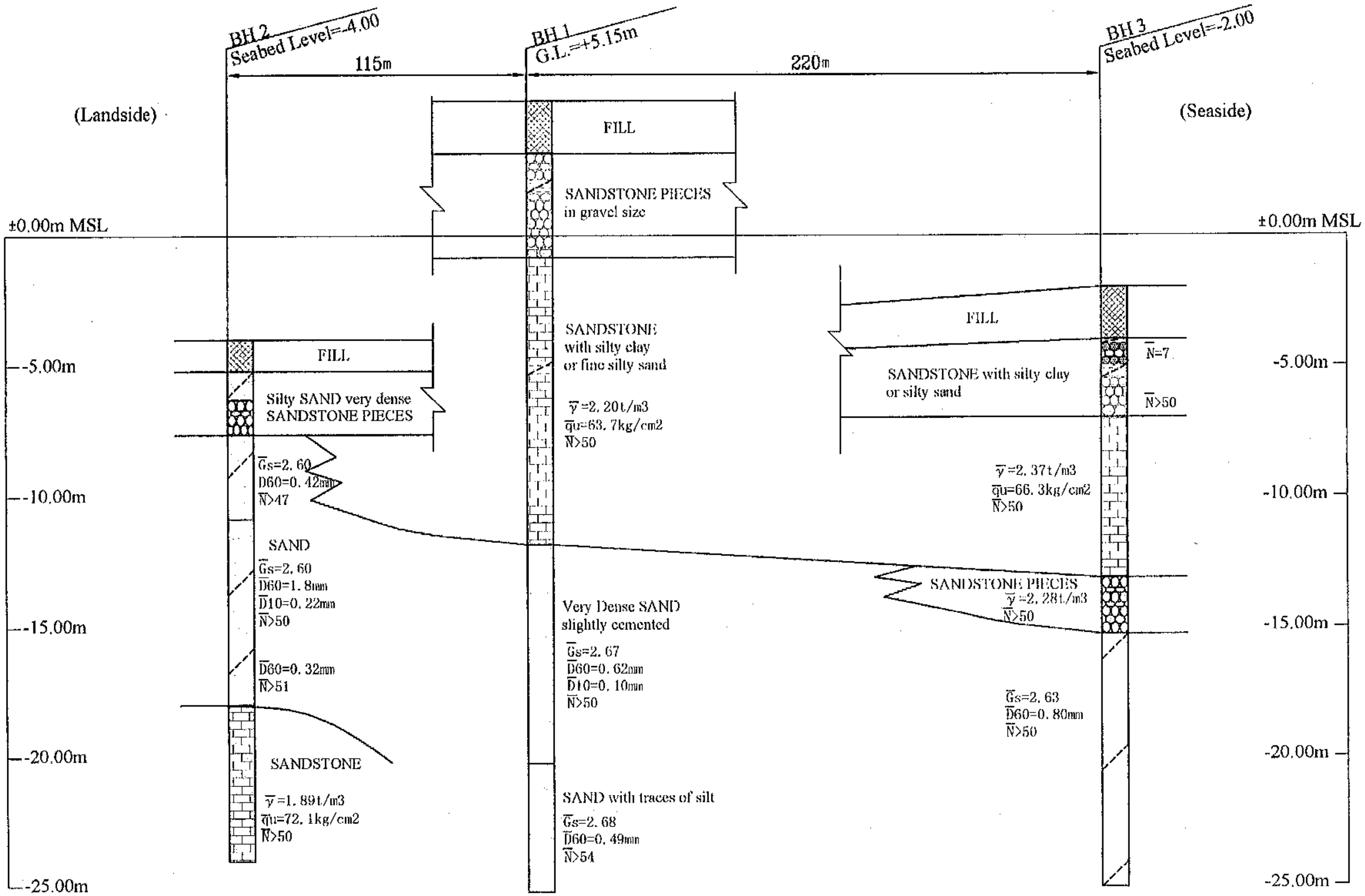


Figure A3.1.4 Subsoil Profile along Alexandria Maritime Lock

APPENDIX 5-I BIOLOGICAL SAMPLING RESULTS

Table (1a): Phytoplankton Species Identified in Alexandria Project Area (Aug. 2002)

Species	Location				
	A1	A2	A3	A4	A5
I- Chlorophyceae					
1. Actinastrum hantzshii Lagerheim				+	+
2. Ankistrodesmus falcatus (Corda)			+		
3: Chlorella parasitica Brandt..			+	+	+
4. Chlorella vulgaris Beyer.				+	+
5. Closterium acutum . West.					+
6. Pedistrum simplex.				+	
7. Monoraphidium convolutum					+
8. Scenedesmus dimorphous.				+	
9. Staurastrum paradoxum Meyen.			+		+
II – Cyanophyceae					
1. Aphanocapsa montana Cramer.			+		
2. Chroococcus limneticus Limm.				+	
3. Lyngbya limnetica Lemm.					+
4. Merismopedia convoluta Kutz.			+		
5. Merismopedia warmingiana				+	
6. Microcystis aeruginosa Kutz.					+
7. Microcystis reinboldii			+		
8. Oscillatoria formosa Ag.				+	
9. Oscillatoria okeni Ag. Ex.					+
10. Oscillatoria tenuis Ag. Ex.			+	+	+
11. Oscillatoria tenuis f. tergestina			+	+	+
12. Phormidium tenue Gomont.					+
III- Bacillariophyceae					
1. Aulacoseira granulata Her.				+	+
2. A. granulata. Var. angestisma			+	+	
3. Cyclotella ocellata Pant.			+	+	+
4. Cyclotella meneghiniana Kutz.				+	+
5. Cyclotella comta (Her.) Kutz	+				
6. Synedra ulna.		+			
7. Nitzschia palea (Kutz) W.Sm.					+
8. Nitzschia sigms. (Kutz) W.Sm				+	
9. Nitzschia obtusa W.Sm.			+		
10. Cymbella gracilis (Raben.)			+		
11. Fragilaria construens (Ehren).	+				
12. Navicula anglica Ralfs.					+
13. Navicula cryptocephala Kutz.	+				
14. Surirella ovalis Breb.					+
15. Navicula exigua. Mueller.		+			
16. Navicula pygmaea Kutz..					+

Table (1b): Phytoplankton Species Identified in Boulin Project Area (Aug. 2002)

Species		Location				
		B1	B2	B3	B4	B5
<u>I- Chlorophyceae</u>						
1.	*Actinastrum hantzshii* Lagerheim	+				
2.	*Ankistrodesmus falcatus* (Corda)	+				+
3.	*Ankistrodesmus spiralis* Lemm.			+		
4.	*Chlorella ellipsoidea* Gerneck.	+			+	
5.	*Chlorella vulgaris* Beyer.		+		+	
6.	*Closterium acutum* Breb			+		
7.	*Coelastrum reticulatum* (Dangeard)	+				
8.	*Coenochloris pyrenoidosa* Korsh.		+			
9.	*Cosmarium phaseolus* Breb.		+			+
10.	*Cosmarium saxonicum* Bary	+			+	
11.	*Dictosphaerium pulchellum* Wood.			+		
12.	*Elakatothrix gelatinosa* Wille	+		+		+
13.	*Franceia ovalis* Lemm.		+			
14.	*Golenkinia paucispina*		+			
15.	*Golenkinia radiata* Chodat	+				+
16.	*Gomphosphaeria lacustris* Chodat	+				
17.	*Gomphosphaeria pusilla* Komarek		+			
18.	*Monoraphidium griffithii* (Berk.)		+		+	
19.	*Oocystis borgei* Snow.		+	+		
20.	*Oocystis parva* W. et G. S. West.			+		+
21.	*Planktonema lauterbornii* Schmidle.	+				+
22.	*Pleurotaenium trabecula* Ehren		+	+		
23.	*Protococcus viridis* C.A. Agardh.	+			+	
24.	*Sphaerocystis schroeteri* Chodat			+		
25.	*Staurodesmus pachynchus* Teilling	+			+	
26.	*Staurastrum tetracerum* Ralfs.					+
27.	*Staurastrum paradoxum* Meyen.		+			
28.	*Staurastrum pingue* Teilling				+	
<u>II - Cyanophyceae</u>						
1.	*Aphanocapsa montana* Cramer.	+		+		
2.	*Chroococcus limneticus* Limm.		+		+	
3.	*Chroococcus minutus* Kutz	+			+	
4.	*Chroococcus turgidus* Kutz			+		+
5.	*Gloecapsa stegophila* (Itzig.)		+		+	
6.	*Gloeocystis gigas* Kutz.			+		
7.	*Gloeocystis versiculosa*			+		
8.	*Gomphosphaeria Pusilla.*	+				
9.	*Gomphosphaeria lacustris* Chodat.			+		
10.	*Lyngbya limnetica* Lemm.	+	+	+	+	
11.	*Merismopedia convoluta* Kutz.		+			
12.	*Merismopedia warmingiana* Larg.		+			
13.	*Microcystis aeruginosa* Kutz.	+		+		
14.	*Microcystis reinboldii* (Richter).		+	+		+
15.	*Oscillatoria agardhii Gomont.*	+		+	+	
16.	*Oscillatoria limnetica* Lemm.	+	+	+		+

