Engineering Design, Construction Management, and Environmental Assessment Services for Secondary Cities Project in Egypt

FINAL

ENVIRONMENTAL ASSESSMENT REPORT

FOR

ASWAN CITIES

(KOM OMBO, DARAWO AND NASR CITY)

WATER DISTRIBUTION, WASTEWATER COLLECTION & CONVEYANCE, WATER & WASTEWATER TREATMENT

Submitted to:

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT, CAIRO, EGYPT

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Acronyms and Abbreviations

USAID	United States Agency for International Development
CDM	Camp Dresser & McKee International Inc.
AAW	Dr. Ahmed Abdel-Warith Consulting Engineers
NOPWASD	National Organization for Potable Water and Sanitary Drainage
GOE	Government of Egypt
EEAA	Egyptian Environmental Affairs Agency
WWISP	Water and Wastewater Institutional Support Project
CEQ	Council on Environmental Quality
NBU	National Biodiversity Unit
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
ED/CM	Engineering Design and Construction Management
NWTP	New Water Treatment Plant
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Weights and Measures

m^3/d	cubic meters per day
lps	liters per second
l/p/d	liters per person per day
°C	temperature in degrees Celsius
m	meters
mm	millimeters
ug/l	micrograms per liter
mg/l	milligrams per liter
NTU	Normal Turbidity Units
BOD_5	5-day biochemical oxygen demand
Feddan	A unit of area equal to 4,200 m^2
Hectare	A unit of area equal to 10,000 m^2
uS/cm	microsiemens per centimeter - unit of measure of conductivity. Equal to micromhos/cm in U.S. system of measurements

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Executive Summary

Overview

For Kom Ombo, Darawo, and Nasr City in the Aswan Governorate, the proposed project has nine components.

For Kom Ombo, the existing water treatment facilities are to be rehabilitated and expanded. The water transmission and distribution network is also to be rehabilitated and expanded. A sewerage network is to be designed and constructed.

Similar works are proposed for Darawo. A new wastewater stabilization pond plant is to serve Kom Ombo and Darawo jointly.

Nasr City obtains its treated water from Kom Ombo. In this project, it is proposed to expand the transmission and distribution system, and to design and construct a sewerage network, and a wastewater stabilization pond system.

For each of the proposed project components, the potential for construction and operations activities to incur adverse and beneficial environmental effects has been estimated, with respect to the physical environment, the socio-economic environment, and the cultural/aesthetic environment.

The EA has identified several factors which should be granted due attention by the appropriate authorities, but no reasons to cancel, postpone, or seriously replan any of the components. All the environmental effects identified and discussed can be satisfactorily mitigated.

Furthermore, all components of the project will provide significant natural, social, and economic environmental benefits to the Aswan area cities.

Particular Items

- The chief industrial establishment in the region is the Egyptian Sugar and Distillation Company at Kom Ombo, situated just across the Kassel Canal from the existing water treatment plant. The industrial wastewater discharge from the Sugar Plant is to the Nile, just upstream of the Kassel Canal intake, with the result that the Kassel Canal intake is by this discharge. This, in turn, has degraded the supply for the existing Kom Ombo water treatment plant, which draws from the Kassel Canal.

  It is understood that the sugar factory is proceeding with the construction of their own treatment facility, and thus, discharge of wastes to the Kassel Canal will be eliminated. This is not within the scope of the Secondary Cities Project, and the responsible Egyptian agencies are urged to ensure that this is actually accomplished in a timely manner.

- In this part of Egypt, away from the flood plain of the Nile, one often encounters a form of soil called, "swelling clay". This is soil that has not been wetted for many thousands of years. Then, when it does become wet, it swells and otherwise changes its soil properties, including bearing capacity. This phenomenon can be structurally devastating , when water leaks to soils in built-up areas. In Nasr City, for example, a four-story hospital stands empty (and dangerous), with cracked and failing walls, ceilings, and staircases. In areas where these soils are found, special care must be taken with the installation of water and sewer lines.

- There is a fleet of several hundred cruise ships on the Nile carrying several tens of thousands of tourists at a time, in high tourist season. At present their wastes are simply discharged to the river. At Luxor, efforts are underway to operate a facility to discharge the wastewater from the cruise ships to the sewerage system. Such a system is worthy of consideration for other of the cruise ships' ports of call, including the Kom Ombo pharaonic temple.

  Any pumpout system at Kom Ombo Temple should be operated and maintained in a way that will be reliably financed, and fully used by the cruise fleet. Also, the wastewater system will need to be designed to handle this flow, if there is a good probability that the facility will be installed, either presently or in the foreseeable future.

- Great care must be exercised when placing pipelines in archaeological zones. In the most important areas, sewers should be designed to be placed not more than 1 or 2 m below grade, to minimize disturbance of as yet unexcavated antiquities.

- Treatment plant effluent will most likely be reused for agriculture. This is good practice, as long as available laws and guidelines regarding the reuse of wastewater, and an appreciation for the other hydraulic components in the system, are observed.

  In particular, there are two months of the year when farmers cannot use any irrigation water on their crops (principally, sugar cane at harvest time). Alternative disposal arrangements must be made for this condition. Off-season discharge to agricultural drains is generally not feasible without enlarging the hydraulic capacity of the drains, particularly at culverts and siphons. Therefore, disposal arrangements must comprehensively take into account the entire seasonal water management balance of the region.

- The reuse of sewage sludge in agriculture is widely practiced in Egypt, and is expected to be practiced at the region's two proposed stabilization pond plants from time to time, when the ponds need to be de-sludged (about every five years). The USEPA criteria and guidelines for the agricultural use of sewage are suggested for use.

- Water quality was sampled during this Environmental Assessment, and showed no parameter to be present in troublesome concentrations. Some parameters showed sufficiently high levels to require monitoring, as a part of ongoing operation and maintenance of the water supply and wastewater disposal system.

General Items

To minimize the adverse effects and to maximize the benefits of the project:

- Store materials and dispose wastes properly. For example, in the expansion and rehabilitation of the water treatment plants, there is an opportunity to make sure that all reasonable measures are taken to safely store and use the chlorine gas used for disinfection.

- Train the workforce, and plan to do so in excess of obvious needs. If there are 10 positions which require trained personnel, prepare to train not 10, but 50 or 100 if possible. On the one hand, this will be necessary to retain a competent staff at Aswan area cities, as trained personnel naturally tend to migrate to better jobs elsewhere, if they can be found, at least in the present era. On the other hand, such apparent "over-training" should be viewed as a national investment that will return benefits over a long time horizon, for the benefit of the whole country, and of the local region in particular.

- To help keep facilities operational, eliminate institutional barriers to supplying parts as and when they are needed. That needed spare parts *exist* for pump stations, pipelines, and treatment plants is not enough; like water itself, the parts are useless if they cannot flow to the points where they are needed. Like unaccounted-for water, and like trained staff who "leak away" to other jobs, there is bound to be "leakage" of parts that never reach their intended destination. However, such leakage should be controlled by means other than making it difficult to keep operational a system so vital to the health and well-being of the community.
- To the greatest extent feasible, set a construction priority among the project components and execute them rapidly in series, rather than trying to execute many projects simultaneously, with funding severely limiting the progress of any project, and with many project sites remaining open, as inconvenient and often dangerous intrusions, in a community
- Sewerage of a district should have fiscal and administrative provision to ensure that not only are the sewers put in the ground, but that all house connections to the sewer are correctly made, as well.
- To avoid sewage ponding, the sewerage of a district should not lag far behind water supply to that district. This is particularly important in "swelling-clay"areas.
- The planning and design of the effluent reuse facilities at the Ballana and Nasr City waste stabilization ponds is outside the scope of this project. It is strongly recommended that this matter be pursued and proceed in such a fashion that the facilities are ready for use at the same time that the ponds are placed into operation.

