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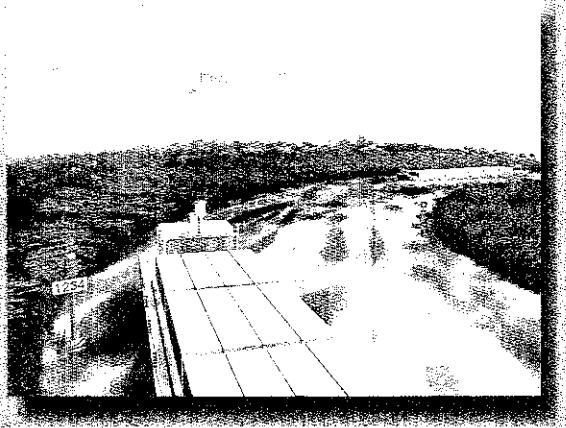
Japan International Cooperation Agency (JICA)
River Transport Authority (RTA)

NO. 52

FINAL REPORT

PRESENT CONDITIONS

THE DEVELOPMENT STUDY ON THE INLAND WATERWAY SYSTEM IN THE ARAB REPUBLIC OF EGYPT



March 2003

The Overseas Coastal Area Development Institute of Japan (OCDI)
Pacific Consultants International (PCI)

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(As of 2002)

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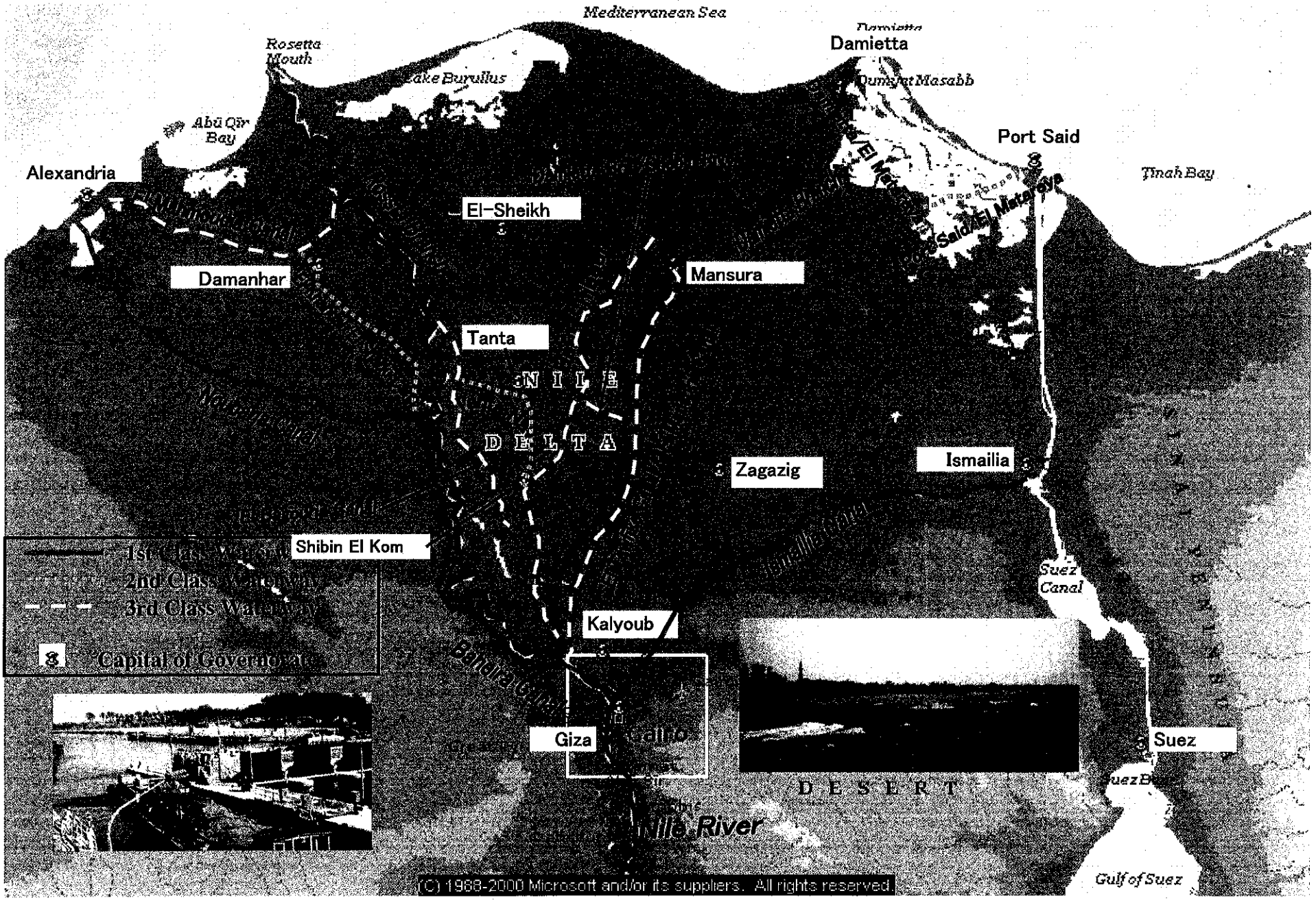


Sketch Map of Inland Waterway Network in the Nile Delta

PREFACE

In response to a request from the Government of the Arab Republic of Egypt (hereinafter referred to as "GOE"), the Government of Japan decided to conduct the Study on the inland waterway system in the Arab Republic of Egypt and entrusted the study to the Japan International Cooperation Agency (JICA).

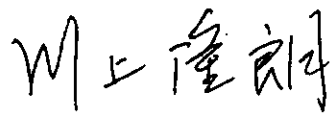
JICA selected and dispatched a study team headed by Dr. Haruo OKADA (hereinafter referred to as "the Study Team") of the Overseas Coastal Area Development Institute of Japan (OCDI) and comprised of OCDI and Pacific Consultants International (PCI) to Egypt three times between December 2001 and December 2002.

The team held discussions with the officials concerned of the GOE and conducted the field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of GOE for their close cooperation extended to the team.

March 2003



Takao Kawakami

President

Japan International Cooperation Agency

LETTER OF TRANSMITTAL

March 2003

Mr. Takao Kawakami
President
Japan International Cooperation Agency

Dear Mr. Kawakami

It is my great pleasure to submit herewith the Final Report of the Development Study on the Inland Waterway System in the Arab Republic of Egypt".

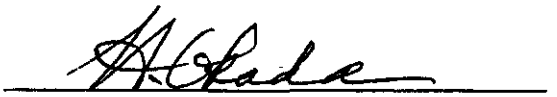
The Study Team of the Overseas Coastal Area Development Institute of Japan (OCDI) and Pacific Consultants International (PCI) conducted surveys in Egypt over the period between December 2001 and December 2002 according to the contract with the Japan International Cooperation Agency (JICA).

The Study Team compiled this report, which proposes the future development scenario including Master Plan and Short-term Plan for the promotion of Inland Waterway Transport (IWT) system in the Delta area up to 2020 and 2010 respectively, through close consultation with officials of the River Transport Authority (RTA) and other authorities concerned.

On behalf of the Study Team, I would like to express my heartfelt appreciation to RTA and other authorities concerned of the Government of the Arab Republic of Egypt for their diligent cooperation, assistance and heartfelt hospitality, which they extended to the Study Team.

I am also greatly indebted to the Japan International Cooperation Agency, the Ministry of Foreign Affairs, the Ministry of Land, Infrastructure and Transport, and the Embassy of Japan in the Arab Republic of Egypt for valuable suggestions and assistance during the course of the Study.