Species		Location				
		B1	B2	B3	B4	B5
17.	*Oscillatoria planctonica* Wolos.		+	+		+
18.	*Phormidium mucicola* Naumann		+	+		
19.	*Phormidium tenue* Gomont.	+		+		
<u>III- Bacillariophyceae</u>						
1.	*Aulacoseira granulata* Her. Simon.	+	+	+	+	+
2.	*Aulacoseira granulata.* Var. angest.	+	+	+	+	+
3.	*Cyclotella ocellata* Pant.	+	+	+	+	+
4.	*Cymbella gracilis* (Raben.)		+	+		
5.	*Fragilaria construens* (Ehren).			+		+
6.	*Navicula anglica* Ralfs.	+			+	
7.	*Navicula dicephala* (Ehren)		+			
8.	*Navicula exigua.* Mueller.			+	+	
9.	*Navicula radiosa* var. *tenella*					+
<u>IV – Dinophyceae</u>						
1.	*Peridinium africanum* Lemm. Lif.			+		
2.	*P. willei* Huitfeld - Kass.		+			

Table (2a): Identified Zooplankton Species and Density (org.m^{-3}) in Alexandria Project Area (Aug. 2002)

Species	A_1	A_2	A_3	A_4	A_5
Protozoa					
Eutintinnus macilentus Jorgemen	100	150	0	0	0
Favella ehrenbergii Claparede	150	0	0	0	0
Globegrina inflata D'orbigng	50	150	50	0	0
Centropyxis aculeata Stein	0	0	0	0	150
Subtotal	300	300	50	0	150
Rotifera					
Brachionus calyciflorus Pallas	0	0	0	0	14000
Brachionus angularis Gosse	0	0	0	0	18000
Cephalodella catellina Müller	0	0	0	0	2000
Monostola closterocercoid Schmarda	0	0	0	0	3000
Lepadella patella Müller	0	0	0	0	1000
Proales decipiens	0	0	0	0	4000
Euchlanis dilitata Ehrenberg	0	0	0	0	3000
Subtotal	0	0	0	0	45000
Copepoda					
Nauplius larvae	4300	2700	1300	0	250
Cyclopoid copepodid	100	0	0	0	0
Calanoid copipodid	150	50	0	0	0
Candacia bispinosa Clams	50	0	0	0	0
Paracalanus parvus Claus	300	100	0	0	0
Acartia clausi Giesbrecht	0	50	0	0	0
Clausocalanus arcuicornis Dana	100	0	0	0	0
Oithona nana Giesbrecht	150	100	0	0	0
Euterpina acutifrons Dana	0	150	50	0	0
Macrosetella gracilis Dana	0	0	100	0	0
Subtotal	5150	3150	1450	0	250
Meroplankton					
Cirriped larvae	150	450	100	0	0
Polycheate larvae	50	100	0	0	0
Echinodermates larvae	0	250	0	0	0
Free living Nematoda	0	0	0	0	1000
Subtotal	200	800	100	0	1000
Cladocera					
Moina micrura	0	0	0	0	6000
Diaphanosoma esccisum	0	0	0	0	1000
Chydorus sphaericus	0	0	0	0	1000
Subtotal	0	0	0	0	8000
Total	5650	4250	1600	0	54,400

Table (2b): Identified Zooplankton Species and Density (org.m^{-3}) in Boulin Project Area (Aug. 2002)

Species	B_1	B_2	B_3	B_4	B_5
Rotifera					
Brachionus calyciflorus Pallas	38000	12000	27000	15000	18000
Brachionus angularis Gosse	7000	0	0	0	0
Brachionus quadridentatus Hermann	0	0	0	0	2000
Brachionus urceolaris Müller	5000	0	1000	2000	0
Brachionus falcatus Zacharis	2000	1000	0	0	0
Brachionus Plicatipis Müller	1000	0	1000	0	0
Keratella cochlearis Gosse	10000	4000	0	0	3000
Keratella Tropica Apstein	4000	0	0	0	0
Anuraeopsis fissa Gosse	0	0	0	0	1000
Euchlanis dilatata Enrenberg	1000	5000	2000	0	3000
Pompholyx complanata Gosse	6000	0	0	0	0
Lecane bulla Gosse	1000	0	0	0	0
Lecane papuana Murray	0	0	0	0	1000
Lecane luna Müller	1000	0	3000	2000	0
Lecane leontina Turn.	0	0	0	0	4000
Lecane hamata Stokes	2000	0	0	0	0
Asplanchna girodi Deguerne	1000	0	0	0	0
Asplanchna sieboldi Leydig	0	0	0	0	1000
Hexarthra mira Hudson	2000	0	0	0	0
Trichocerca pusilla Jennings	1000	0	1000	0	0
Trichocerca elongata Gosse	0	0	0	1000	2000
Proalides sp.	2000	0	0	0	0
Philodina roseola Ehrenberg	1000	0	0	0	0
Epiphanes senta Ehrenberg	3000	0	0	0	0
Polyarthra vulgaris Carlin	15000	3000	1000	0	2000
Subtotal	103000	25000	36000	20000	37000
Cladocera					
Alona rectangula ***Sars***	2000	0	0	0	0
Alona cambawa Guerne	0	1000	1000	0	2000
Bosmina longirostris Müller	5000	2000	3000	2000	10000
Diaphanosoma excisum Sars	1000	0	0	0	0
Macrothrix spinosa King	0	0	0	0	3000
Ceriodaphnia dubia Richard	1000	0	1000	3000	0
Ilyocrptus agilis Kurz	0	0	2000	0	0
Chydorus sphaericns Müller	0	2000	0	0	1000
Simocephalus vetulus Müller	0	0	0	0	1000
Leydigia acanthocercoides Fisher	0	2000	1000	0	1000
Subtotal	9000	7000	8000	5000	18000

Species	B1	B2	B3	B4	B5
Copepoda					
Nauplius larvae	4000	3000	2000	2000	3000
Cyclopoid copepodid	1000	0	0	0	1000
Thermocyclops neglectus Sars	1000	0	100	0	0
Macrocyclops albidus	0	0	0	0	1000
Acanthocyclops robustris Sars	1000	1000	0	1000	0
Schizopera nilotica	0	2000	0	1000	0
Subtotal	4000	6000	3000	5000	5000
Meroplankton					
Chironomus larvae	1000	2000	0	0	2000
Free living nematoda	0	1000	1000	0	1000
Ostrocod species	1000	0	0	1000	0
Subtotal	2000	3000	1000	1000	3000
Total	121000	41000	48000	31000	63000