CHAPTER 1

Project Description

1.1 Project Setting

The report presents the Environmental Assessment (EA) for the Secondary Cities Project activities in cities of Kom Ombo, Darawo and Nasr City of the Aswan Governorate. This EA forms part of the Secondary Cities Project ED/CM contract that has been executed on June 1, 1995 between the United States Agency for International Development (USAID) and Camp Dresser & McKee International Inc. (CDM). A "Basis of Design" report is concurrently in preparation. Supported by this EA, and by a reports on the Rehabilitation of the Kom Ombo and Darawo Water Treatment Plants, the "Basis of Design" report will lead to the final design of the recommended facilities.

1.1.1 Location

Kom Ombo, Darawo and Nasr City are located in the Aswan Governorate, forming a triangle centered about 40 km north of Aswan city. The cities lie along the eastern side of the Nile River valley plain. Darawo is about 35 km north of Aswan, Kom Ombo is about 45 km north of Aswan and 2 km east of the River Nile and Nasr City is about 50 km north of Aswan and 15 km east of the River Nile (Figure 1-1). The city of Kom Ombo lies at about 24°25' North Latitude and 32°55' East Longitude.

1.1.2 Purpose

The cities of Kom Ombo, Darawo and Nasr City are not providing residents with full water services. Also, no formal wastewater collection or treatment systems are available. To address these serious concerns various measures to improve the water and wastewater utilities are being developed.

The water supply for the Kom Ombo, Darawo, and Nasr City area is a regional supply system (Figure 1-2), in that not only are the three cities supplied from the water treatment plants, but several smaller villages also receive their water supplies from these plants. A new regional water plant is currently under construction, and is expected to be operational in 1997. This plant is located about 19 km northwest of Kom Ombo on the east bank of the River Nile. This new plant is not within the scope of this project, except for its effects on supply requirements.

Proposed Kom Ombo and Darawo Facilities

For Kom Ombo, the proposed water supply improvements include the rehabilitation and expansion of the existing water treatment facilities located on the Kassel Canal, and expansion of the water transmission and distribution network.

For Darawo, the proposed water supply improvements will include the rehabilitation of the existing water treatment plant, and expansion of the transmission and distribution systems.

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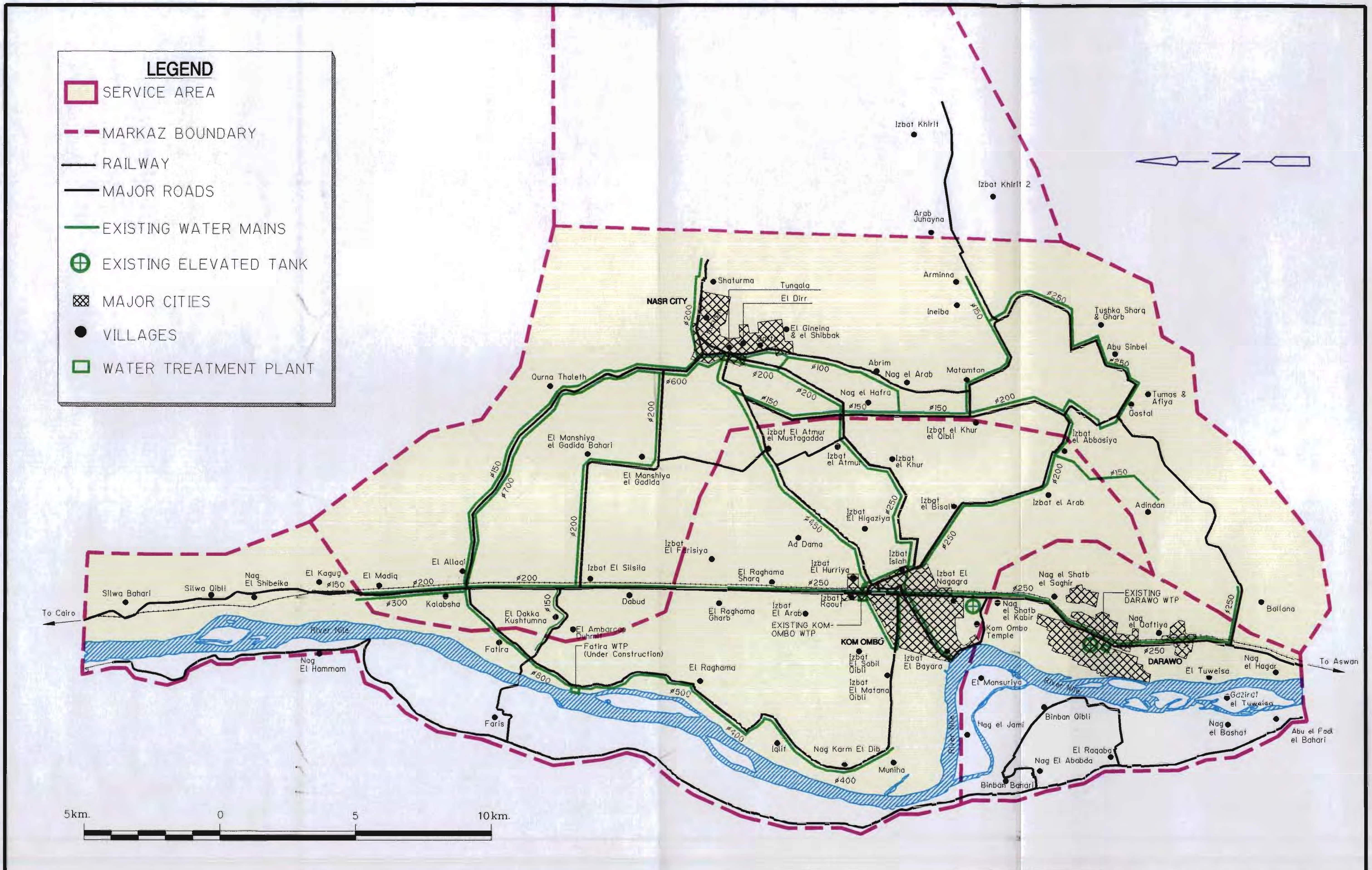

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SECONDARY CITIES ED/CM PROJECT

USAID GRANT No. 263-0236

ENVIRONMENTAL ASSESSMENT
ASWAN CITIES
REGIONAL WATER SERVICE AREA

PROJECT NO. 3055
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FIGURE NUMBER
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Neither Kom Ombo nor Darawo have a wastewater collection network at present; the project activities will include the design and construction of a sewerage network for Kom Ombo and for Darawo. The project will also include the design and construction of a new wastewater stabilization pond treatment plant to serve both cities (Figure 1-3).

Proposed Nasr City Facilities

Nasr City obtains its treated water by pipeline from the regional water supply system (Figure 1-2). This project will consist of the expansion of the existing transmission mains and distribution network as required, including construction of additional storage facilities as needed.

The project will consist of the design and construction of wastewater stabilization ponds (Figure 1-3), including the means for effluent reuse and the construction of sewers, wastewater pump stations and associated force mains.

1.1.3 Stage in Planning

In order to assist the Government of Egypt (GOE) expanding and improving its institutional reform efforts in the water and wastewater sector, USAID is funding the Secondary Cities Project.

Since 1977, the GOE and USAID have collaborated in expansion and upgrading of water and wastewater facilities in Egypt, principally in Cairo, Alexandria, and the three Suez Canal cities. The National Organization for Potable Water and Sanitary Drainage (NOPWASD), has a backlog of more than 200 of Egypt's other, generally smaller, cities that have requested assistance to construct new water and wastewater treatment facilities and networks, or to expand and rehabilitate existing facilities. NOPWASD has in turn sought USAID assistance in meeting these requests.

Experience indicates that appropriate policy and institutional reforms must be implemented to ensure the sustainability of such projects, once constructed. Therefore, USAID is pursuing structural changes to utilities that will enable the GOE to establish locally funded and locally controlled water and wastewater facilities, supported by adequate tariffs.

The Secondary Cities Project is being developed to assist the GOE in amplifying such reform efforts. For the cities concerned it includes implementation of needed facilities; for Egypt as a whole it may be viewed as a pilot, or demonstration, project, in its institutional reform aspects. Therefore, of the more than 200 cities requesting aid, seven have been selected, in part because of their diversity, ranging from Mansoura, a large city in the agricultural/industrial delta; to Nuweiba, a small Sinai town now burgeoning with foreign tourism, to Nasr City, an Upper Egypt township of villages relocated more than 30 years ago from the rising waters of Lake Nasser.