Yours faithfully,



Haruo Okada
Team Leader
The Development Study on the Inland Waterway System in the Arab Republic of Egypt

LIST OF ABBREVIATIONS

AfDB	African Development Bank
AfDF	African Development Fund
APA	Alexandria Port Authority
BOD	Biochemical Oxygen Demand
CAIP	Cairo Air Improvement Project
°C	Centigrade
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
DANIDA	Danish International Development Agency
DO	Dissolved Oxygen
DPA	Damietta Port Authority
EEAA	Egyptian Environmental Affairs Agency
EIA	Environmental Impact Assessment
EIMP	Environmental Information and Monitoring Program
EMTP	Environmental Monitoring Training Project
ENR	Egyptian National Railway
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HC	Hydrocarbon
Hp	Horse Power
IEE	Initial Environmental Examination
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organization
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
LE	Egyptian Pounds
Nr	Number
Lin.m	Linear Meter
l.s	Lump Sum
MARPOL	International Convention for the Prevention of Pollution from Ships
m	Meter
m2	Square Meter
m3	Cubic Meter
mm	Milimeter
MOT	Ministry of Transport
MT	Metric Tons
m/s	Meter per Second

MWRI	Ministry of Water Resource & Irrigation
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
O_3	Ozone
PM	Particulate Matter
PSPA	Port Said Port Authorty
%	Percent
RTA	River Transport Authority
sec	Second
SO_2	Sulfur Dioxide
TDS	Total Dissolved Solids
TEU	Twenty Feet Equivalent Unit
THC	Total Hydrocarbon
TOC	Total Organic Carbon
TN	Total Nitrogen
TP	Total Phosphorus
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development

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Volume I -Present Conditions-

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Chapter 1 Introduction

The Nile River is one of the major international rivers in the world and it is composed of upstream tributaries running through many countries with the mainstream flowing through Egypt over the border with Sudan to the Mediterranean Sea. Egypt is a well-known country as the origin of Egyptian Civilization that began to flourish for about 5000 years ago using the aforementioned major water resources of the Nile River Basin. Even today, population and various kinds of activities in Egypt are concentrated in the Nile Delta and along the Nile Valley.

On the other hand, the Government of Egypt has been attempting to increase the area of agriculture and other uses through irrigation. This has led to an improvement in agricultural productivity and to an increase population in this area. As a result, irrigation canals and other purpose canals network have been developed as ramifications of the Nile River. Navigable canals of its network and the Nile River are utilized as river transport routes for a long time ago in Egypt.

River transport as well as road and railway has formerly played an important role in sustaining the economic activities of the country. It is particularly used to carry bulky commodities such as raw materials for industrial production and agricultural products. However, with the development of the highway network and increasing motorization, some of cargo transport has tended to shift from inland waterway to road transportation. Therefore, the modal share of inland waterways has recently been decreasing in Egypt. To pull the river transport system out of its recession, it is important to improve the entire transport system through an evaluation of infrastructures, operation and management system.

In the age of global economic integration, it is important to ensure an efficient transport network comprising inland waterway transport network and the Mediterranean ports. In view of this, there have been several studies focusing on the canal development plans, the barge transport system and other engineering aspects. However, these studies apparently have tended to concentrate on a short-term solution rather than on a long-term development strategy / policy. Therefore, the development policy and long-term master plan for the inland waterway system are necessary to improve infrastructures and operation.

In the upsurge of the concern for impact on the environment from greenhouse gases in the global warming issue and air pollutants that being emitted from the heavy traffic in the Cairo capital region, the inland waterway transport system still has significant advantages. Major advantages of the inland waterways which need to be studied are its energy efficiency, its cost effectiveness, and its relative benignancy to environment.

In many sectors of Egyptian society, the country is presently being faced with rapid socio-economic reform to achieve further development. One of the trends is the transition from public authorities to

profitable organizations and it is likely to be applied to RTA. Accordingly, it is important to study more effective management and operation system of the inland waterway.

Under these circumstances, a comprehensive study is needed to address economic and physical aspects of the inland waterway system. The study will include a long-term conceptual plan, a master plan and a short-term development plan, in order to contribute to achieving the sustainable development of the Egypt in the 21st century.

Chapter 2 Socio-economic Conditions in Egypt

2.1 Population

The population of Egypt in the year 2000 is estimated to be 63.8 million. The average annual growth rate is 2.0% for the period 1991-2000, indicating a gradual decline year by year during the last two decades from 2.6% in 1981 to 1.8% in 2000 (see Table 2.1.1).

Table 2.1.1 Historical Trend of Population of Egypt

Unit: '000

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Population	53,617	54,780	55,930	57,064	58,180	59,272	60,396	61,524	62,655	63,800
Annual Growth Rate	2.2%	2.2%	2.1%	2.0%	2.0%	1.9%	1.9%	1.9%	1.8%	1.8%

Source: World Bank Development Indicators

Note: The latest population census by the government was conducted in 1996, which indicates the same figure as shown in the above table.

Among the current total population of 63.8 million, the populations in Lower Egypt, Middle Egypt, Upper Egypt and Frontier account for 62.15%, 20.2%, 16.30% and 1.40% of the total population, respectively. Summing up the populations of Lower Egypt and Giza, approximately two thirds of the Egyptian population has a distribution in and around the Nile Delta. The population of so-called "Urban Area" containing Cairo, Alexandria, Port Said and Suez in terms of Governorate accounts for 18.68% of the total of Egypt (see Table 2.1.2).

2.2 Gross Domestic Product (GDP)

In the last decade from 1991-2000, Economy of Egypt showed steady growth with an average annual growth rate of 4.8% in Gross Domestic Product (GDP) as a total. As to GDPs by sector, services sector indicated the largest growth of 5.1% per annum in the same period, followed by industry (4.1%) and Agriculture (3.2%). Among the industrial sector, the manufacturing sector showed a high growth of 6.4% in the same period (see Table 2.2.1).

Table 2.1.2 Population of Egypt by Governorate in 2000

Area	No.	Governorate	Capital	('000)	(%)
Lower Egypt	1	Cairo	Cairo	7,337	11.50%
	2	Alexandria	Alexandria	3,573	5.60%
	3	Port-Said	Port-Said	574	0.90%
	4	Suez	Suez	434	0.68%
	5	Damietta	Damietta	983	1.54%
	6	Dakahlia	Mansura	4,530	7.10%
	7	Sharkia	Zagazig	4,594	7.20%
	8	Kalyoubia	Kalyoub	3,573	5.60%
	9	Kafr-El-Sheikh	Kafr-El-Sheikh	2,361	3.70%
	10	Gharbia	Tanta	3,637	5.70%
	11	Menoufia	Shibin El Kom	2,999	4.70%
	12	Behera	Damanhar	4,294	6.73%
	13	Ismailia	Ismailia	766	1.20%
	Total			39,652	62.15%
Middle Egypt	14	Giza	Giza	5,168	8.10%
	15	Beni-Suef	Beni-Suef	1,978	3.10%
	16	Fayoum	Fayoum	2,169	3.40%
	17	Menia	Menia	3,573	5.60%
	Total			12,888	20.20%
Upper Egypt	18	Asyout	Asyout	2,999	4.70%
	19	Suhag	Suhag	3,381	5.30%
	20	Qena	Qena	2,616	4.10%
	21	Aswan	Aswan	1,021	1.60%
	22	Luxor	Luxor	383	0.60%
	Total			10,399	16.30%
Frontier	23	Red Sea	Krughada	191	0.30%
	24	El-Wadi El-Gidid	Dakhia	128	0.20%
	25	Matrouh	Matrouh	255	0.40%
	26	North Sinai	Arish	255	0.40%
	27	South Sinai	Shibin El Sheikh	64	0.10%
	Total			893	1.40%
Grand Total				63,800	100.00%

Source: The Statistical Year Book 1993-1999: Central Agency for Republic Mobilization and Statistics, 2001 World Bank Development Indicators

Note: Population by governorate was estimated by multiplying population in 2000 from "World Bank Data" and the percentage from the census in 1996 from "The Statistical Year Book data"