Table (3a): Identified Benthic Species Density (org.m^{-2}) and their Biomasses (gm .m^{-2}) in Alexandria Project Area (Aug. 2002)

Species	A1		A2		A3		A4		A5	
	No.m^{-2}	gm.m^{-2}	No.m^{-2}	gm.m^{-2}	No.m^{-2}	gm.m^{-2}	No.m^{-2}	gm.m^{-2}	No.m^{-2}	gm.m^{-2}
Coelentrata										
Sea anemone sp.	0	0	0	0	80	0.74	0	0	0	0
Annelida										
Neries diversicolor Saint-Joseph	160	10.06	80	6.4	0	0	0	0	0	0
Hydroides elegan	320	0.72	240	0.44	80	0.02	0	0	0	0
Steraspis scutata Rietsch	160	0.04	0	0	160	0.06	0	0	0	0
Tubificide sp.	0	0	0	0	0	0	0	0	0	0
Subtotal	640	10.82	320	6.94	240	0.08	0	0	0	0
Mollusea										
Corbula gibba Olivier	0	0	0	0	80	58.62	0	0	0	0
Cerastoderma glucum Bruguiere	0	0	0	0	80	30.96	0	0	0	0
Venerupis rhomboides Pennant	0	0	160	14.56	0	0	0	0	0	0
Subtotal	0	0	160	14.56	160	89.58	0	0	0	0
Total	640	10.82	480	21.5	240	90.32	0	0	0	0

Table (3b): Identified Benthics Species Density (org.m^{-2}) and their Biomasses (gm. m^{-2}) in Boulin Project Area (Aug. 2002)

Species	B1		B2		B3		B4		B5	
	No.m^{-2}	gm.m^{-2}	No.m^{-2}	gm.m^{-2}	No.m^{-2}	gm.m^{-2}	No.m^{-2}	gm.m^{-2}	No.m^{-2}	gm.m^{-2}
Insecta										
Chironomus faruae	320	0.98	560	1.04	160	0.26	0	0	0	0
Subtotal	320	0.98	560	1.04	160	0.26	0	0	0	0
Annelida										
Branchiura sowerbyi *Beddard*	0	0	160	2.68	240	1.56	0	0	0	0
Limnodrilus holffmesteri Claparede	1120	1.12	0	0	0	0	0	0	0	0
Potamethrix hammoniensis Michaelsen	80	0.02	80	0.04	1200	1.78	0	0	0	0
Tubifex tubifex Müller	0	0	160	0.06	240	0.20	0	0	0	0
Subtotal	1200	1.14	400	0.78	1680	3.54	0	0	0	0
Mollusca										
Melanoides Tuberculata Müller	0	0	160	4.7	480	22.16	160	3.98	0	0
Gyraulus ehrenbergi Beck	0	0	0	0	0	0	80	0.3	0	0
Hydrobia stagnalis Blanckenhern	240	1.26	0	0	0	0	0	0	0	0
Corbicula fluminalis Müller	1920	478.4	0	0	80	102.4	0	0	0	0
Subtotal	2160	479.66	160	4.7	560	124.56	240	4.28	0	0
Total	3680	481.78	1120	8.52	2400	128.36	240	4.28	0	0

Table (4a): Total Bacterial Counts (TBCs), Bacterial Indicators of Sewage Pollution and Sulphate-reducing Bacteria (SRB) in Alexandria Project Area (Aug. 2002)

Location	Water					
	TBCs × 10^7		Bacterial indicators			SRB
	22℃	37℃	TC	FC	FS	
A1	0.104	0.076	3×10^2	1×10^2	3×10^2	0.0
A2	0.045	0.02	4×10^2	2×10^2	3×10^2	0.0
A3	0.13	0.124	240×10^2	210×10^2	23×10^2	0.0
A4	2300	7680	44×10^8	35×10^8	3×10^8	36
A5	2920	4320	1200×10^9	930×10^9	4×10^9	44

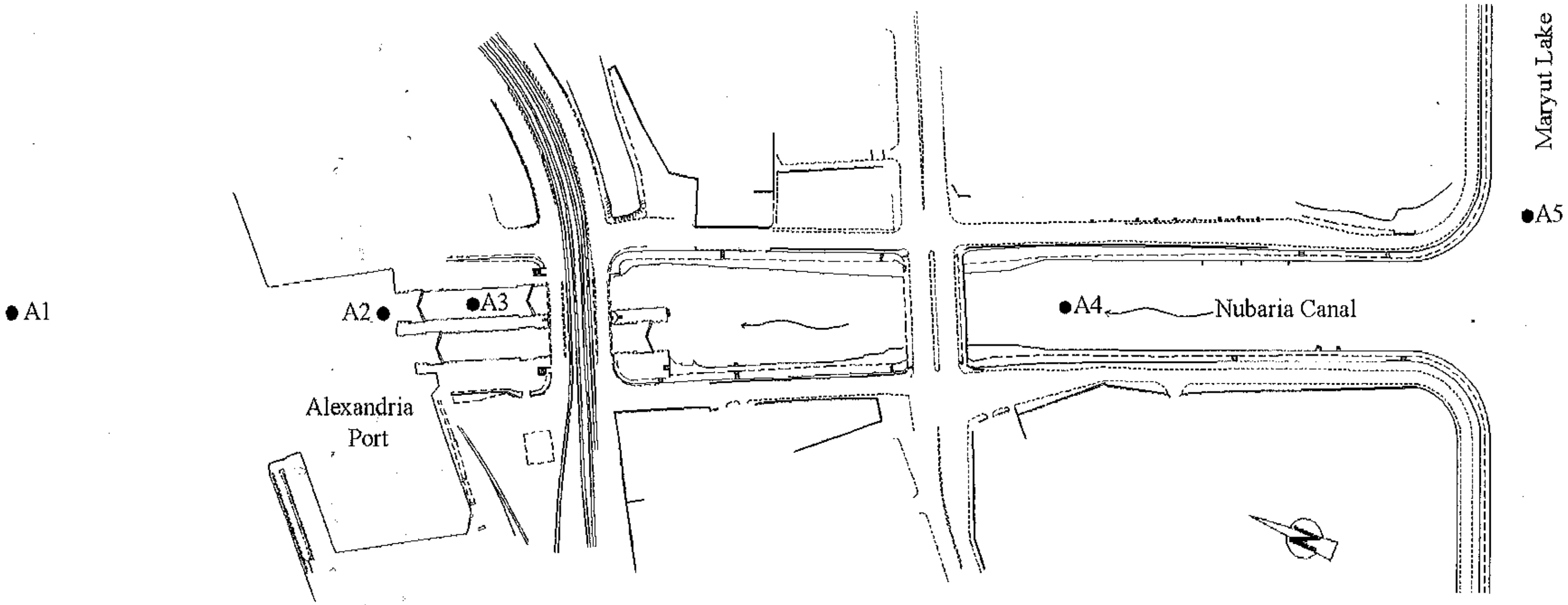
Location	Sediment					
	TBCs × 10^9		Bacterial indicators			SRB
	22℃	37℃	TC	FC	FS	
A1	0.56	0.24	75×10^2	43×10^2	23×10^2	0.0
A2	0.22	0.16	110×10^2	64×10^2	64×10^2	0.0
A3	0.74	0.26	460×10^2	240×10^2	93×10^2	0.0
A4	640	3560	400×10^8	350×10^8	7×10^8	460
A5	1620	9346	2900×10^9	2300×10^9	43×10^9	1100

TC: Total coliform FC:Faecal coliform
FS:Faecal streptococci

Table (4b): Total Bacterial Counts (TBCs), Bacterial Indicators of Sewage Pollution and Sulphate-reducing Bacteria (SRB) in Boulin Project Area (Aug. 2002)