Background data and information for the Secondary Cities Project were gathered and reported in a project paper, whose objectives were to:

a) Analyze the feasibility of water and wastewater projects and sustainable institutional arrangements;

b) Define the policy constraints and recommended strategies for reform;

c) Refine the estimated levels of assistance required;

d) Explore implementation options; and

e) Identify the environmental consequences of site selection.

That project paper, completed in March 1994, constitutes the point of departure for the current design phase of the Secondary Cities Project, for Kom Ombo, Darawo, Nasr City and the other cities of the project. This report, the environmental assessment of the Kom Ombo, Darawo and Nasr City water and wastewater interventions, likewise begins from information presented in the project paper of 1994, amplified by a more detailed examination of existing data and interviews with citizens and professionals involved with the project.

As part of the EA, a scoping session was held in Aswan on 14 October 1995. The purpose of the scoping session was to bring together parties with an interest in the proposed new water and wastewater facilities to assist in identifying environmental issues that should be addressed by the EA.

1.1.4 Summary of Environmental Procedures

The project is implemented under the supervision of the National Organization for Potable Water and Sanitary Drainage (NOPWASD), representing the Government of Egypt (GOE), and the United States Agency for International Development (USAID).

Egypt is in the process of establishing a strong commitment to the preservation of the environment. An environmental assessment is required to satisfy the comprehensive body of regulations that have been developed to protect the Egyptian environment based on Law 4 for the Year 1994.

In addition to meeting the Egyptian regulations, the USAID environmental procedures embodied in 22 CFR 216 "Environmental Procedures" must be satisfied. These Egyptian and USAID regulations are discussed in the following sub-sections.

Egyptian Environmental Legislation

Law 4 of the Year 1994 entitled "Promulgating the Law on the Environment" and its Executive Regulations, the Prime Ministerial Decree No. 338 for the Year 1995, set forth the overall framework for protection of the environment. Under the law, installations or establishments that are subject to the provisions on evaluation of the environmental impact assessments are determined according to the type of the establishment's activity; the extent of the establishment's exhaustion of natural resources, especially waters, agricultural lands, and mineral wealth; the site of the establishment; and the type of power used in operating the establishment. The proposed water supply and wastewater facilities are under these controls.

Law No. 4/94 requires the preparation of an environmental impact assessment with the application for license for a project. The owner of the establishment- according to the provision of this law- shall attach to his application a statement describing the project, comprising the data included in the form to be prepared by the environmental affairs agency. In addition the owner shall monitor and record the impact of the project's activity on the environment.

Law No. 4/94 established an agency for the protection and development of the environment which is called, "Egyptian Environmental Affairs Agency" (EEAA). This agency replaces the agency which was established by virtue of Republican Decree No. 631 of the year 1982, with all its rights and obligations.

A series of regulations have been issued by different ministries, which are

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SECONDARY CITIES ED/CM PROJECT

USAID GRANT No. 263-0236

ENVIRONMENTAL ASSESSMENT

ASWAN CITIES
REGIONAL WASTEWATER SYSTEM

PROJECT NO. 3055
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FIGURE NUMBER
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applicable to the project facilities. These include:

▪ Presidential Decree No. 93/1962	Concerning drainage of liquid wastes
▪ Decree No. 649/1962	The executive regulations of Law No. 93/1962
▪ Decree No. 470/1971	On the norms of atmospheric pollution in establishments and industrial sub-ordinated units
▪ Law No. 57/1978	On eliminating pools and swamps and prevention of digging works
▪ Presidential Decree No. 631/1982	Regarding establishing an Environmental Affairs Authority at the Presidency of the Council of Ministers
▪ Law No. 102/1982	Concerned with the establishment and management of Egyptian protected natural areas
▪ Law No. 48/1982:	Protection of the River Nile and waterways from pollution
▪ Ministerial Decree No. 08/1983	The executive regulations of Law No. 48/1982
▪ Decree No. 09/1988	Regarding the amendment of certain provisions of the Ministerial Decree No. 08/1983
▪ Ministerial Committee organized under law No. 276/1994	Reuse of wastewater in irrigation
▪ Decree No. 108/1995	Ministry of Health standards for drinking water

In addition to the above regulations NOPWASD, through the Water and Wastewater Institutional Support Project (WWISP) had proposed water and wastewater standards. These standards are included in final report no. CG-11 entitled, "Environmental Standards for Potable Water and Wastewater Discharge", and SR-9 entitled, "Environmental Code Enforcement Program".

USAID Environmental Procedures

USAID's environmental procedures are found in 22 CFR Part 216, and are further explained in the Agency's Handbook 3, Appendix 2D. These procedures are consistent with Executive Order 12114, issued January 4, 1979, entitled "Environmental Effects Abroad of Major Federal Actions" and the purposes of the National Environmental Policy Act of 1970. These guidelines, which were adopted in 1976 and revised in 1980, formalize the agency's commitment to environmental considerations during the decision-making process leading to implementation or rejection of a project. Within the process, reasonably foreseeable environmental impacts are identified, and alternatives or mitigating measures are recommended. The USAID environmental procedures are

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outlined in Table 1-1.

For projects falling in various classes of actions (Sect.216.2.d), including potable water and sewerage projects other than those that are small scale, either an Environmental Assessment (EA) or Environmental Impact Statement (EIS) will be required (Sect. 216.2.d.1.xi). Thus, an EA or EIS is required for the water supply and wastewater measures proposed for Kom Ombo, Darawo and Nasr City under this project.

An EA is defined as "a detailed study of the reasonably foreseeable significant effects, both beneficial and adverse, of a proposed action on the environment of a foreign country or countries" (Sect. 216.1.c.4). It must be prepared when an EIS is deemed unnecessary according to the criteria in Sect. 216.7.

An EIS is defined as " a detailed study of the reasonably foreseeable environmental impacts, both positive and negative, of a proposed AID action and its reasonable alternatives on the United States, the global environment or areas outside the jurisdiction of any nation as described in Sect. 216.7 of the procedures " (Sect. 216.1.c.5). It must be prepared when " agency actions significantly affect.... (1) the global environment or areas outside the jurisdiction of any nation (e.g., the oceans) ; (2) the environment of the United States; or (3) other aspects of the environment at the discretion of the Administrator " (Sect. 216.7.a). In the case of (1) and (3) above, an EIS " will generally follow the President's Council on Environmental Quality (CEQ) Regulations, but will take into account the special considerations and concerns of AID."

In June, 1994, a Positive Threshold Decision was issued for all of the cities participating in the Secondary Cities Project, and this document identified the necessity for the preparation of this EA. The Positive Threshold Decision is documented in Appendix I.

1.2 Existing Facilities and Conditions

1.2.1 Water Supply System

In general, the existing water supply system for the combined Kom Ombo, Darawo and Nasr City area can be considered as a regional supply system, in that there are water treatment plants at Kom Ombo and Darawo which supply water not only to these two cities but also to many of the smaller villages in this general area. In addition, because these water treatment plants do not have the capacity to supply all of the regional water demands, there are several compact water treatment facilities installed within the regional service area. These should be considered as temporary facilities, and are assumed to be removed from service when other, more reliable, sources of supply are completed.

A new regional water treatment plant is under construction, on the east bank near Fatirah, 19 km northwest of Kom Ombo. This plant, rated at 400 lps, is expected to be placed into service in 1997.

There is a transmission network, basically centered at Kom Ombo, that distributes water throughout the area. NOPWASD is expanding this regional transmission network.