Table 2.2.1 Historical Trend of Gross Domestic Product (GDP)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CURRENT GDP (billion LE)										
Overall (GDP)	111.2	139.1	157.3	175.0	204.0	229.5	256.3	280.2	302.3	334.9
Agriculture	19.1	21.7	24.4	27.5	32.1	37.0	42.3	45.9	49.4	52.7
Industry	36.2	43.7	48.3	53.4	61.7	67.7	76.2	84.6	89.2	104.4
Manufacturing	18.0	21.7	24.4	28.0	33.3	37.9	43.4	48.8	55.2	61.2
Services	53.5	65.7	73.4	82.1	97.3	109.5	121.0	131.7	144.4	156.4
Net taxes on products	2.5	8.0	11.1	12.0	13.0	15.3	16.8	18.0	19.3	21.4
GDP (Index 1995=100)										
Overall (GDP)	85.5	89.3	91.9	95.5	100.0	105.0	110.8	117.0	124.0	130.3
(Annual Growth Rate)	1.1%	4.4%	2.9%	3.9%	4.7%	5.0%	5.5%	5.6%	6.0%	5.1%
Agriculture	89.6	91.3	93.6	97.2	100.0	103.1	106.6	110.6	114.7	118.6
(Annual Growth Rate)	2.4%	2.0%	2.5%	3.8%	2.9%	3.1%	3.4%	3.7%	3.7%	3.4%
Industry	90.0	91.4	93.4	98.5	100.0	104.1	110.0	117.8	122.1	129.6
(Annual Growth Rate)	5.3%	1.5%	2.2%	5.5%	1.5%	4.1%	5.7%	7.1%	3.7%	6.1%
Manufacturing	85.3	86.6	89.1	92.9	100.0	107.5	116.5	125.6	137.8	148.7
(Annual Growth Rate)	5.8%	1.5%	2.9%	4.2%	7.7%	7.5%	8.4%	7.8%	9.7%	7.9%
Services	86.2	88.1	90.4	93.1	100.0	106.1	112.1	118.1	127.8	134.3
(Annual Growth Rate)	3.0%	2.2%	2.7%	3.0%	7.4%	6.1%	5.6%	5.4%	8.3%	5.1%
DEFLATORS (Index 1995=100)										
Overall (GDP)	63.7	76.3	83.9	89.8	100.0	107.1	113.4	117.4	119.5	125.9
Agriculture	66.6	74.1	81.4	88.3	100.0	111.9	123.9	129.4	134.3	138.6
Industry	65.1	77.5	83.9	87.9	100.0	105.4	112.3	116.4	118.4	130.6
Manufacturing	63.4	75.3	82.2	90.6	100.0	105.9	111.7	116.5	120.2	123.5

Source: World Development Indicator: World Bank

Note: Sectoral indices in 2000 were estimated referring to the statistics of Central Bank of Egypt

2.3 Industrial Activities

2.3.1 Agriculture

The agriculture in Egypt highly depends on the River Nile. Owing to the Aswan High Dam located in the Upper Egypt extending over the border between Egypt and Sudan and irrigation network connected with the River Nile, Egypt produces various crops throughout the year. The crops are categorized into so-called winter crops and summer crops differentiated in harvest season. In winter crop season from October to May, precipitation is less than that in summer season from May to October. The representative winter crop is wheat and is harvested in May. On the other hand, the representative summer crops are rice, maize, sugar cane and various fruits including citrus, grapes and apples. Vegetables are harvested through out the year. Owing to the development of irrigation network, the agricultural production has been increasing year by year in most of the crops, especially in wheat and onion (see Table 2.3.1).

Table 2.3.1 Agricultural Production by Type of Major Crops

Unit: '000 MT

Type of Crops	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Wheat	4,482	4,618	4,833	4,437	5,723	5,735	5,850	6,094	6,346	6,456
Maize	5,122	5,070	5,039	5,437	5,178	5,825	5,147	5,430	5,908	5,650
Rice	3,448	3,909	4,161	4,583	4,764	4,900				6,000
Potato	1,786	1,619	995	1,325	1,765	1,939	1,803	1,357	1,137	
Onion	579	606	742	481	692	811	726	904	1,444	893
Tomato	3,806	4,697	4,768	4,707	5,087	6,021	5,883	6,099	5,943	6,785
Sugar-cane	11,095	11,524	11,708	12,412	13,822	14,105				15,706
Beet	1,106	744	795	825	920	842	1,143	1,951	2,650	2,890
Orange	1,694	1,771	1,324	1,513	1,555	N/A				1,611
Vegetable	8,378	8,960	9,640	9,955	10,567	11,858				10,400

Source: Ministry of Agriculture and Statistics Year Book, Central Agency for Mobilization and Statistics

As to wheat and maize, in the year 2000, 6.6 million tons of wheat and 5.6 million tons of maize were produced respectively in Egypt, totaling 12.2 million tons, while approximately the same amount of wheat (7.1 million tons) and maize (5.2 million tons) were imported, indicating their self-sufficiency rate of around 50%. The farmland of wheat and maize widely distributes along the River Nile and within the Nile Delta, and the areal distributions of population and production expressed in percentage mostly coincide, that necessitates distributing imported wheat and maize all over the country. On the other hand, rice is self-sufficient (6.0 million tons of local production in 2000), which is produced mostly within the Nile Delta (see Table 2.3.2).

Table 2.3.2 Production of Agricultural Products by Governorate in 2000

Unit: MT

Area				Winter Crops						Summer Crops									
Zone	No.	Governorate	Capital	Wheat	Barley	Broad Bean	Sugar Beet	Onion	Vegetables	Rice	Maize	Sugar Cane	Onion	Vegetables	Citrus	Grapes	Banana	Apple	Other Fruits
Lower Egypt	1	Alexandria	Alexandria	127,437	3,768	15,565	1,940	3,088	275,972	12,984	30,957	1,040		823,689	8,829	2,654	1,464	13,563	40,868
	2	Behera	Damanhar	648,911	10,319	73,009	73,496	21,775	408,955	974,007	453,290	11,664	12,963	559,965	379,554	16,667	37,708	47,174	109,151
	3	Gharbia	Tanta	369,842	119	10,112	140,719	114,840	52,723	636,228	255,024	58,058		46,661	96,631	88,900	17,820	25,932	4,445
	4	Kafr-El-Sheikh	Kafr-El-Sheikh	512,711	9,135	32,409	1,378,567	4,700	123,047	1,099,440	208,217	15,613		233,918	34,499	1,893	4,132	201	6,103
	5	Dakahlia	Mansura	778,352	79	63,659	578,615	56,609	123,818	1,767,459	198,982	23,824	15,463	57,993	36,083	45,405	13,338	2,994	15,424
	6	Damietta	Damietta	59,230	48	7,774	53,537	996	18,349	190,265	11,839	1,200	234	31,662	5,139	1,332	406	10	38,770
	7	Sharkia	Zagazig	762,624	18,347	41,922	40,309	17,466	431,075	1,073,203	695,009	506	753	329,533	419,037	24,513	4,487	4,873	120,326
	8	Ismailia	Ismailia	87,500	4,382	872	3,159	10	419,430	16,925	106,833	60		250,486	68,651	7,105	864	424	101,189
	9	Port-Said	Port-Said	520					291		927			1,210					
	10	Suez	Suez	4,730	1,525	744		1,765	33,135	17,501	7,756	1,625	90	26,672	1,339	142	1,040	93	6,662
	11	Menoufia	Shibin El Kom	266,954	52	899	445	689	21,962	615	825,286	2,460	851	22,572	229,885	31,817	68,882	17,819	29,857
	12	Kalyoubia	Kalyoub	130,584		1,252		80,688	253,910	74,912	308,084	38,240	29,834	171,444	299,434	11,708	53,194	2,110	61,425
	13	Cairo	Cairo	806	14	22			5,104	251	2,719	2,652	600	4,581	1,699	300	56	460	2,098
	Total			3,750,201	47,788	248,239	2,270,787	302,626	2,167,771	5,863,790	3,104,923	156,942	60,788	2,560,386	1,580,780	232,436	203,391	115,653	536,318
Middle Egypt	14	Giza	Giza	88,475	997	73		4,428	440,953		225,225	74,983	83,265	387,172	91,982	35,581	54,125	5,718	66,507
	15	Beni-Suef	Beni-Suef	315,251	955	532	20,641	113,694	182,788	377	318,693	56,051		172,058	34,670	16,072	16,116	191	2,576
	16	Fayoum	Fayoum	398,372	17,243	2,989	20,989	64,825	245,781	96,094	124,054	15,437		34,846	18,634	9,883	8	240	61,411
	17	Menia	Menia	534,114	1,233	10,288	554,877	29,562	359,876	60	887,618	1,480,542		126,316	17,885	121,618	7,923	625	4,971
	Total			1,336,212	20,428	13,882	596,507	212,509	1,229,398	96,531	1,555,590	1,627,013	83,265	720,392	163,171	183,154	78,172	6,774	135,465
Upper Egypt	18	Asyout	Asyout	369,403	669	18,824	14,440	65,542	161,766		266,378	93,292		102,122	75,758	29,631	27,465	1,573	22,146
	19	Suhag	Suhag	403,099	796	2,834	50	80,072	279,815		374,081	1,030,981		34,691	22,582	8,087	16,862	26	4,478
	20	Qena	Qena	176,432	3,272	1,437		3,260	584,322		99,175	7,611,200		16,903	10,874	2,707	90,969	31	5,296
	21	Aswan	Aswan	38,577	2,025	727		9,649	263,661		20,349	4,006,005		83,865	8,426	455	12,679		4,317
	22	Luxor	Luxor	34,934	42	553		1,110	8,988		33,731	1,178,719		5,491	1,869	3,168	6,216		1,522
	Total			1,022,445	6,804	24,375	14,490	159,633	1,298,552	0	793,714	13,920,197	0	243,072	119,509	44,048	154,191	1,630	37,759
Total of Lower, Middle and Upper Egypt				6,108,858	75,020	286,496	2,881,784	674,768	4,695,721	5,960,321	5,454,227	15,704,152	144,053	3,523,850	1,863,460	459,638	435,754	124,057	709,542
Other Area	23	El-Wadi El-Gid	Dakhla	67,495	4,465	7,736		5,619	23,727	37,344	1,676			2,601	4,179	1,093	99	324	4,504
	24	Matrouh	Matrouh	22,574	13,002	7,994		588	9,890		8,528			77,925	72	6,052		270	188,775
	25	North Sinai	Arish	527	2,526	7		Ata	116,380		79			9,285	8,744	3,387		1,803	143,807
	26	South Sinai	Shibin El Sheik	92	192				3,150					686	40	46	3	17	4,024
	27	Noubaria		364,506	4,187	51,676	8,575	81,820	563,487	2,831	185,864	1,615	6,342	1,013,054	524,599	604,889	324,649	341,798	389,803
	Total			455,194	24,372	67,413	8,575	88,027	716,634	40,175	196,147	1,615	6,342	1,103,551	537,634	615,467	324,751	344,212	730,913
Grand total				6,564,052	99,392	353,909	2,890,359	762,795	5,412,355	6,000,496	5,650,374	15,705,767	150,395	4,627,401	2,401,094	1,075,105	760,505	468,269	1,440,455