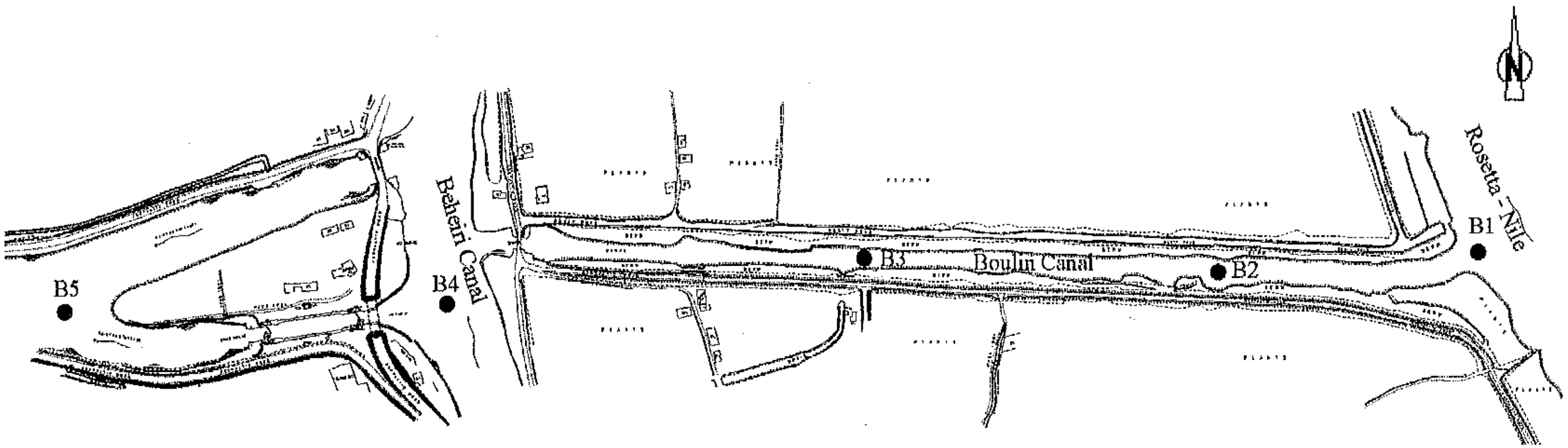
Location	Water						Sediment					
	TBCsX10^5		Bacterial indicators			SRB	TBCs × 10^7		Bacterial indicators × 10^2			SRB
	22℃	37℃	TC	FC	FS		22℃	37℃	TC	FC	FS	
B_1	4.8	0.2	1200	460	4	0.0	3.1	1.4	1200	430	460	0.0
B_2	7.2	0.2	2100	750	240	0.0	4.4	2.9	240	150	35	0.0
B_3	15.2	7	2100	930	75	0.0	4.8	5	230	93	210	0.0
B_4	3.2	0.1	1100	240	6.2	0.0	0.73	0.28	210	75	44	0.0
B_5	4.6	1.6	1200	210	4	0.0	1.8	1.58	280	43	3	0.0

TC: Total coliform FC: Faecal coliform
FS: Faccal streptococci



A1 Alexandria port waters at about 250m offshore of the Maritime Lock
A2 Alexandria port waters in front of the Maritime Lock
A3 Alexandria port waters inside the Maritime Lock
A4 Nubaria canal at about 300m upstream of the Maritime Lock
A5 Maryut Lake at about 1km upstream of the Maritime Lock

Locations of Water Environmental Survey – Alexandria Project Area (Aug. 2002)



B1 Rosetta-Nile in front of Boulin canal outlet
B2 Boulin canal at about 200m upstream of its outlet into Rosetta-Nile
B3 Boulin canal at about 200m downstream of its connection with Beheri canal
B4 Beheri canal in front of its outlet into Nubaria canal
B5 Nubaria canal at about 400m downstream of Boulin Lock

Locations of Water Environmental Survey – Boulin Project Area (Aug. 2002)

Appendix 6-1 Discharge Volume from the Upper/Middle Nile

1. Aswan High Dam

Water resource of Egypt has been dependent on the Nile River since immemorial time. This dependence amounts to 95 %, according to "The Study on the Role of Cargo Transportation through Inland Waterway (Nov. 2001) by Transport Planning Authority (TPA)". The average annual natural flow of the Nile River is estimated at Aswan is about 84.0 thousands million m3 (84.0 x 10^9 m3). Based on the 1959 Nile Waters Agreement between Egypt and Sudan, Egypt's preset annual share downstream Aswan is 55.5 thousands million m3 (55.5 x 10^9 m3).

Of course, the most important role of this water resource management is being played by the Aswan High Dam (AHD), completed in 1968. Figure 6.3.1 illustrates the comparison between the discharge volume before and after the completion of AHD. The operation of AHD made it possible to achieve the stable water supply through the year. In the recent 5 years (1996-2000), the discharge from AHD is also secured enough volume, which amounts to about 70 - 120 million m3/day in winter, then maximum discharge volume in summer up to 260 million m3/day (see Figure A6-1-1).

2. Barrages along the Upper/Middle Nile

In addition, Figure A6-1-2 shows the locations of major barrages which are operated by MWRI (Ministry of Water Resources and Irrigation), and these barrages are located on the Nile mainstream and its two branches (Damietta and Rosetta). Concerning major barrages in the Upper Egypt, Figure 6.3.2 indicates monthly fluctuations of discharge volume at three barrages (Esna, Nag.-Hammadi and Asyut). Then, sub-figures (Fig.A6-1-2 (1) – A6-1-2 (3)) show discharge volumes from each barrage as well as from Aswan High Dam (AHD) by two bars.
Of course, going down the Nile River, discharge volume are decreasing as can be seen from the comparison of Fig.A6-1-2 (1) – A6-1-2 (3). Because the local use of water should be consumed along the Nile Valley.

Meanwhile, the comparison of the water depth with the discharge is also shown in Figure A6-1-2. In each barrage, daily records of water level are registered at upstream and downstream side. Rough calculation method may be applied in order to estimate water depth. In this method using the limited data available, this rough estimation is to find the remainder of water level at downstream of lock/ barrage and sill level of navigational lock which is next to the barrage. The equation is indicated as below.

(Water Depth) = (Average of daily Minimum Water Level at downstream) – (Bed Level of Lock).

Strictly speaking, it is impossible to estimate an exact water depth, because of difference between the location of measurement station and lock.