The regional system appears to have been expanded over the years without significant planning. Accordingly, there are problems with low pressures throughout the system. Without rehabilitation of the system, its ability to

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Table 1-1 Summary of USAID Environmental Procedures

USAID Environmental Procedures	Description of Environmental Procedure	Remarks
1. Initial Environmental Examination (IEE)	First review of the reasonably foreseeable effects of a proposed action on the environment.	Not required for activities identified in 216.2 (d), the category of this project.
2. Threshold Decision	A formal agency decision which determines, whether a proposed agency action is a major action affecting the environment.	Required for the Secondary Cities Project new interventions in Luxor (see Appendix I).
3. Negative Declaration	Declaration in writing that the agency will not develop an EA or an EIS regarding an action found to have an effect on the environment.	No negative declaration was made for Luxor
4. Scope of EA or EIS	Identification of the significant issues relating to the proposed action and determination of the key issues to be addressed in the EA or EIS. Expert consultations, public and private installations and host governments should participate in the scoping.	Written statements covering the environmental key issues. Review and approval by the Bureau Environmental Officer (BEO) is required.
5. Preparation of EA or EIS	A detailed study of the reasonably foreseeable significant impacts, both beneficial and adverse, of a proposed action on the environment.	Report covering the study is required. BEO review and approval is required.
6. Monitoring	Environmental monitoring is an integral part of the EA or EIS and the project implementation to the same extent as other aspects of the project.	EA or EIS should include a monitoring program
7. Revisions	In the case of major changes in scope of work or nature of project during its implementation, the Negative Declaration will be reviewed and the above procedures will be carried out again.	Supplements to EA or EIS will be required and BEO review and approval is required.

accommodate present and future demands will continue to diminish.

Existing Kom Ombo Facilities.

Kom Ombo is presently the largest individual producer of water in the Kom Ombo regional network.

The water treatment facilities at the Kom Ombo site include a conventional water treatment plant (WTP), designed by NOPWASD and placed in operation in 1973, and a package plant unit. The plant is based on the chemically-enhanced settling/rapid sand filtration technology common throughout Egypt. The WTP has a rated capacity of 200 lps. The package plant has a rated capacity of 28 lps. The WTP and the package plant unit share the same source of raw water (the Kassel Canal) and the same intake structure, raw water valve vault, and raw water basin. All other treatment units for the WTP and the package unit are separate. The WTP supplies treated water to the distribution system in Kom Ombo and the package plant unit supplies treated water to Sabel, a village approximately 5 km from Kom Ombo. The plant is located at the northern end of the city. The plant is in need of rehabilitation and a separate report regarding rehabilitation has been issued.

Water from the Kom Ombo plant is discharged, through 600 mm, 400 mm and three 250 mm diameter pipes, to a system which supplies Kom Ombo City and the Darawo/Kom Ombo and Nasr City region, including outlying villages.

The local distribution system for Kom Ombo serves the area shown in Figure 1-4. The system consists of approximately 60 km of asbestos cement pipes ranging in size from 100 mm to 250 mm. The system serves approximately 90 percent of the city.

There are no existing elevated tanks in Kom Ombo. However, there is a 350 m^3 capacity, 15 m high, elevated tank under construction at El-Bayara district. The height of this tank is not adequate, taking into consideration that the minimum recommended pressure in the network is 15 m.

The Governorate Housing Department is responsible for operating the water supply and treatment facilities and for the main distribution system. Local distribution networks are the responsibility of the City Council.

Existing Darawo Facilities.

At present, the total water production capability of the existing Darawo water treatment facilities is 6,910 m^3/d (80 lps). The Darawo plant receives raw water primarily from the Darawo Canal. As occurs elsewhere in the region, the raw water supply from the canal is significantly reduced each January due to the lowering of water levels in the River Nile. To supplement the system during low water levels, a total of 6 groundwater wells, to depths averaging 50 m, produce approximately 60 lps of water. The groundwater has a salinity of about 500 ppm. Because it serves as a stand-by source for the canal water, the groundwater, when required, is pumped directly to the treatment plant for processing. The groundwater level appears to be relatively stable although it has dropped somewhat.

A new intake facility is presently under construction, comprised of a floating pump facility in the River Nile. When completed, water from the river will be pumped into the supply pipes which presently deliver well water to the treatment plant. In this manner, the Darawo Canal intake, and the need to use well water

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SECONDARY CITIES ED/CM PROJECT

USAID GRANT No. 263-0236

ENVIRONMENTAL ASSESSMENT
KOM OMBO
EXISTING WATER DISTRIBUTION SYSTEM

PROJECT NO. 3055-007
FILE: ENAR\CWMPL003
FIGURE NUMBER
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during periods when the canal is closed, will be eliminated.

The Darawo plant is based on the chemically-enhanced settling/rapid sand filtration technology common throughout Egypt. It was designed by NOPWASD and was constructed in 1963.

The area covered by the local distribution system for Darawo is shown in Figure 1-5. The system is operated and maintained by the local government. It consists of approximately 44 km of asbestos cement pipes ranging in size from 100 mm to 350 mm. The system serves approximately 80 percent of the homes and business. Residents in buildings which are not connected to the distribution system obtain their water from groundwater sources. There is a 300 m^3 capacity, 40 m high elevated tank located at the Darawo WTP.

Existing Nasr City Facilities

Nasr City presently receives its water from the regional network. Water from the regional distribution system is fed to the Nasr City area through an 11-km long, 450 mm steel and asbestos cement water transmission pipe. Adjacent outlying villages are also supplied. Problems with low pressures were confirmed by Nasr City officials who noted that the city suffers annually from particularly severe water shortages during the months of January and February.

The local distribution system for Nasr City is shown in Figure 1-6. It is a single-line system (not looped) consisting of approximately 40 km of asbestos cement and galvanized steel pipes ranging in size from 50 mm to 150 mm. The system serves approximately 90 percent of the homes and businesses. About 50 percent of the population receives their water through metered connections, 40 percent have unmetered connections, and 10 percent use standpipes. The system is operated and maintained by the local government.

Leak Detection Program

A hydraulic investigation and a limited leakage study were conducted in Kom Ombo, Darawo and Nasr Cities to determine the system operation parameters. The average pressure in the Kom Ombo and Darawo networks were 23 m while it was 18 m at Nasr City.

The leak detection survey covered about 4 km of Kom Ombo, 3 km of Darawo, 1 km of Nasr City water mains and 11.5 km of the regional line between Kom Ombo and Nasr City. About 35 leaks were found with a total estimated leakage of 27.9 lps. Over 48 percent of the leaks were found in the water main lines. It was noticed that the most of the public taps in Nasr City were leaking.

1.2.2 Wastewater Systems

In general, there are no formal wastewater collection and disposal systems in any of the three cities, although there are informal systems in Nasr City and Kom Ombo. The Nasr City system, consisting of a network of collection pipes and disposal pits, serves only a small portion of the city. The remainder of the residents rely on cess pits which are pumped out occasionally. In a similar fashion, the Kom Ombo system, of which there are only sketchy details available, is comprised of a network of collector pipes, disposal pits, and three small lift stations. These systems discharge to nearby drains, east and west of the Cairo-Aswan Railway. These systems serve only a portion of the city. No information has been made available as to any informal systems in Darawo.

1.3 Proposed Improvements

1.3.1 Planning Basis for Project Requirements.

Presented in this section is the discussion on the development of the drinking water supply and wastewater systems for Kom Ombo, Darawo and Nasr City.

There then follows a summary of the layout and description of the project facilities. While no major revisions are anticipated in relation to the project, it is important to note that this is a dynamic process in which specific details could change during the course of the design and construction phases.

The project design period was defined as 1995 to 2010, and it was recommended in the "Design Criteria" report that this period be extended to Year 2015. In addition, at the request of NOPWASD, and with USAID's approval, projections will be extended until the year 2025, and an assessment made as to staged facilities to meet the needs beyond the year 2015.

From the information on the existing water system, and using the population projections, discussed in Section 2.3.1, and demands to estimate future systems flows, an assessment of appropriate modifications to the present systems has been developed.

Water System Requirements.

Based on the projected 2015 and 2025 populations, a summary of the projected water demands for Kom Ombo, Darawo and Nasr markez are presented in Tables 1-2, 1-3 and 1-4.