Source: Agricultural Statistics, Volume1(Nov. 2000) and Volume2 (July 2001), Ministry of Agriculture and Land Reclamation, Economic Affaires Sector

Note: Harvest Seasons of Winter and Summer Crops are around May and Octover/November, respectively

2.3.2 Manufacture

Major manufacturing products in Egypt in terms of amount measured in metric tons are cement, iron and steel products, fertilizer, foodstuffs, etc. Along with economic growth of Egypt in the last decade achieving annual growth rate of 4.8%, production of those manufacturing goods has been increasing in the same period, indicating annual growth rates of 4.6% in cement, 5.7% in fertilizer and 5.9% in iron and steel products. On the other hand, proportional to an increase in population and upgrading a living standard, production of foodstuffs has been increasing indicating annual growth rates of 3.7% in flour, 5.1% in refined sugar (see Table 2.3.3). Those goods are also major imports or exports as a result of the balance of a large amount of demand and supply in each item; cement is major import cargo and fertilizer is major export cargo.

Table 2.3.3 Historical Trend of Major Manufacturing Production in Egypt in 1991-2000

Unit: '000 MT; otherwise specified

Item	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cement	15,762	14,943	15,116	16,445	16,937	18,111	19,253	20,972	22,140	23,598
Iron and Steel Products	2,523	2,664	2,866	3,019	2,950	2,936	3,914	4,403	4,805	4,238
Reinforcing Steel Bars	1,658	1,832	2,016	2,167	2,067	2,230	3,027	3,482	3,966	3,353
Steels Sheets	490	487	450	490	533	358	525	571	485	885
Longitudinal Products	375	345	400	362	350	348	362	350	354	N/A
Aluminum Products	227	231	231	235	243	275	275	272	282	295
Aluminum Sheets	40	45	45	40	40	70	70	67	70	75
Others	187	186	186	195	203	205	205	205	212	220
Wires and Cables	86	82	79	89	100	76	111	105	135	143
Fertilizer	5,609	6,036	6,387	6,690	7,132	7,754	8,007	7,421	8,252	9,218
Nitrogenous Fertilizers	4,340	5,085	5,598	5,895	6,118	6,654	6,671	6,128	7,121	8,160
Phosphoric Fertilizers	1,269	951	789	795	1,014	1,100	1,336	1,293	1,131	1,058
Synthetic Detergent	81	68	64	50	45	42	29	66	181	225
Cars (Number)	23,322	22,022	28,443	27,473	39,973	55,438	64,454	80,891	81,397	77,664
Passenger Cars	7,663	6,276	9,078	11,758	23,339	28,100	33,503	37,784	43,000	46,981
Minibuses	1,763	2,080	2,096	8,437	1,230	1,780	3,802	2,650	2,800	820
Buses	760	701	652	291	657	612	790	1,580	1,320	1,660
Trucks	8,064	7,860	10,839	1,205	8,830	18,620	20,422	32,650	27,380	21,000
Foodstuffs										
Flour	3,611	3,623	4,114	4,210	4,338	4,663	4,215	4,330	4,800	5,000
Edible Oil	568	491	660	473	448	538	727	798	854	810
Refined Sugar	893	991	1,004	1,099	1,131	1,125	995	1,099	1,243	1,393

Source: Ministry of Industry

2.3.3 Petroleum and Mining

Newly discovered oil and gas deposits in Lower Egypt and the Western Desert, especially at Alamain, El-Fayoum, and the Red-Sea area are considered as a turning point in the petroleum industry in Egypt. The State is now raised to become one of the oil exporting countries.

Petroleum and Mining production are shown in Table 2.3.4 and 2.3.5. Production of Iron ore reached 2.9 million tons, in 1999/2000 and Fuel oil, Butane Gas and Natural Gas are reached 11.8 million tons, 0.5 million tons, 14.5 million tons in 1999/2000 respectively.

Table 2.3.4 Petroleum Production by Products

(Unit: thousand tons)

Product	1993/ 1994	1994/ 1995	1995/ 1996	1996/ 1997	1997/ 1998	1998/ 1999	1999/ 2000
Benzine (Gasoline)	1,900	1,890	1,910	1,987	2,030	2,208	2,300
Kerosene	1,877	1,774	1,199	1,269	1,260	1,072	1,011
Jet Fuel	497	585	886	847	860	939	920
Gas oil and Diesel Oil	4,415	5,111	5,488	5,810	5,889	6,007	5,989
Fuel Oil	11,502	11,744	12,212	12,557	12,700	12,773	11,785
Butane Gas	370	392	437	451	445	436	486
Natural Gas	8,226	9,114	9,710	10,168	10,434	11,872	14,500

Source: "Statistical Year Book, 1993-2000, June 2001" Central Agency for Public Mobilization and Statistics

Table 2.3.5 Mining Production by Products by Type

(Unit: thousand tons)

Product	1993/ 1994	1994/ 1995	1995/ 1996	1996/ 1997	1997/ 1998	1998/ 1999	1999/ 2000
Phosphate	864	1,044	1,238	1,428	1,059	1,165	1,177
Iron Ore	2,703	2,433	2,098	2,744	3,001	3,002	2,932
Salt (common)	1,116	1,193	1,632	2,024	2,488	2,588	1,990
Others	279	309	392	349	380	417	268

Source: "Statistical Year Book, 1993-2000, June 2001" Central Agency for Public Mobilization and Statistics

2.4 Foreign Trade

2.4.1 Agricultural Products

Major imported agricultural products are wheat and maize that amounted to 12.3 million MT in the year 2000 and were almost the same amount of their local productions in the same year in Egypt. As mentioned in Section 2.3.1, wheat is categorized as winter crops and hence is imported from winter to spring before its harvest, viz. May. At contrast, maize is summer crops and hence is imported from summer to autumn. In addition to cereals, various agricultural products such as green beans, potatoes as seeds, lentils, black tea and apples are imported, totaling to 589,000 MT in 2000 (see Table 2.4.1 to Table 2.4.2).