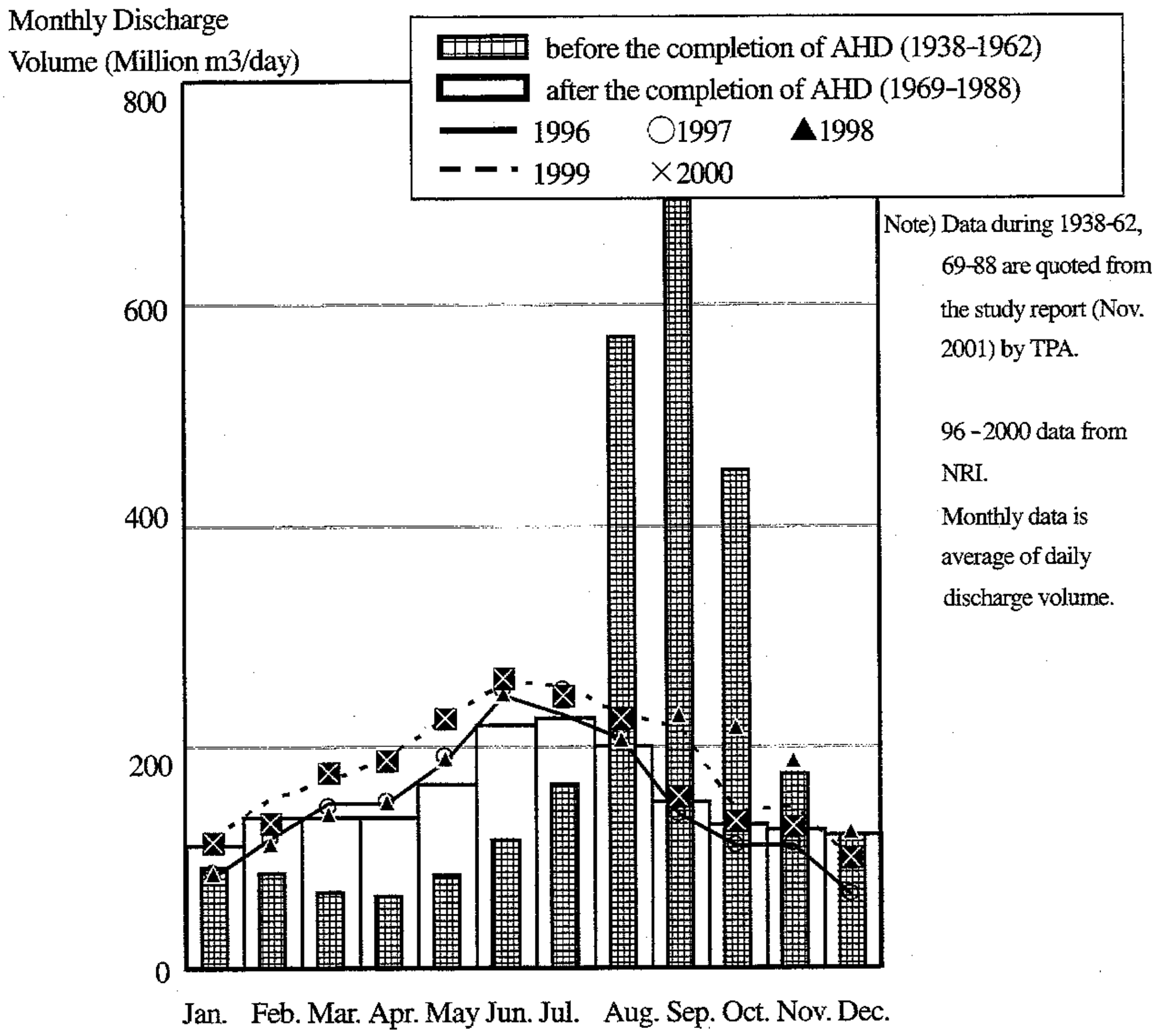
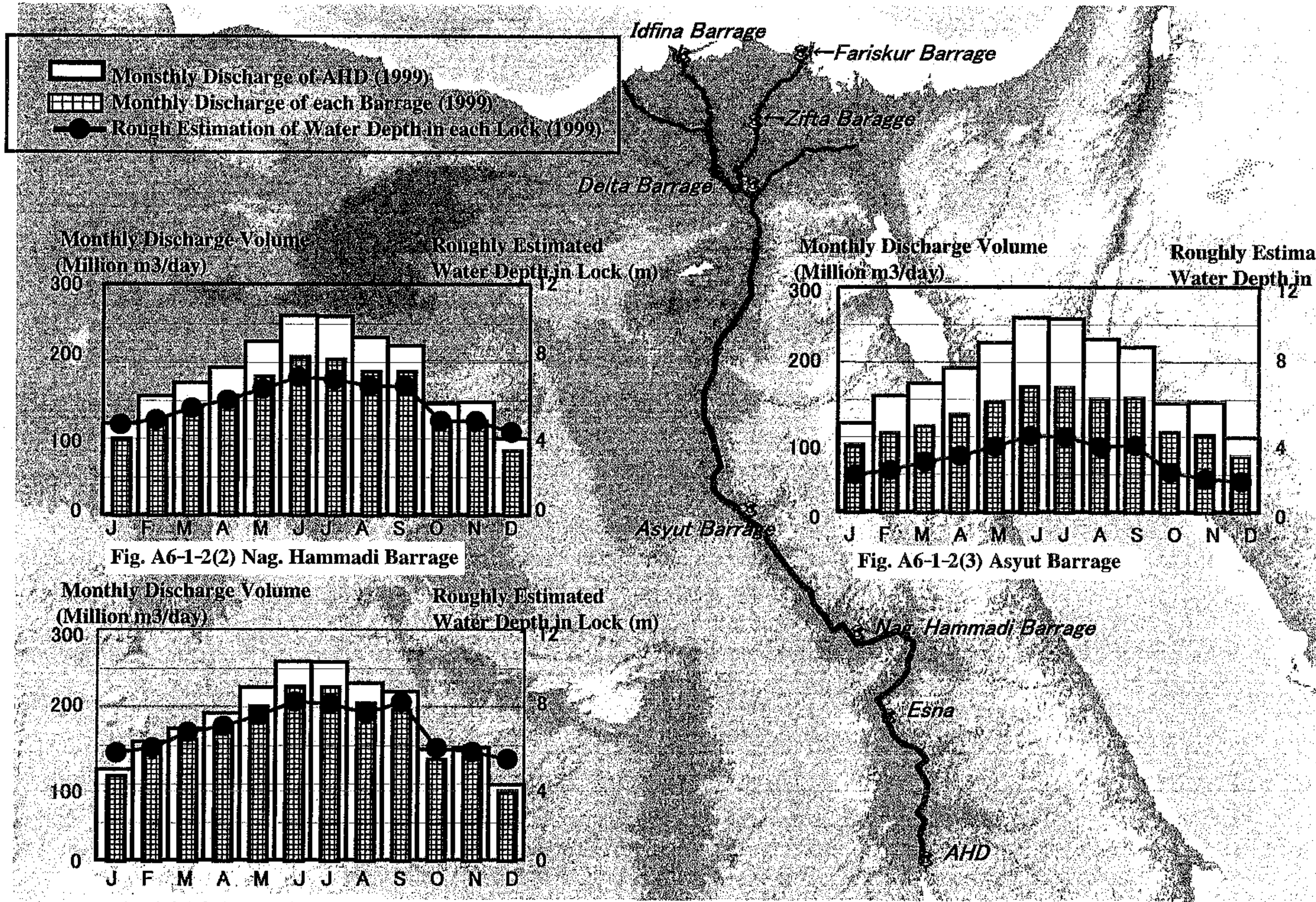


Figure A6-1-1 Monthly Discharge Volume of the Aswan High Dam (AHD)

From observations of Delta's canals, it is almost certain that both structures are adjacent to measurement stations as can also be seen in this figure, then it is possible to gain some trends of the relation to discharge volume with water depth as shown in Fig.A6-1-2(1) - Fig.A6-1-2(3)

According to this preliminary calculation as shown by the line graphs in Fig.A6-1-2(1) - A6-1-2(3), it is certain that water depth is related with discharge volume or discharge curve. In add, going down the river to Asyut Lock, minimum water depth during winter block-season tend to decline into about 2 m.



Source) NRI, RTA, TPA

Figure A6-1-2 Location of Major Barrages and Comparison of the Water Depth with the Discharge Volume

note) Discharge volume is average of daily data
Water depth = Downsteram side water level (average of daily minmum level) − Sill (Bed) level in each lock

Appendix 6-2 fluctuation of water depth along the Beheiry/Nobaria Canal

This Appendix 6-2 indicates the fluctuation of water depth along the Beheiry/Nobaria Canal during 1996 - 2000.

In these figures (Fig. A6-2-1 (1) and (2)), each graph indicates four water-depth curves which shows monthly average of daily data. Typical curves are shown by two lines at July and two lines at January. The curves at July give the water depth of high-water discharge period and January's curves present the water depth of dry-season, moreover these graphs also indicate monthly minimum water level.