Table 1-2 Summary of Projected Water Demands - Kom Ombo - m^3/d

	YEAR 2015			YEAR 2025		
CATEGORY	CITY	VILLAGES	TOTAL	CITY	VILLAGES	TOTAL
Residential	17,055	28,227	45,282	23,745	36,844	60,589
Commercial	1,023	847	1,870	1,425	1,105	2,530
Industrial	1,364	0	1,364	1,900	0	1,900
Institutional	1,194	1,129	2,323	1,662	1,474	3,136
Losses	4,127	6,041	10,168	5,746	7,885	13,631
Total	24,763	36,243	61,006	34,478	47,308	81,786

Wastewater System Requirements

Based on the projected 2015 and 2025 populations of each city area, a summary of the projected wastewater flows for Kom Ombo, Darawo and Nasr

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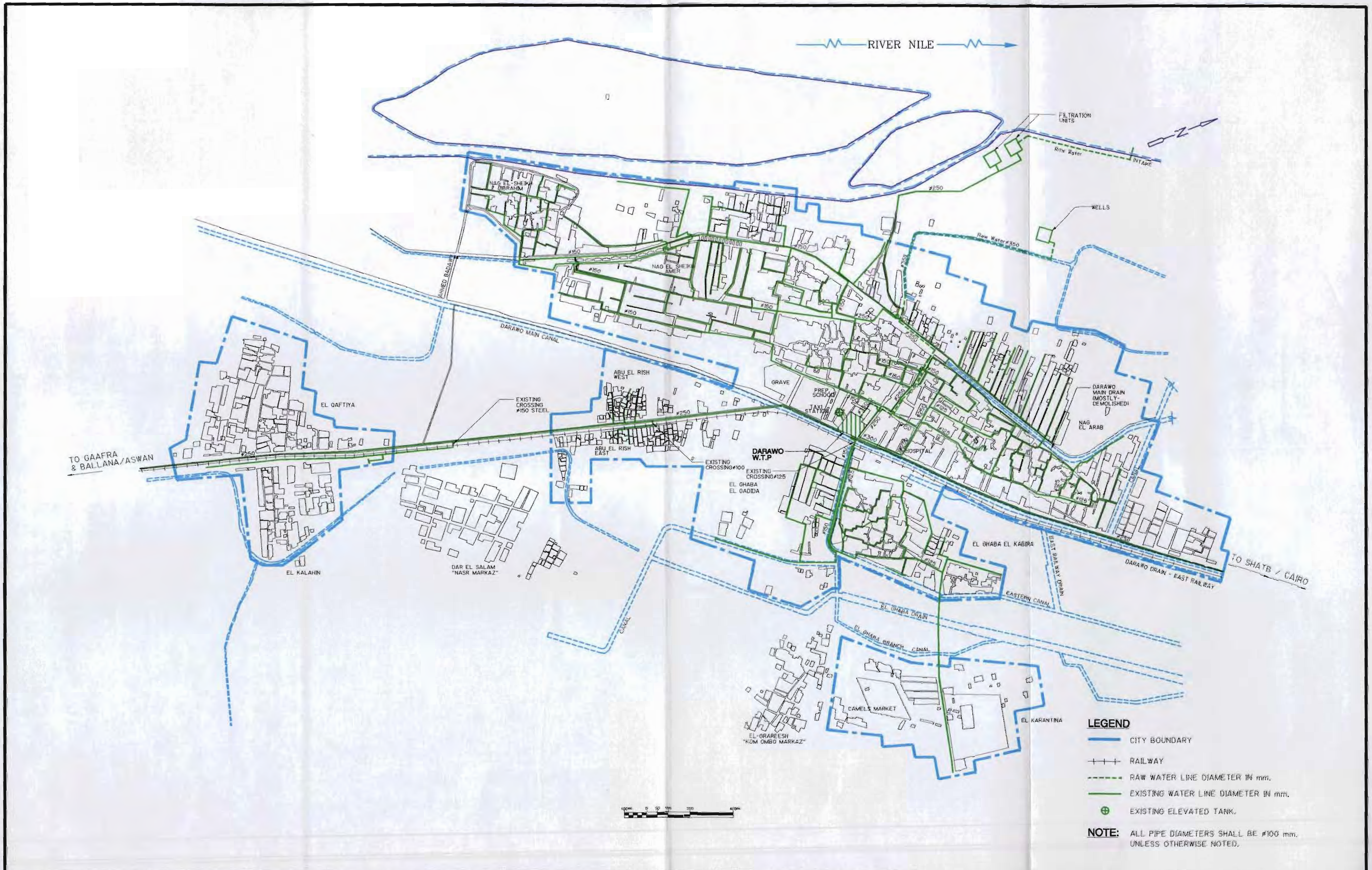

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SECONDARY CITIES ED/CM PROJECT

USAID GRANT No. 263-0236

ENVIRONMENTAL ASSESSMENT
DARAWO
EXISTING WATER DISTRIBUTION SYSTEM

PROJECT NO. 3055-008
FILE: EAANR\CWMPL001

FIGURE NUMBER
1-5

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SECONDARY CITIES ED/CM PROJECT

USAID GRANT No. 263-0236

ENVIRONMENTAL ASSESSMENT
NASR CITY
EXISTING WATER DISTRIBUTION SYSTEM

PROJECT NO. 3055-009
FILE: ENAR\CWMPL001
FIGURE NUMBER
1 - 6

Table 1-3 Summary of Projected Water Demands - Darawo - m³/d

	YEAR 2015			YEAR 2025		
CATEGORY	CITY	VILLAGES	TOTAL	CITY	VILLAGES	TOTAL
Residential	7,481	4,014	11,495	10,116	5,239	15,355
Commercial	449	120	569	607	157	764
Industrial	0	0	0	0	0	0
Institutional	524	161	685	708	210	918
Losses	1,691	859	2,550	2,286	1,121	3,407
Total	10,145	5,154	15,299	13,717	6,727	20,444

Table 1-4 Summary of Projected Water Demands - Nasr - m³/d

	YEAR 2015			YEAR 2025		
CATEGORY	CITY	VILLAGES	TOTAL	CITY	VILLAGES	TOTAL
Residential	1,426	10,954	12,380	1,891	13,885	15,776
Commercial	29	219	248	38	278	316
Industrial	0	0	0	0	0	0
Institutional	100	438	538	132	555	687
Losses	311	2,322	2,633	412	2,944	3,356
Total	1,865	13,933	15,798	2,473	17,662	20,135

City are presented in Table 1-5.

1.3.2 Layout and Description of Proposed Facilities

The project discussed below comprises the following principal elements:

- Expansion of Kom Ombo water treatment plant
- Rehabilitation of existing conventional water treatment plants at Kom Ombo and Darawo
- Rehabilitation and expansion of the water distribution systems and the associated storage tanks
- New wastewater collection network and conveyance systems
- Construction of two new wastewater stabilization ponds (NWSP), including facilities for effluent disposal; one to serve Kom Ombo and Darawo and the other to serve Nasr City

Table 1-5 Summary of Projected Wastewater Flows - m^3/d

	YEAR 2015			YEAR 2025		
CATEGORY	**Kom Ombo**	**Darawo**	**Nasr City**	**Kom Ombo**	**Darawo**	**Nasr City**
Residential	15,349	6,733	1,283	21,371	9,104	1,702
Commercial	921	404	26	1,282	546	34
Industrial	1,228	0	0	1,710	0	0
Institutional	1,074	471	90	1,496	637	119
Infiltration	1,857	761	0	2,586	1,029	0
Total	20,430	8,369	1,399	28,444	11,317	1,855

The following sections describe the proposed water and wastewater facilities for the Aswan area. The design information discussed below has been taken from the Basis of Design Report and the Rehabilitation Reports for the Kom Ombo and Darawo Water Treatment Plants.