On the other hand, major exported agricultural products are rice, potatoes, oranges, potatoes and onion, totaling to 857,000 MT in 2000 (see Table 2.4.3).

Table 2.4.1 Imported Cereals (Wheat and Maize) in 1998 - 2000

Unit: '000 MT

Product Item	1998		1999		2000	
Wheat	6,925	67.5%	6,564	59.3%	7,166	58.4%
Maize	3,328	32.5%	4,500	40.7%	5,110	41.6%
Total	10,253	100.0%	11,064	100.0%	12,276	100.0%

Source: Ministry of External Commerce and Supply

Table 2.4.2 Imported Agriculture Products Excluding Cereals in 1998 - 2000

Unit: MT

Product Item	1998		1999		2000	
Green beans used as seeds	18,129	4.9%	139,008	4.9%	157,309	26.7%
Potatoes used as seeds	42,449	11.5%	61,031	11.0%	91,249	15.5%
Lentils	80,481	21.7%	77,962	14.0%	83,993	14.3%
Greens not used as seeds	18,129	4.9%	87,647	15.7%	73,800	12.5%
Black tea	65,328	17.7%	72,526	13.0%	63,047	10.7%
Fresh apple	38,662	10.4%	45,581	8.2%	53,225	9.0%
Grated coconut	8,001	2.2%	5,992	1.1%	7,925	1.3%
Fresh or drying banana	11,604	3.1%	5,159	0.9%	5,254	0.9%
Grade of pepper un-milled	3,569	1.0%	2,911	0.5%	5,149	0.9%
Drying chick-pea	5,716	1.5%	3,947	0.7%	5,086	0.9%
Drying grapes	3,541	1.0%	1,917	0.3%	4,471	0.8%
Others	74,516	20.1%	53,671	9.6%	38,346	6.5%
Total	370,124	100.0%	557,353	100.0%	588,854	100.0%

Source: Ministry of External Commerce and Supply

Table 2.4.3 Exported Major Agriculture Products in 1997 - 2000

Unit: '000MT

Products	1997		1998		1999		2000	
Rice	201	21.4%	242	17.3%	307	30.9%	360	35.8%
Fresh oranges	243	25.9%	207	14.8%	211	21.2%	209	20.8%
Potatoes	233	24.8%	228	16.3%	256	25.7%	156	15.5%
Fresh onion	104	11.1%	150	10.8%	106	10.7%	139	13.8%
Others	159	16.9%	570	40.8%	115	11.6%	143	14.2%
Total	941	100.0%	1,398	100.0%	995	100.0%	1,006	100.0%

Source: Ministry of External Commerce and Supply

2.4.2 Manufacturing Products and Raw Materials

Major imported manufacturing products and raw materials for their manufacturing are cement, iron pellets, sawn timber, coal, iron/steel products, fertilizer, petroleum etc. On the other hand, major exported manufacturing products are petroleum and fertilizer. Among them, iron pellets are provided for the ironworks equipped with direct reduction furnaces located behind Dekhila Port. On the other hand, coal landed on the ports of Alexandria and Dekheila is provided for the iron works equipped with ballast furnaces located in Helwan (see Tables 2.4.4 –2.4.7)

Table 2.4.4 Available Chemical Fertilizers in 1997 - 2000

Unit: '000MT

Year	Type	Local Prod.	Import	Supply Total	Export	Available
2000	Nitrogen	8,124	238	8,362	1,622	6,740
	Phosphate	1,144	-	1,144	119	1,026
	Potassium	-	57	57	-	57
	Total	9,268	295	9,564	1,741	7,823
1999	Nitrogen	7,505	234	7,740	1,679	6,060
	Phosphates	1,150	-	1,150	149	1,299
	Potassium	-	116	116	-	116
	Total	8,656	350	9,005	1,819	7,475
1998	Nitrogen	5,869	345	6,214	741	5,472
	Phosphates	1,289	-	1,289	212	1,077
	Potassium	-	52	52	-	52
	Total	7,158	397	7,555	953	6,602
1997	Nitrogen	5,804	202	6,006	213	5,793
	Phosphate	1,375	-	1,375	310	1,065
	Potassium	-	48	48	-	48
	Total	7,179	250	7,429	523	6,906

Source: Ministry of Agriculture

Table 2.4.5 Imported and Exported Cement

Unit: '000MT

Import/Export	97/98	98/99	99/00
Import	2,742	5,204	2,680
Export	56	9	23

Source: Ministry of External Commerce and Supply

Table 2.4.6 Imported and Exported Iron/Steel Products

Unit: '000MT

Import/Export	1997	1998	1999	2000
Import	448	592	424	74
Export	93	99	109	132

Source: Ministry of External Commerce and Supply

Table 2.4.7 Imported Major Raw Materials

Unit: '000MT

Material Item	1996	1997	1998	1999	2000
Timber	1,575	1,826	2,137	1,969	2,403
Iron Pellets	1,394	1,988	3,146	2,180	3,222
Coal	1,943	1,798	2,034	1,808	1,744
Petroleum	2,315	1,659	1,875	1,793	2,486

Source: Ministry of External Commerce and Supply

2.4.3 Trade Partners of Egypt

Trading partners of Egypt are shown in Table 2.4.8. As for the import trading partners, European Union (EU) accounted for 1.78 billion US$, followed by United States (0.97 billion US$) and Asian Countries (0.75 billion US$) in 2000/2001. On the other hand, for the export, United States accounted for 0.67 billion US$, followed European Union (0.35 billion US$) and Asian Countries (0.21 billion US$) in 2000/2001.

Table 2.4.8 Trading Partners in Egypt

Unit: Million US$

Period	1999/2000			2000/2001*		
	Import	Export	Balance	Import	Export	Balance
European Union (EU)	1,839.3	335.2	-1,504.1	1,784.2	352.0	-1,432.2
Other European countries	425.1	61.2	-363.9	386.3	98.3	-288.0
Russian Federation & C.I.S.	81.5	3.9	-77.6	48.3	4.4	-43.9
USA	782.1	621.7	-160.4	966.8	672.6	-294.2
Arab countries	161.7	102.2	-59.5	194.6	104.8	-89.8
Asian countries	763.5	163.5	-600.0	748.6	208.0	-540.6
African countries	17.7	7.3	-10.4	26.0	3.6	-22.4
Australia	56.1	1.3	-54.8	54.5	1.9	-52.6
Other countries	178.1	9.1	-169.0	133.5	8.0	-125.5
Total**	4,305.1	1,305.4	-2,999.7	4,342.8	1,453.6	-2,889.2

Source: Central Bank of Egypt (Last Update on 2 Dec., 2001)

2.5 Fourth Five-Year Plan

(1) General Framework

The fourth five-year plan envisages a rise in the overall resource of the economy by 35.7% at an annual growth rate of 6.9%. GDP of industry is expected to rise from 8.7% in 1996/1997 to 10.8% in 2001/2002. Agriculture sector's GDP will reach 15.5% of the total GDP with the growth rate of 4.2% by the end of plan.

The agriculture crops whose exports are expected to grow in the next five years include fresh and frozen vegetable, 14.4%; fruits, 20.5%; potato, 12.8%, and medicinal and perfume herbs, 14.5%. Cotton will also continue to be exported in adequate quantities in order to preserve its presence on world markets.

As to industrial exports, they are expected to grow at 25.1% for engineering industries, 19.0% for food industries, 18.9% for textile industries, 17.0% for chemical industries, 23.2% for construction materials and refractory industries and a high growth rate is forecast for leather and furniture industries.