During the recent years (1996 - 2000), water depth on the Beheiry Canal (the stretch of 0 km to 82 km) were recorded falling down to about 2 m in the dry seasons, then these figures shows that the fluctuation at January (difference between the "average" and the "minimum") are larger than high-water discharge period (at July). From these data, there is a definite possibility that a sudden drop in the water level will be caused in dry season, as described in "Egypt National Transport Study Phase III (1984) by Dutch consultants".

However, above results are roughly estimated as some of cross-sections. Moreover, discharge volume in the same time should also be considered. The Study found/gained the newest data from the cross-sectional survey in order to examine the improvement program this IW (Beheiry/Nobaria Canals).

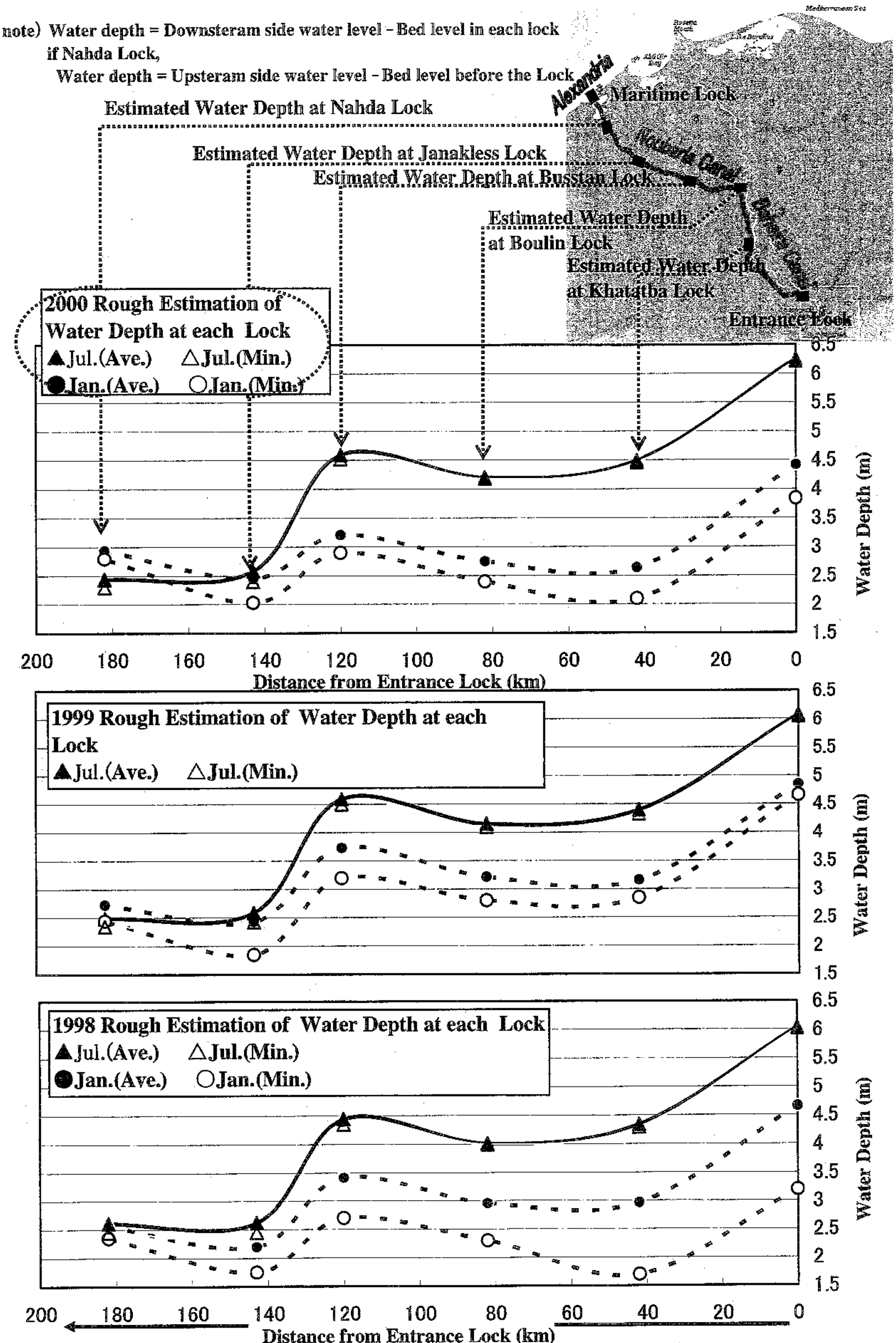


Figure A6-2-1 (1) Rough Estimation of Water Depth on Noubaria/Baheria Canal (1998-2000)

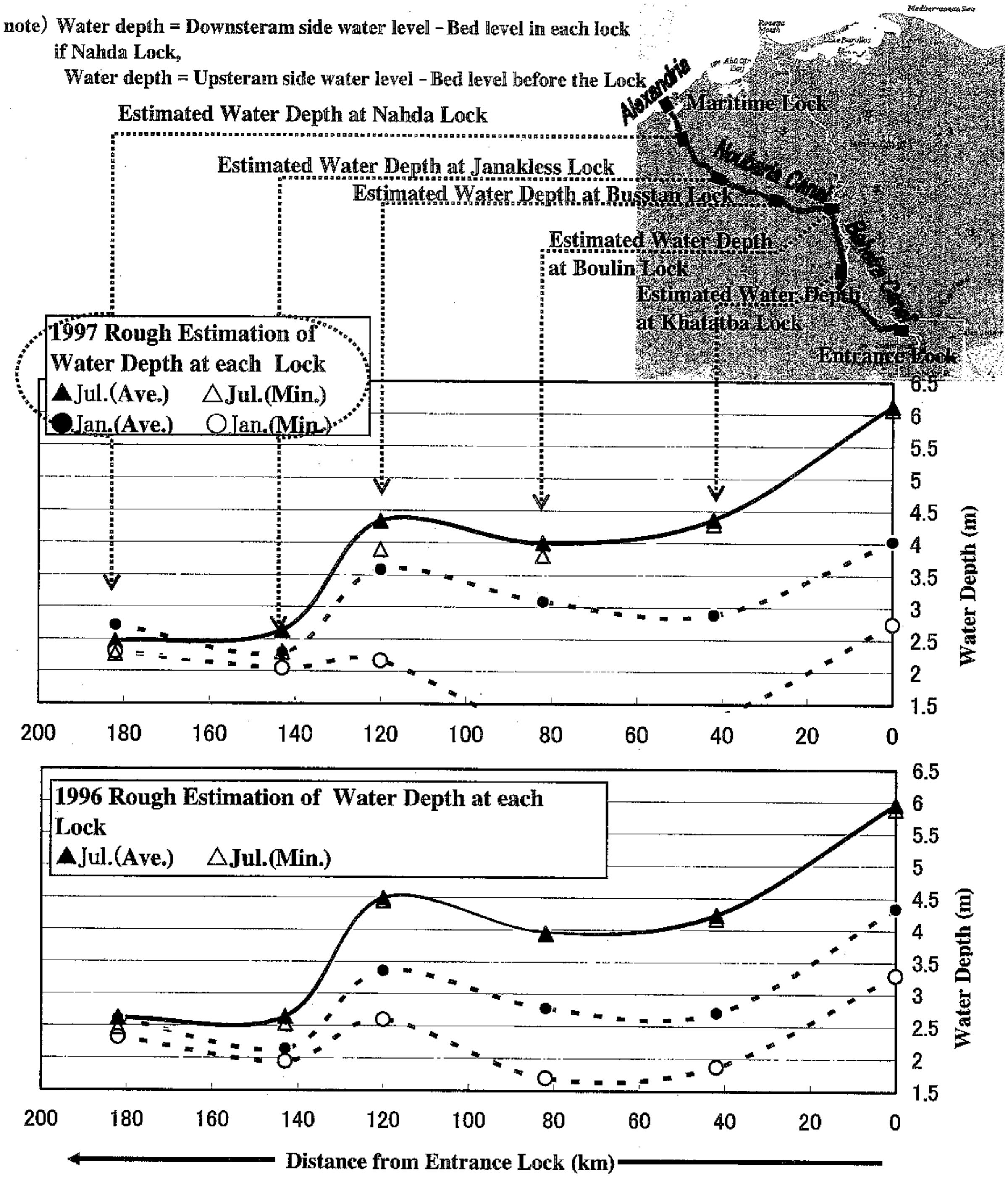


Figure A6-2-1(2) Rough Estimation of Water Depth on Noubaria/Baheria Canal (1996-1997)