Rehabilitation and Expansion of Existing Water Treatment Facilities

Rehabilitation of the Kom Ombo Water Treatment Facilities

The Kom Ombo water treatment plant, using chemically-enhanced settling/rapid sand filtration technology common in Egypt, was designed by NOPWASD and commissioned in 1973. The water treatment plant components most relevant to the environmental assessment of the present project are:

- An off-site (nearby) dual intake structure at the edge of Kassel Canal.
- Flocculation/sedimentation basins.
- Monomedia rectangular filters.
- Two 2,000 m^3 below-grade treated water storage reservoirs.
- Alum storage, batching and feed facilities
- Gaseous chlorine storage and feed facilities

The rehabilitation report developed a set of recommended actions for this plant. The actions with environmental relevance are:

- Upgrade the electrical system to meet minimum safety standards and pump motor power requirements in the pump stations
- A new dry alum storage building is needed for the alum chemical feed system. Installation of an emergency eyewash and shower system in

the batching room, and providing protective aprons and eye goggles is also of importance. Oil and grease are leaking from the mechanical mixers and need to be checked to see whether food grade oil can be used in the gear boxes, if not, mixers should be replaced by air mixing mixers

- For the chlorine system:
  - Construct a new chlorine building
  - Provide a system for securing the cylinders in place
  - Install a chlorine gas detector with audible alarm system near the storage pad
  - Install a gas scrubber system to contain a leak from a tonne cylinder and the appropriate instrumentation to automatically activate the system when a leak is detected

Other environmentally related items include installation of new handrails around the tanks, installation of flow meter devices, and improving the sump pump systems, to better maintain dry floors and trenches.

Most of these items have environmental relevance with regard to occupational safety and health of the plant workers, but also to the neighboring community, particularly in the matter of the storage and handling of chlorine gas.

The clarifier sludge and backwash water are currently discharged to Kassel Canal 100 m down stream of the WTP intake structure.

Expansion of the Kom Ombo Water Treatment Plant

The Kom Ombo water treatment plant expansion is designed to increase the water treatment plant capacity to 400 lps. The plant will treat water from the River Nile to a level meeting the Egyptian regulations for drinking water. The existing plant site is sufficiently large for the existing facilities and anticipated expansion facilities.

The expansion of the treatment plant will include a new 200 lps raw water pump, two new flocculation basins, two new sedimentation basins, two new backwash pumps and a new filter waste washwater settling basin. The filters, chlorination facilities and treated water storage of the existing water treatment facility will be a part of the water treatment expansion as shown on Figure 1-7.

For the construction and operation of the proposed new water treatment plant, different activities, as related to this EA, are likely to be performed. These activities are summarized in Table 1-6, and their implications are discussed more fully in Chapters 3 and 4.

Rehabilitation of the Darawo Water Treatment Facilities

The 80 lps water treatment plant at the Darawo site was originally constructed in 1963. Some of the pumping equipment was replaced in 1989. The water is drawn from the Darawo Canal. During periods of inadequate flow in the canal the city relies on groundwater. The WTP supplies treated water to the distribution system in Darawo. A sketch of the site and the WTP facilities is provided as Figure 1-8.

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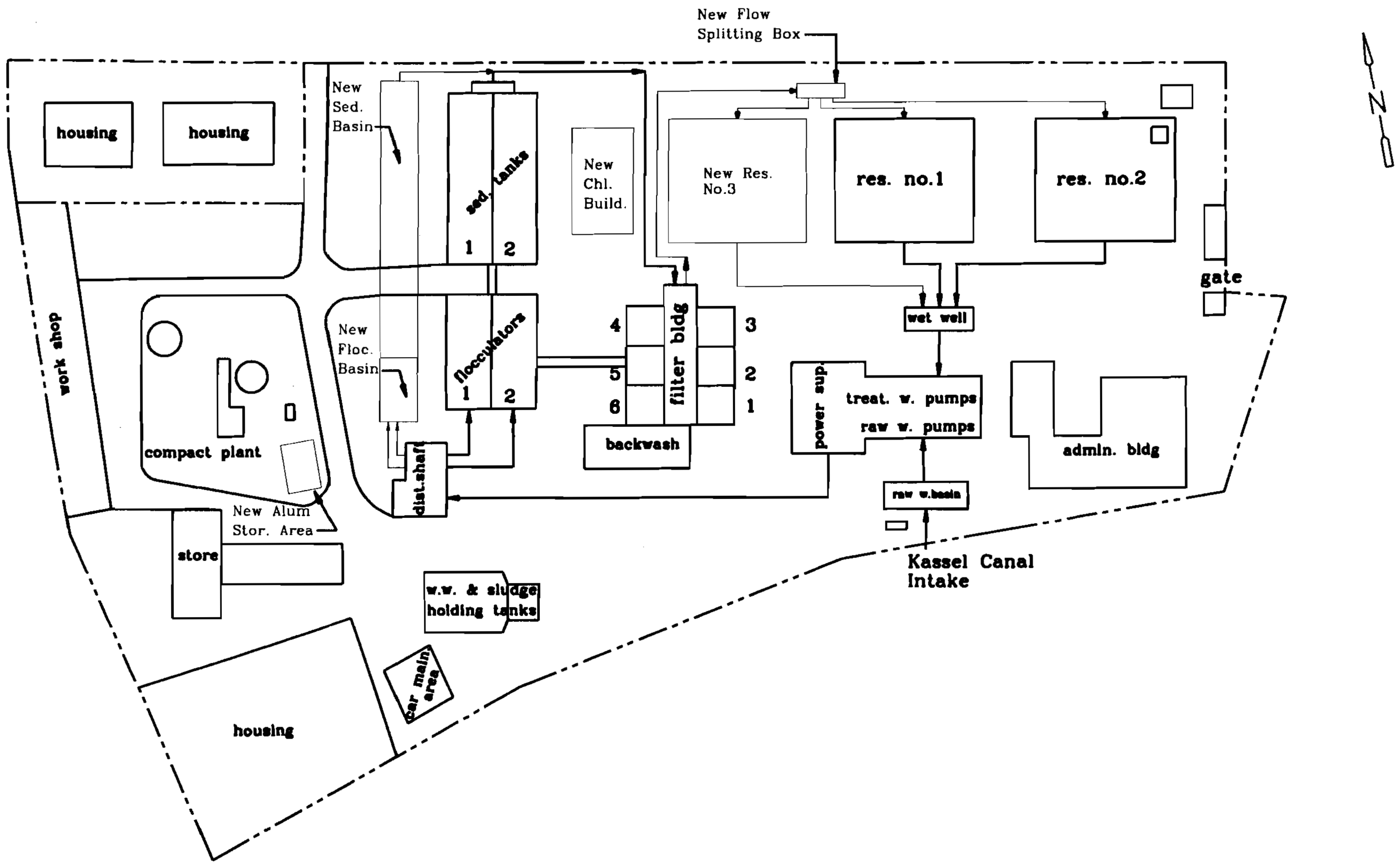
Table 1-6 Activities Related to Expanded Kom Ombo Water Treatment Plant

Activity	Description
Construction Activities	
Temporary occupation of construction area	Available land inside the treatment plant area will be used for the expansion.
Preparation and drainage of site	Likely to involve mechanical earth excavation, plantation removal, dewatering and removal of existing facilities in site
Transportation and other services	Transport of people, equipment and raw construction materials through the main roads close to the site, Water supply and wastewater system, electricity, etc. through the city systems
Construction, piling, material handling and storage	Lands within the existing plant site
Presence of temporary structures and equipment on site	Offices, guard houses and storage sheds
Supply of materials and other resources	Locally manufactured construction materials from cement, steel bars, bricks, aggregate, etc.
Supply of facility equipment	From USA to Alexandria and then by road to the site
Waste disposal	Removal of excessive soils, construction materials
Work force	About 100 of local workers
Construction schedule	To start June 1997
Operation Activities	
Supply and transportation of materials, and other resources	Diesel fuel, oil, greases, chemicals and spare parts
Material handling and storage	Storage of diesel fuel, chlorine and alum
Plant operation and maintenance	See plant layout, Figure 1-7, and facility equipment for maintenance
Waste Disposal	Filter backwash water and sludge from sedimentation process
Work Force	Around 50 qualified technical staff and operators (see Table 1-12) for operating and maintaining the plant.
Presence of plant	Additional drinking water availability