Targeted total GDP for the Year 2001/2002 according to Economic Sectors is shown in Table 2.5.1.

Table 2.5.1 Targeted Total GDP for Year 2001/2002 according to Economic Sectors

Sector	Expected for 1997/1998	Planned for 2001/2002	Annual growth rate (%)
Agriculture	42,325	52,021	4.2
Industry	43,383	72,447	19.8
Petroleum	15,854	16,713	1.1
Electricity	4,220	6,158	7.9
Construction	12,750	21,507	11.0
Total of commodity production	118,532	168,846	7.3
Total of Production service	77,552	111,142	7.5
Total of Social services	43,416	55,012	4.8
Total	239,599	335,000	6.9

Source: "The Fourth Five Year Plan for Economic and Social Development (1997/98-2001/02), and the Plan of Its First Year (1997/98)"; The Ministry of Planning

(2) Population

Population features at end of plan are shown in Table 2.5.2.

Table 2.5.2 Population Features of 2001/2002

Item	1998/1997	2001/2002
Population growth rate	1.94%	1.66%
Birth Rate	2.60%	2.27%
Mortality Rate	0.66%	0.61%
Average babies per woman	3.4	2.9
Use of birth-control by wives	50%	60%

Source: "The Fourth Five Year Plan for Economic and Social Development (1997/98-2001/02), and the Plan of Its First Year (1997/98)"; The Ministry of Planning

2.6 Egypt in the 21st Century

(1) Population

According to the most reserved estimate, population is projected to reach 80 million in 2017, excluding Egyptian expatriates abroad. This requires successful family planning and increased awareness of the need to maintain the downtrend of population growth rata and bring it gradually to around 1.2% in 2017.

(2) Agriculture Development

Agriculture development strategy is primarily based on preserving and improving the productivity of cultivated land, and protecting it from urban expansion. It is also planned to further enhance the productivity of the newly-reclaimed land since 1982, amounting to 1.6 million feddens, adjacent to boundaries of the Old Valley, and to the east and west of the Delta. It is also targeted to increase agricultural production at a real growth rate of around 4% per annum, in order to meet food requirements of the population and cope with the needs of development.

Crop structure should be adjusted in line with an indicative policy, taking into consideration water rationing and relationship between water unit and value added for each crop, especially rice and sugar cane. Areas for growing grain crops should be expanded and rainy coastal areas exploited.

(3) Industrial Development

Industrial development is the mainstay for establishing production bases and maximizing the export capabilities of the national economy. A growth rate of not less than 9% in the fourth five-year plan is targeted which would progressively rise to an average of 11% until 2017.

(4) Petroleum

The petroleum sector plays a leading role as a foreign currency-generating activity. It has become the main source of operating electric power, and the basic raw material for some industries such as Azote fertilizers. The development strategy of this sector is based on integrated policies based on the following:

- Maximizing the pivotal role of the petroleum sector as a key source of national income, foreign exchange, and job opportunity;
- Preserve and protect the environmental against pollution;

- Boost development efforts north of the valley by increasing available refinery capacity at Wadi Firan refinery; and so on.

Chapter 3 Natural Conditions

3.1 General

In order to provide the Study Team with study-related information, the data and information on natural conditions were collected in the 1st Field Work in Egypt. The required data and information were collected to the satisfaction in covering the area focused in this study and obtaining general understanding on natural conditions. These data and information are used to facilitate assigned tasks of the Study Team for developing master plan and short-term plan.

In addition, a series of site surveys such as topographic and bathymetric surveys along Upper River Nile and Beheiry/Nobaria Canals, and other survey including subsoil investigation, water and riverbed quality analysis at the proposed project sites was executed during the 1st Field Work in Egypt during a period from December 2001 to March 2002. This chapter outlines the scope & method of the site survey works. The data and findings obtained through these site surveys for natural conditions are presented in details in Appendix 3-1.

3.2 Geographical Conditions

The country of Egypt occupies the northeastern region of Africa continent. The River Nile is the second longest river in the world. The Nile originates at the Equatorial Plateau where the weather regime is hot and rainy in whole year and flows to north through Sudan Valley, Nubian Desert, and Upper & Lower Egypt for a distance of 6,500 km long till it reaches the Mediterranean Sea.

The geographical region of Egypt may be divided into three major areas, i.e. Nile Valley and Delta, Eastern Desert and Western Desert areas. The area focused in this study for Inland Waterway Transport System is Nile Valley and Delta area, which basically fertile owing to the water flows of the River Nile. The Nile Valley and Delta area geographically includes the following regions.

1) Upper Egypt, the south of Aswan, which is a mountainous region in the weather regime of Sahara Desert,
2) Lower Egypt in the River Nile Delta where the River Nile forks into two major branches, and
3) Suez Canal Zone that is extended from Suez Gulf to the Mediterranean Sea

Almost the whole region of Egypt geographically belongs to desert climate with little raining, but the coastal area facing to the Mediterranean Sea belongs to the Mediterranean climate and generally mild and highly seasonal in nature with a few rainfalls experienced in winter.

3.3 Meteorological Conditions

Tables 3.3.1 to 3.3.3 show monthly change of maximum and minimum temperature, humidity and rainfall in major city by geographic regions for a period from 1993 to 1999. Upper Nile and Nile

Delta areas are characterized with hot desert climate with little raining while the north coastal area is mild and experienced a little rain in winter owing to the Mediterranean Sea weather regime. Unlike those changes recorded in Upper Nile and Nile Delta, the monthly humidity at coastal area is very high.

Table 3.3.1 Monthly Change of Temperature by Region and Major City (1993~1999)

(℃)

Region	City		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Upper Nile	Aswan	Max	22.7	25.2	29.7	35.1	38.7	41.4	41.0	40.8	39.2	35.9	29.0	24.2
		Min	8.5	10.0	11.0	18.8	22.7	25.1	25.1	25.6	23.8	20.5	14.8	10.3
	Asyut	Max	20.0	22.1	26.0	31.5	35.5	37.4	36.7	36.4	34.5	31.4	25.9	20.9
		Min	5.9	7.0	10.3	14.9	18.9	21.4	22.2	22.0	19.8	17.1	11.8	7.6
Nile Delta	Cairo	Max	18.8	20.5	23.6	28.3	32.0	33.9	34.7	34.2	32.6	29.2	24.7	20.2
		Min	8.9	9.6	11.6	14.5	17.6	19.9	21.9	22.0	20.3	17.3	14.0	10.3
	Tanta	Max	18.5	19.7	22.2	26.6	30.7	33.4	32.9	32.7	31.8	29.4	24.0	19.8
		Min	6.4	6.3	8.0	11.0	13.7	17.8	19.6	19.6	17.8	15.4	11.6	7.7
	Ismailia	Max	19.5	21.0	23.5	28.3	31.8	34.7	35.9	35.7	33.5	30.4	25.7	21.0
		Min	7.8	8.4	10.1	13.5	16.3	19.4	21.7	21.9	20.2	17.3	13.2	9.3
Mediterranean Sea	Alexandria	Max	18.3	19.0	20.9	24.0	26.5	28.6	29.6	30.4	29.6	27.6	24.0	20.1
		Min	9.1	9.3	10.9	13.4	16.5	20.2	22.6	23.6	21.2	17.8	14.3	10.6
	Damietta	Max	18.2	18.5	20.3	23.1	26.4	29.2	30.6	30.9	29.3	27.3	23.6	19.7
		Min	8.6	9.0	11.0	13.6	16.8	20.0	21.4	21.6	20.2	18.4	15.1	10.7
	Port Said	Max	17.3	17.7	19.2	22.4	24.8	28.1	29.8	30.2	28.8	26.7	22.8	19.0
		Min	11.4	11.6	13.5	16.4	18.9	22.2	23.9	24.5	23.5	21.6	17.2	13.0
Red Sea	Suez	Max	19.6	21.2	23.8	28.7	32.0	34.9	35.7	35.7	33.2	30.3	25.2	20.9
		Min	10.4	11.2	13.1	16.4	19.5	22.4	24.0	24.2	22.7	20.1	15.9	11.8