Appendix 6-3 Monthly Discharge Volume from Bolin Barrage into Nobaria Canal

Appendix 6-3 shows the discharge volume from the Bolin barrage. According to the Alexandria branch office of MWRI, the Nobaria Canal has three major water resources which consist of Bolin Barrage (from Beheiry Canal), inflow of another canal and sanitary sewage. In addition, MWRI states that designed flow capacity of this canal is estimated about 27 million m3/day, and this capacity volume is composed of 14 million m3/day (Beheiry Canal), inflow 10 million from another canal and 3 million m3/day of sanitary water. Figure A6-3-1 indicates monthly discharge volume from Beheiry Canal which hold largest portion among aforementioned three resources.

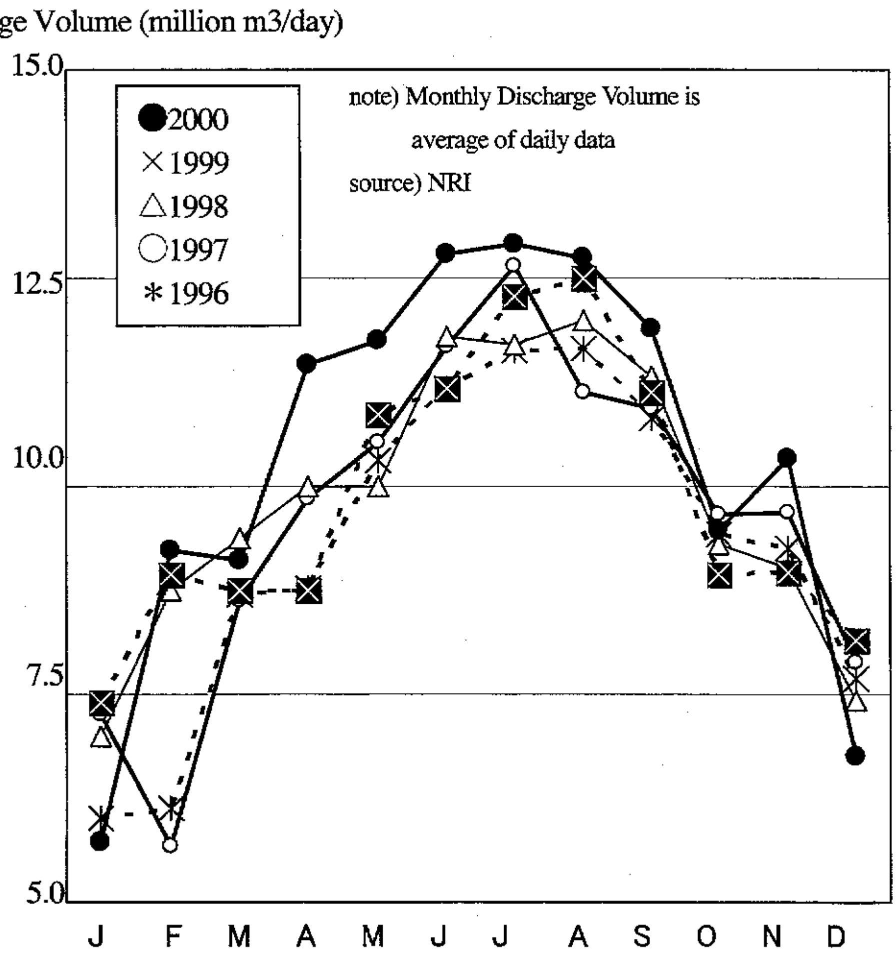
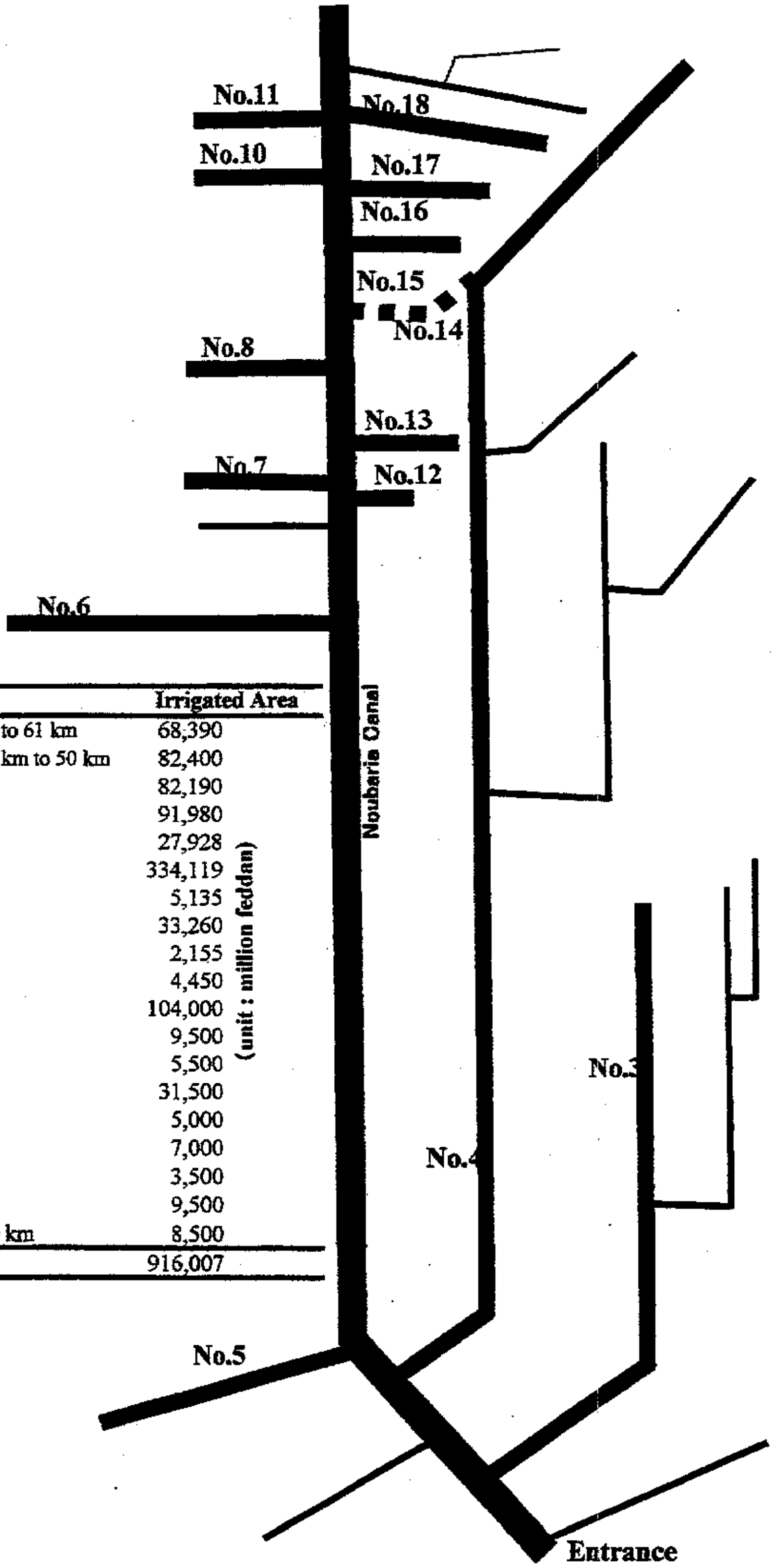


Figure A6-3-1 Monthly Discharge Volume into the Noubaria Canal from Baheria canal

In summer seasons of recent years, the discharge volume from Baheria into Noubaria canal accounts for 13 million m3/day as shown in Figure A6-3-1. This volume is nearly design volume of 14 million m3/day, so that it is unlikely that water depth will rise without increase in other water resources into Noubaria canal.