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with Dr. Ahmed Abdel-Warith Consulting Engineers	SECONDARY CITIES ED/CM PROJECT — USAID GRANT No. 263-0236		FIGURE NUMBER 1-7

The water treatment plant components most relevant to the environmental assessment of the present project are:

- A raw water intake at the Darawo Canal
- A remote well field
- Clariflocculator basins
- Filters
- 2,000 m^3 ground storage tank and 100 m^3 elevated storage tank
- Alum storage, batching and feed facilities
- Gaseous chlorine storage and feed facilities

The rehabilitation report developed a set of recommended actions for this plant. The actions with environmental relevance are:

- Construction of new intake on the River Nile (contracted by others)
- Install safety guards around high service pumps and motor couplings
- Inspection of the electrical service in the filter building, and repair as necessary to bring the system up to internationally recognized codes
- Lining of the three alum batching tanks against leakage, and repair of any existing leaks
- Installation of an emergency eyewash and shower system in the batching room, and provision of protective aprons and eye goggles
- Construction of a new chlorine building to house chlorine cylinders and chlorination equipment
- Provision of readily accessible safety equipment in wall-mounted cabinets just outside the chlorine building, appropriate for the handling of chlorine gas
- Upgrade the electrical system to meet minimum safety standards and pump motor power requirements in the pump stations

Most of these items have environmental relevance with regard to occupational safety and health of the plant workers, but also to the neighboring community, particularly in the matter of the storage and handling of chlorine gas.

Clarifier sludge and backwash solids are currently discharged to a nearby drain.

Different activities, as related to this EA, are likely to be performed for the construction and operation of the existing water treatment plants. These activities are summarized in Table 1-7.

1.3.3 Rehabilitation and Expansion of Water Distribution System and the Associated Storage Tanks.

Although not a part of this project, several modifications to the existing regional network have been proposed. These modifications include the construction of

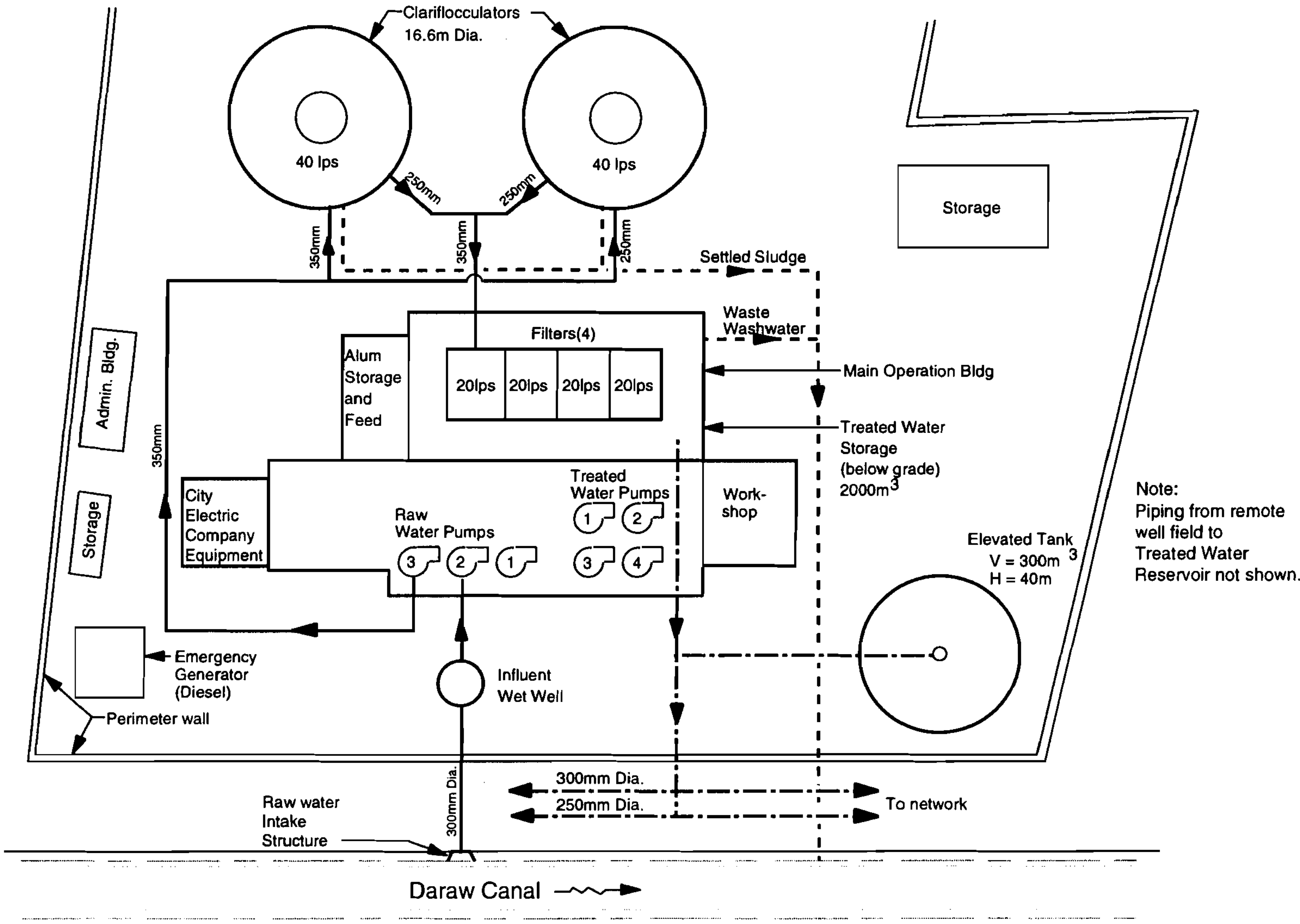

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Table 1-7 Activities Related to the Rehabilitation of Existing Water Treatment Plants

Activity	Description
Construction Activities	
Temporary occupation of construction area	Available land inside the treatment plant area
Supply of materials and other resources	Locally manufactured construction materials from cement, steel bars, bricks, aggregate, etc.
Supply of facility equipment	From USA to Alexandria port and then by road to the site
Waste disposal	Removal of excessive soils, construction materials
Work force	About 100 local workers
Construction schedule	To start June 1997
Operation Activities	
Supply and transportation of materials and other resources	Diesel fuel, oil, greases and spare parts chlorine gas chemicals
Material handling and storage	Storage of diesel fuel, chlorine and alum
Plant operation and maintenance	See plant layout Figures 1-7 and 1-8 facility equipment for maintenance
Waste disposal	Filter backwash water and sludge from sedimentation process
Work force	About 95 qualified technical staff and operators (see Table 1-12)
Presence of plant	Additional drinking water availability with improved quality

a new main outer loop connecting Fatira, Kalabsha, Nasr, El-Abbasseia, Ballana, Darawo, Kom Ombo, Muniha and back to Fatira with pipelines ranging from 800 to 400 mm diameter. The loop is reinforced by inner pipelines connecting Kom Ombo to Kalabsha, Nasr and Abbasseia. The northern part of this network is presently under construction by NOPWASD. This network will be supported with five additional new elevated tanks at Muniha Village, Nasr City, El-Abbasseia Village, Ballana and Silwa Qibli.

Figure 1-9 presents the proposed local water distribution system for Kom Ombo. The main modifications to the system include the construction of a 250 mm pipeline connecting eastern and western Kom Ombo and crossing the railway at the sugar cane tunnel, a new 250 mm diameter pipeline along Kassel Canal to feed El-Bayara District, a new 250 mm diameter loop around Izbat El Hagagi in the south east of Kom Ombo and two new elevated tanks (1,200 m^3 each) at El-Basatin west of Kom Ombo and north of the ice factory, in the east of Kom Ombo.