Source: The Statistical Year Book, 2000

Table 3.3.2 Monthly Change of Humidity by Region and Major City(1993~1999)

(%)

Region	City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Upper Nile	Aswan	39	30	22	18	15	15	18	20	22	25	35	40
	Asyut	51	42	35	27	35	28	34	37	41	43	49	52
Nile Delta	Cairo	59	55	52	46	45	48	56	59	59	58	61	60
	Tanta	73	69	68	60	57	58	67	71	70	68	71	72
	Ismailia	66	61	58	51	50	50	55	58	60	62	63	66
Mediterranean Sea	Alexandria	70	68	66	65	67	70	72	71	68	68	69	70
	Damietta	76	75	73	71	71	71	72	76	75	75	76	76
	Port Said	73	70	70	70	70	70	72	72	70	70	69	74
Red Sea	Suez	58	56	51	45	45	47	52	55	56	57	59	60

Source: The Statistical Year Book, 2000

Table 3.3.3 Monthly Change of Rainfall by Region and Major City(1993~1999)

(mm)

Region	City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Upper Nile	Aswan	>0.1	>0.1	>0.1	>0.1	>0.1	0	0.0	0.8	>0.1	0.4	>0.1	>0.1
	Asyut	>0.1	0.3	0.2	0.1	>0.1	>0.1	0.0	>0.1	>0.1	>0.1	0.7	0.1
Nile Delta	Cairo	5.2	3.9	3.8	1.2	0.4	0.1	0	0	0	0.7	3.9	6.3
	Tanta	11.4	10.2	9.3	2.4	0.6	0.1	>0.1	0	0.2	1.7	7.3	12.0
	Ismailia	6.7	6.7	7.1	2.0	1.5	>0.1	0	0	>0.1	1.4	4.7	5.1
Mediterranean Sea	Alexandria	51.8	29.3	13.8	3.7	1.3	>0.1	>0.1	0.2	0.7	9.0	31.8	55.1
	Damietta	26.0	19.7	13.0	4.6	1.5	0.2	>0.1	>0.1	0.4	7.1	15.7	24.0
	Port Said	19.4	13.7	13.8	3.1	1.6	>0.1	0	0	0.2	3.1	7.2	12.8
Red Sea	Suez	4.0	2.3	4.0	0.9	0.9	0.1	0	0	>0.1	2.2	1.5	2.5

Source: The Statistical Year Book, 2000

Figure 3.3.1 & 3.3.2 are the compiled wind data observed in Cairo and Alexandria obtained through EEAA. Figure 3.3.1 shows the frequency of occurrence in % of wind directions for each twelve 30 degree sector observed at Cairo University, which indicates that most predominant direction wind is N to NNW in Cairo region. Similarly, Figure 3.3.2 shows the wind rose recorded in Alexandria which shows that predominant wind directions in Alexandria range from north to northwest. It is also reported that the wind having more than 34 knots (17.5 m/s) in speed has not been observed.

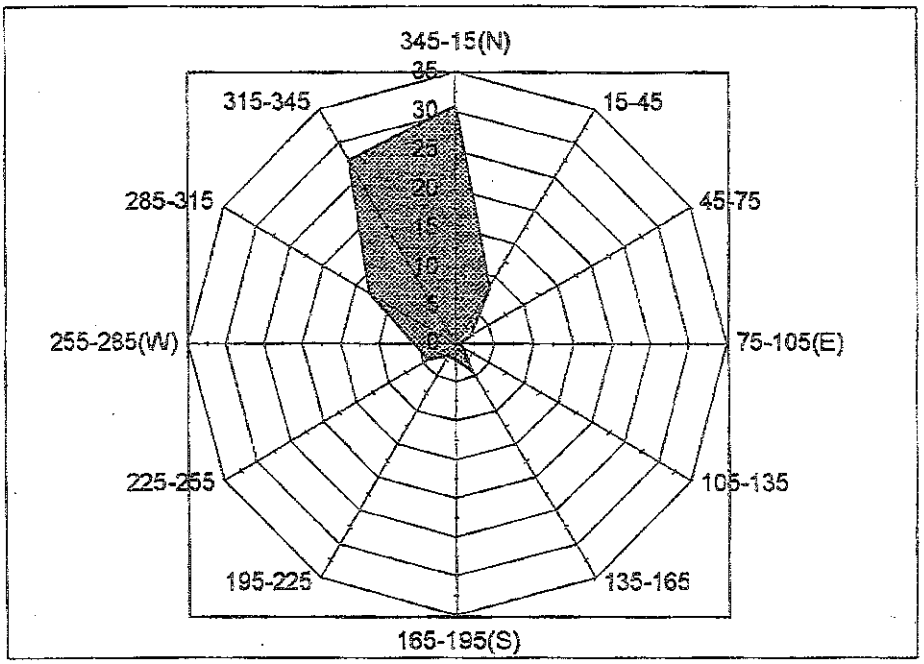

Figure 3.3.1 Frequencies (%) of Wind Direction in Cairo

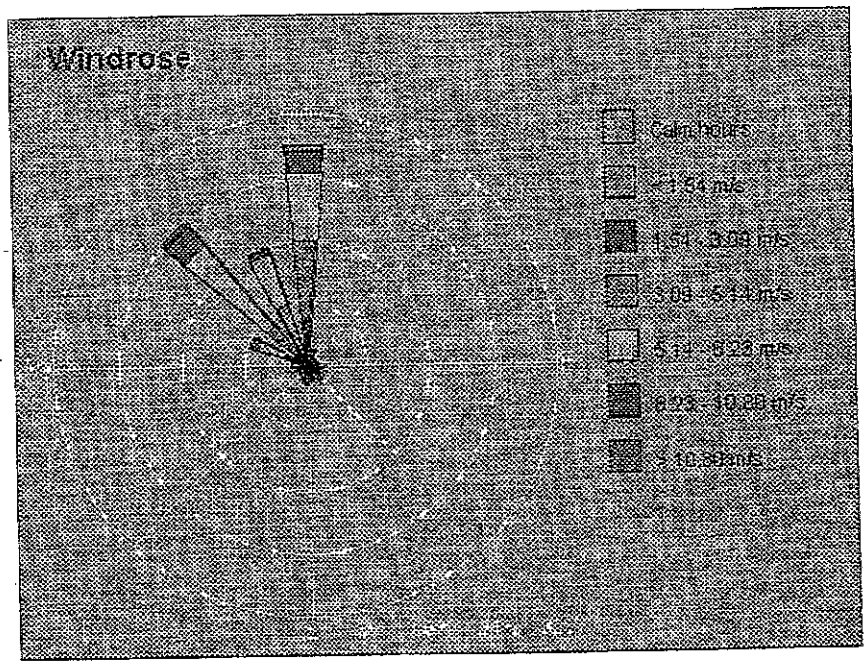

Figure. 3.3.2 Wind Rose in Alexandria

Data on fog occurrence were obtained at Meteorological Institute observation centers. The following are the record on fog occurrence at the area near existing canals in Nile Delta area. These data were recorded by Meteorological Forecast Centers at Khatatba (located along Beheiry canal at Warden Military Airport), Damanhur (located in Damanhur City along Mahmoudia Canal) and Damietta (inside Damietta Port) in past years from its opening of each forecast center (as for Khatatba since 1972, Damanhur since 1963 & Damietta since 1961). There is no observation center located near Nobaria canal and Damanhur is deemed to locate at the nearest point for the area along Nobaria canal.

Table 3.3.4 Monthly Average Days of Fog Occurrence

Location	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Period
Khatatba	1.3	1.1	0.8	0.4	0.2	0.1	0	0	0	1.1	1.9	2.3	~1972
Damanhur	0.3	0.2	0.2	0.1	0.1	0	0	0	0	0.3	0.4	0.8	~1963
Damietta	0.2	0.1	0.1	0	0	0	0	0	0	0	0.2	0.1	~1961

Source: Meteorological Authority of Egypt Unit: Day

Table 3.3.5 Number of Days observed Fog Occurrence in 2001

Location	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Khatatba	10	0	8	0	1	0	0	0	0	0	4	1	24
Damanhur	0	0	0	0	0	0	0	0	0	0	1	1	2
Damietta	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Meteorological Authority of Egypt Unit: Day

The fog phenomenon generally clears away with an increase of ground temperature in the morning.