Appendix 6-4 Water Distribution Network in Nobaria Canal

This Appendix shows the minor irrigation canal network from/to Nobaria Canal.



Source : MWRI

	Canal Name	Irrigated Area
No.1	Noubaria Canal (Direct) from 0 to 61 km	68,390
No.2	Noubaria Canal (Direct) from 8 km to 50 km	82,400
No.3	Narhas	82,190
No.4	El Hager	91,980
No.5	El Tahady	27,928
No.6	El Nasser	334,119
No.7	Al Horaya	5,135
No.8	Al Sawra	33,260
No.9	Al Tahrer	2,155
No.10	Maryopolic	4,450
No.11	Al Maryut	104,000
No.12	Al Moshtarac & Al Tayiman	9,500
No.13	General Control	5,500
No.14	Divider Support	31,500
No.15	Hares 4	5,000
No.16	Hares 3	7,000
No.17	Hares 2	3,500
No.18	Hares 1	9,500
No.19	Land side from 61 km to 100 km	8,500
	Total	916,007

(unit : million feddan)

Appendix 6-5 Discharge Condition into the Damietta Branch

For the solutions to existing navigational constraints, Damietta Branch improvement/rehabilitation project is being carried out by RTA. This project plan were made on basis of discharge conditions into the branch, especially dredging program is highly dependent on the estimation of discharge volume.

At present, discharge conditions are set up as below Figure A6-5-1. In the Damietta Branch Project, discharge flow conditions are estimated supposing the El Salaam Canal Project, this canal project is expected to connect east and west area of Suez Canal, and Sinai Peninsula, and distribute irrigation water into West Delta and Sinai by large-scale new canal. In order to secure a part of required water into a new canal, the discharge program into the Branch will be revised, then Damietta Branch project such as dredging program are made on basis of this revised discharge conditions as indicated in Figure A6-5-1(1) and (2).

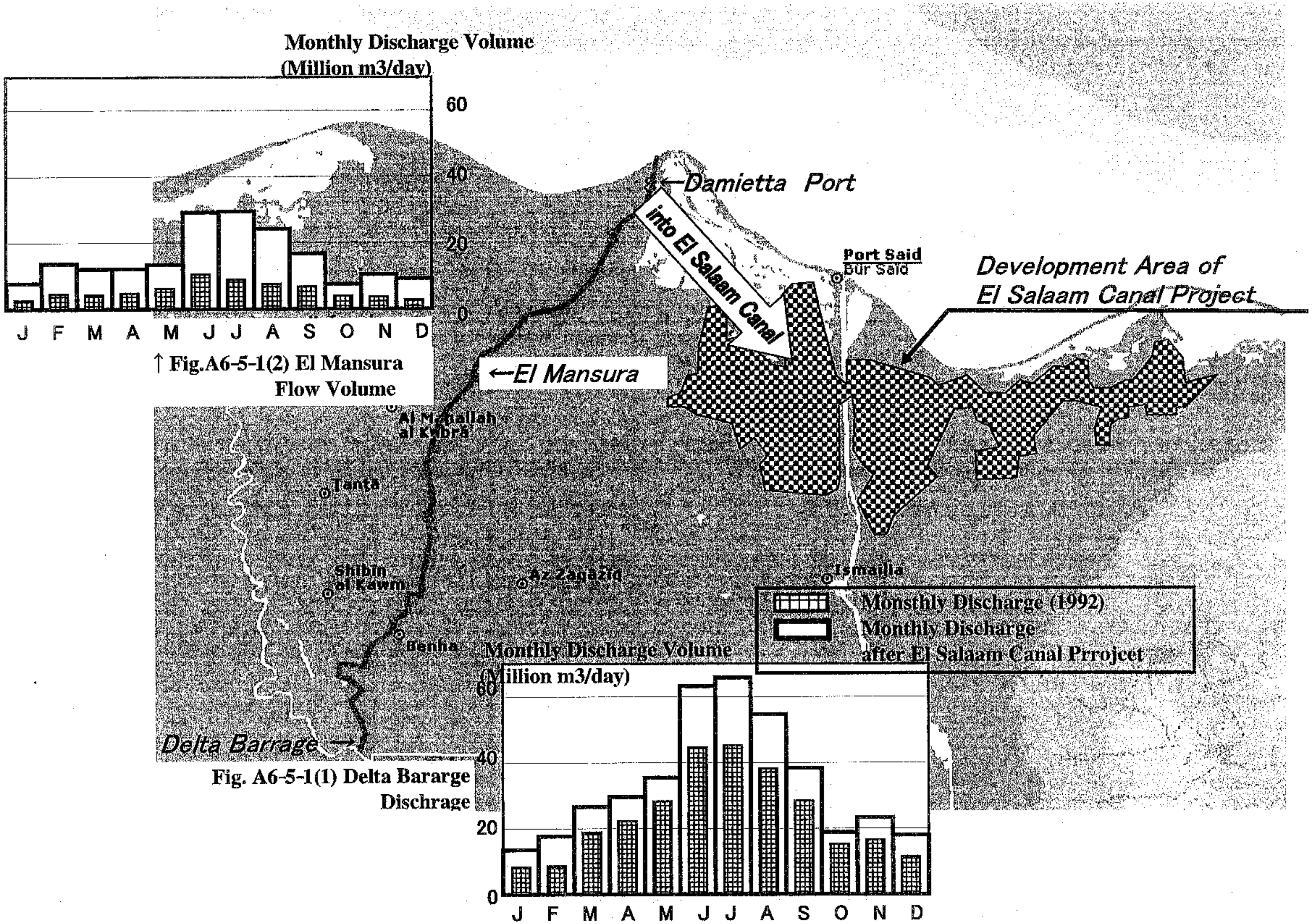


Figure A6-5-1 Discharge Condition into Damietta Branch Source : Tender Document of "Damietta Branch Rehabilitation Project" by RTA

Appendix 6-6 Discharge Conditions to Ismailia canal the basis of MWRI Program II

In Ismailia canal, Table A6-6-1 indicates discharge Volumes at each barrage in upstream (from 28.0 km to 111 km).

Table A6-6-1 Discharge Condition of Ismailia Canal by MWRI Stage II Program (28.0 km to 111.4 km)

Location		Discharge Volume (Million m3/day) Min	Max
km 28.0		19.64	25.66
km 49.7	upstream	18.66	24.46
	downstream	18.49	24.15
km 67.4	upstream	16.06	20.92
	downstream	15.40	20.02
km 70.4	upstream	14.66	19.01
	downstream	12.51	16.08
km 75.0		7.61	9.61
km 92.4	upstream	7.22	9.08
	downstream	6.71	8.39
km 96.5	upstream	6.62	8.27
	downstream	5.89	7.26
km 111.44		5.68	6.98

Source : Two Canal Study (Detailed Design Study Report 1996)

On the other hand, water discharge volume will rapidly decrease in the last stretch (111 km – End) . Table A6-6-2 indicates water discharge conditions for the last stretch.

Table A6-6-2 Discharge Condition of Ismailia Canal by MWRI Stage II Program (111.4 km to End)

Location		Discharge Volume (Million m3/day) min	max
km 111.44	downstream	2.40	2.78
km 123.75	upstream	2.20	2.51
	downstream	1.12	1.31
km 126.25	upstream	1.04	1.23

Source : Two Canal Study (Detailed Design Study Report 1996)

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