3.4 Oceanographic Conditions

(1) Tides at the Port of Alexandria

Nobaria Canal connects the capital city of Cairo with Alexandria, the largest seaport in Egypt. The tide observation gauged inside the port area by survey department of Alexandria Port Authority was reported in JICA Study "The Master Plan and Rehabilitation Scheme of the Greater Alexandria Port" prepared in 1999. Hence, a complete reliance will be made on this report as regards tide regime at ports facing to the Mediterranean Sea.

The tide levels referred to Chart Datum Level (equal to Port Datum Level : DL ±0.00) in the Port of Alexandria are summarized in Table 3.4.1. Tide characteristics are based on data recorded in past 5 years period from January 1994 to May1998. As shown in the Table, the tide characteristics in the port of Alexandria show a notable pattern of semi-diurnal tide variations with about 0.3 meters range of difference between mean high and low water levels as being generally most cases in the Mediterranean Sea.

Table 3.4.1 Tide Levels recorded in past 5 years in Alexandria Port (Jan 1994 – May 1998)

Highest Water Level for past 5 years period	+0.96 m
Mean Monthly Highest Water Level	+0.77 m
Mean High Water Level	+0.61 m
Mean Sea Water Level	+0.48 m
Mean Low Water Level	+0.34 m
Mean Monthly Lowest Water Level	+0.21 m
Lowest Water Level for past 5 years period	+0.04 m
Chart Datum Level (=Port Datum Level)	±0.00 m

Source : Study on Master Pan and Rehabilitation Scheme of the Greater Alexandria Port, November 1999

(2) Wave Climate at the Port of Alexandria

As regards ordinary wave climate at offshore of the port of Alexandria, a reference will be made on the Report "Transit of Inland Waterway Barges from El Dikheila to Alexandria" prepared by Delft Hydraulics in May 1989. This study referred 4 study results on ordinary deepwater wave climate available from different sources of data and computed shallow water waves at Alexandria Port. Among others are presented herein the deepwater climate according to Harris in 1979 as shown in the following Table. The study report has concluded that the influence of shoaling deduction on wave direction was not so much.

Table 3.4.2 Frequency of Occurrence by Deepwater Wave Height and Direction at Alexandria Port

Wave Height (m)	N-NE 339-069	E-SE 069-159	S-SW 159-249	W-NW 249-339	Total	%	Accumulated (%)
0.0-0.3	113	73	59	234	479	15.4	15.4
0.3-0.6	269	152	126	683	1230	39.6	55.0
0.6-1.2	132	120	80	530	862	27.7	82.7
1.2-1.8	48	42	46	181	317	10.2	92.9
1.8-2.1	19	11	24	86	140	4.5	97.4
2.1-2.7	3	3	7	27	40	1.3	98.7
2.7-3.3	2	0	2	18	22	0.7	99.4
3.3-3.6	0	0	1	7	8	0.3	99.6
3.6-4.8				3	3	0.1	99.7
4.8-5.7				2	2	0.1	99.8
5.7-6.6				0	0	0.0	99.8
6.6-7.5				1	1	0.0	99.8
7.5-9.6				5	5	0.2	100.0
TOTAL	586	401	345	1777	3109		
%	18.8	12.9	11.1	57.2	100.0		

Source: Transit of Inland Waterway Barges from El Dikheila to Alexandria prepared by Delft Hydraulics, May 1989

Further reference is made on wave height distribution on monthly, seasonally and yearly basis which was measured at the west of Alexandria Port during the period from 1992 to 1995 using an S4DW wave/current meters. This study indicates that:

- predominant wave directions are from N-W sector,
- waves from NNE and NE are limited in magnitude and occur primarily during summer season,
- maximum wave heights are 2.62m, 1.53m and 1.96m in winter, spring and summer-seasons respectively, and
- design wave characteristics are as follows:

Table 3.4.3 Design Wave Characteristics at Alexandria Port

Return Period (year)	1	10	20	50
Ho (m)	3.4	5	6	6.8
T (sec)	6	8.5	10	15

Source : Fanos et al 1995

3.5 Site Surveys conducted by the JICA Study Team

During the 1st Field Study period in Egypt from December 2001 to March 2002, the Study Team carried out the following field surveys 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 River Nile between Asyut and Cairo
- Site Survey at Nobaria and Beheiry Canal Junction
- Site Survey along Nobaria and Beheiry Canals from Cairo to Alexandria
- Site Survey at & around Maritime Lock in the Port of Alexandria

The scope of work for each survey is briefly summarized as follows. The survey work details are presented in Appendix 3-1 of this report.

(1) Cross Sectional Sounding Survey at the Upper River Nile

The cross sectional sounding survey was conducted at 30 locations within 330km in Upper River Nile between Cairo and Asyut. The 30 locations to be surveyed in this 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. The data obtained through this survey are used for estimation of maintenance dredging required along Upper River Nile from Cairo to Asyut in Master Plan of this Study.

A set of cross section survey and water depth sounding was carried out on 6 traverse lines to the Nile

River flows, which are basically positioned at 200 meters intervals for 1 km longitudinal distance at each survey location. The water depth soundings at Nile River were carried out using echo sounder to measure present water depths within the specified area in a suitable accuracy. All recorded water depths were correlated with and reduced to the base Minimum Water Level determined at each survey location along Upper River Nile.

(2) Site Survey at Nobaria and Beheiry Canal Junction

A series of site investigation works was conducted along existing spillway at Bolin where the junction of Nobaria and Beheiry Canals is located.

Topographic survey at the conjunction area of Nobaria and Beheiry Canals was carried out to obtain a topographic feature to cover the area of 250 m width and 2,000m length along 1.2 km long possible future canal which connects the existing canals with Rasheed Branch. Along future connection canal alignment, the subsoil investigation was carried out at three (3) onshore locations at the site. The subsoil investigation includes execution of site boring, in-situ SPT and soil sampling, such laboratory tests on subsoil samples extracted from bored holes as Specific Gravity, Water Content and Grain Size Analysis by Sieve and Hydrometric Test.

In addition, water and waterbed quality surveys were conducted to identify the level of contamination by heavy metals in the water or waterbed material at the canal and Rasheed Branch areas adjacent to the proposed new canal.

(3) Field Survey along Nobaria and Beheiry Canals from Cairo to Alexandria

A series of site investigation works was conducted along Noboria and Beheiry Canals for about 200 km long from the entrance Delta Lock located on the outskirt of Cairo till the end of canals in Alexandria.

Canal cross sectional 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 measurements at 200 locations in an approximately 1 km interval for the whole area of 200 km long canal. In addition, topographic survey together with cross sectional survey and water depth sounding was carried out at six (6) existing locks along Nobaria (4-locks) and Beheiry Canals (2-locks) to obtain topographic and hydraulic feature at & around each existing lock facility.

The water sampling and subsequent analysis of water quality was executed to identify the contamination level of water at the canal areas. Water samplings were taken at two (2) locations at canal water, one (1) in Alexandria port basin and one (1) from Maryut Lake.

(4) Site Survey at & around Maritime Lock in the Port of Alexandria

A series of site investigation works was conducted at the maritime lock in Alexandria Port. Topographic survey at and around Maritime Lock in the port of Alexandria was carried out to obtain a topographic feature along existing Maritime Lock to cover the area of 200 m wide and 500m long. The subsoil investigation was also carried out at one (1) onshore and two (2) offshore locations near existing maritime lock. The subsoil investigation includes execution of site boring, in-situ testing, laboratory tests on subsoil samples extracted from bored holes for Specific Gravity, Water Content and Grain Size Analysis by Sieve and Hydrometric Test.

Furthermore, the waterbed material survey and subsequent analysis of waterbed (soil) material quality was done, taking samples from water basin offshore of existing maritime lock to identify soil contamination level by heavy metal on the seabed soils in Alexandria port basin where new extension lock is planned to expand to offshore.