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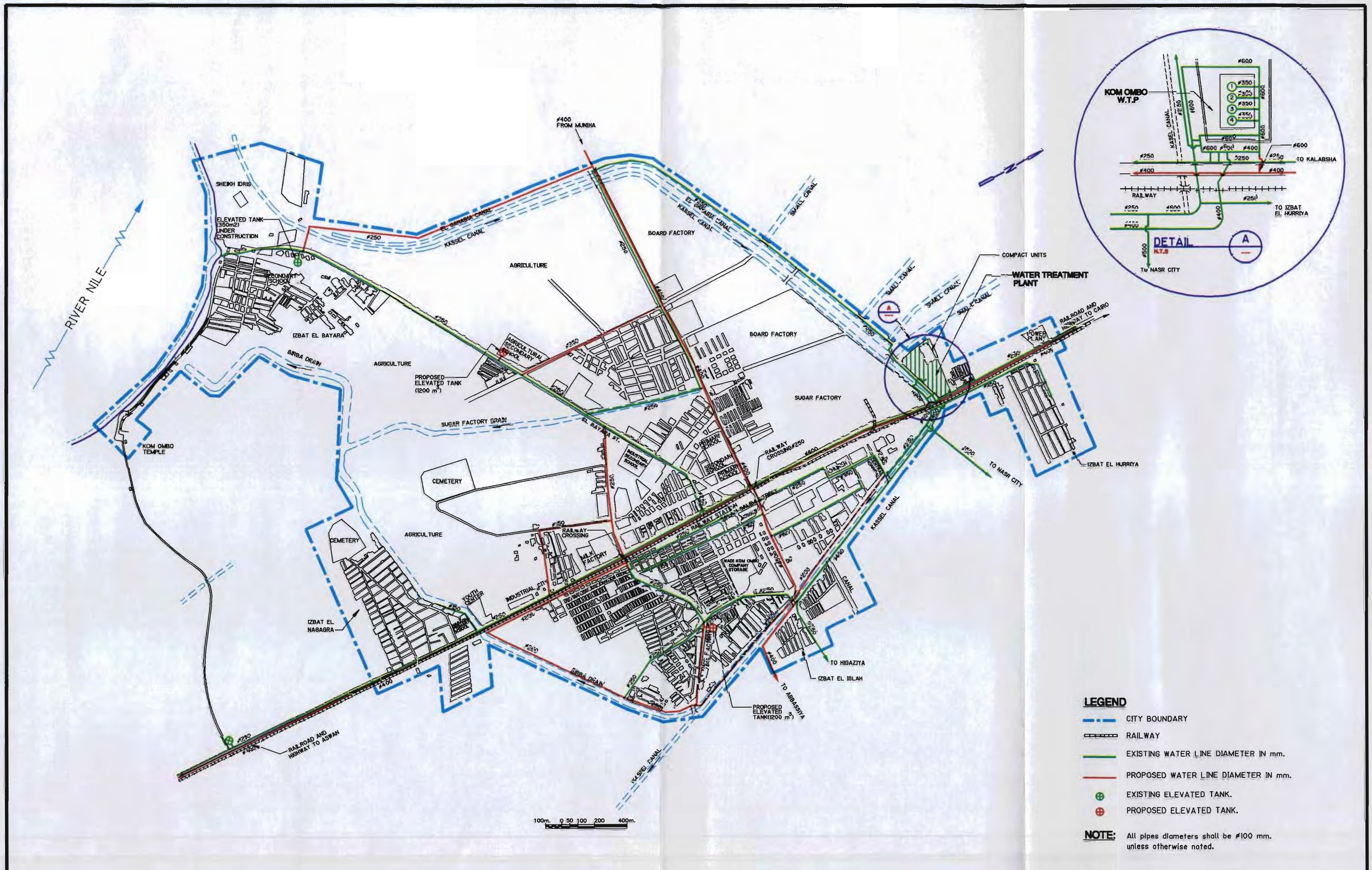

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SECONDARY CITIES ED/CM PROJECT
USAID GRANT No. 263-0236

ENVIRONEMENTAL ASSESSMENT
KOM OMBO
PROPOSED WATER DISTRIBUTION SYSTEM

PROJECT NO. 3055-007
FILE: ENAR\CWPPL003
FIGURE NUMBER
1 - 9

At Darawo, the existing network within the city was extended to form closed loops. As the streets in Darawo are narrow, the general trend was to replace existing pipes rather than add additional pipes. The existing 125 mm diameter railway crossing was replaced by a new 250 mm diameter pipe in the same location to connect the eastern and western parts of the Darawo network. A second railway crossing, 200 mm diameter, at El Qaftiya in the south, is to feed El Kalahin to the east of the railway and a main loop, 200 mm diameter, to feed the western part of Darawo. An elevated tank 1,000 m^3 is proposed near Sheikh Ibrahim district in the west. Figure 1-10 shows the proposed Darawo water distribution system.

A regional elevated tank is proposed at the entrance of Nasr City, which would raise the water pressure during peak flow conditions. The tank is proposed to be about 40 m above the ground elevation. In addition, the network was upgraded to reduce friction losses and to achieve looping (to ensure water supply from at least two points for any node in the network) as shown in Figure 1-11. This include a loop around the northern and southern parts of the city ranging from 250 to 150 mm diameter.

Different activities, as related to this EA, are likely to be performed for the construction and operation of the rehabilitated and expanded water distribution system. These activities are summarized in Table 1-8, and their implications are discussed more in Chapters 3 and 4.

1.3.4 New Wastewater Stabilization Ponds

Two new wastewater stabilization ponds, one for the Kom Ombo and Darawo wastewater networks and the other for the Nasr City wastewater network, are proposed to treat non-industrial wastewater collected within the cities to a level meeting the Egyptian and the USAID regulations for treated wastewater disposal and reuse. The average plant capacities are 33,000 m^3/d and 1,400 m^3/d respectively . Table 1-9 summarizes the expected influent and effluent characteristics for the ponds, and the Egyptian Standards for Disposal in non-potable waters (drains), Article 66 of Law 48/1982 and guidelines for reuse of treated effluents recommended by the Ministry of Housing and Utilities.

Under normal operating conditions the effluent will be reused for irrigation. The systems will be designed to transmit the effluent to allocated agricultural areas, located in the desert adjacent to the plants. To meet the effluent design criteria, the treatment process will include the following:

- Preliminary treatment which includes screening and grit removal
- Waste stabilization ponds which consist of anaerobic ponds, facultative ponds, and maturation ponds
- An effluent reuse system (by others), including pumping to the area designated for reuse

A simplified process flow diagram showing the treatment process is presented in Figure 1-12. Table 1-10 lists the construction and operation activities for the wastewater stabilization ponds.

1.3.5 Wastewater Collection Network and Conveyance Systems

Figures 1-13, 1-14, 1-15 present the proposed wastewater collection systems for Kom Ombo, Darawo and Nasr City. The systems are designed to handle projected flows through 2025.

The Kom Ombo and Darawo sewer networks include proposed sewers and force mains that pass along the main Aswan-Luxor road and the main city roads. In addition several crossings are proposed to the Aswan-Luxor main road, Cairo-Aswan Railway and canals and drains in the area.

The collection systems include five pump stations and force mains in Kom Ombo, two pump stations and force mains in Darawo, and two pump stations and force mains in Nasr City.

Discussions in regard to the collection systems proposed for each of the cities are shown in the Basis of Design report for the Aswan Cities.

Different activities, as related to this EA, are likely to be performed for the construction and operation of a new wastewater collection systems. These activities are summarized in Table 1-11, and their implications are discussed more fully in Chapters 3 and 4.

1.3.6 Work Force

The number of workers to operate and maintain the various facilities is presented in Table 1-12.

The staffing levels shown for the existing plants is unchanged from actual present levels. Also, the staffing levels for the rehabilitated and expanded water supply are unchanged from present levels; actual levels may be somewhat higher.

The staffing level for the new wastewater treatment plants and wastewater collection networks are conservatively estimated to be equal to similar existing plants and networks in other cities.

The staffing total of workers in all categories, and the total of workers added to operated and maintain the expanded and new facilities, is believed to be appropriate.

1.3.7 Construction Activities

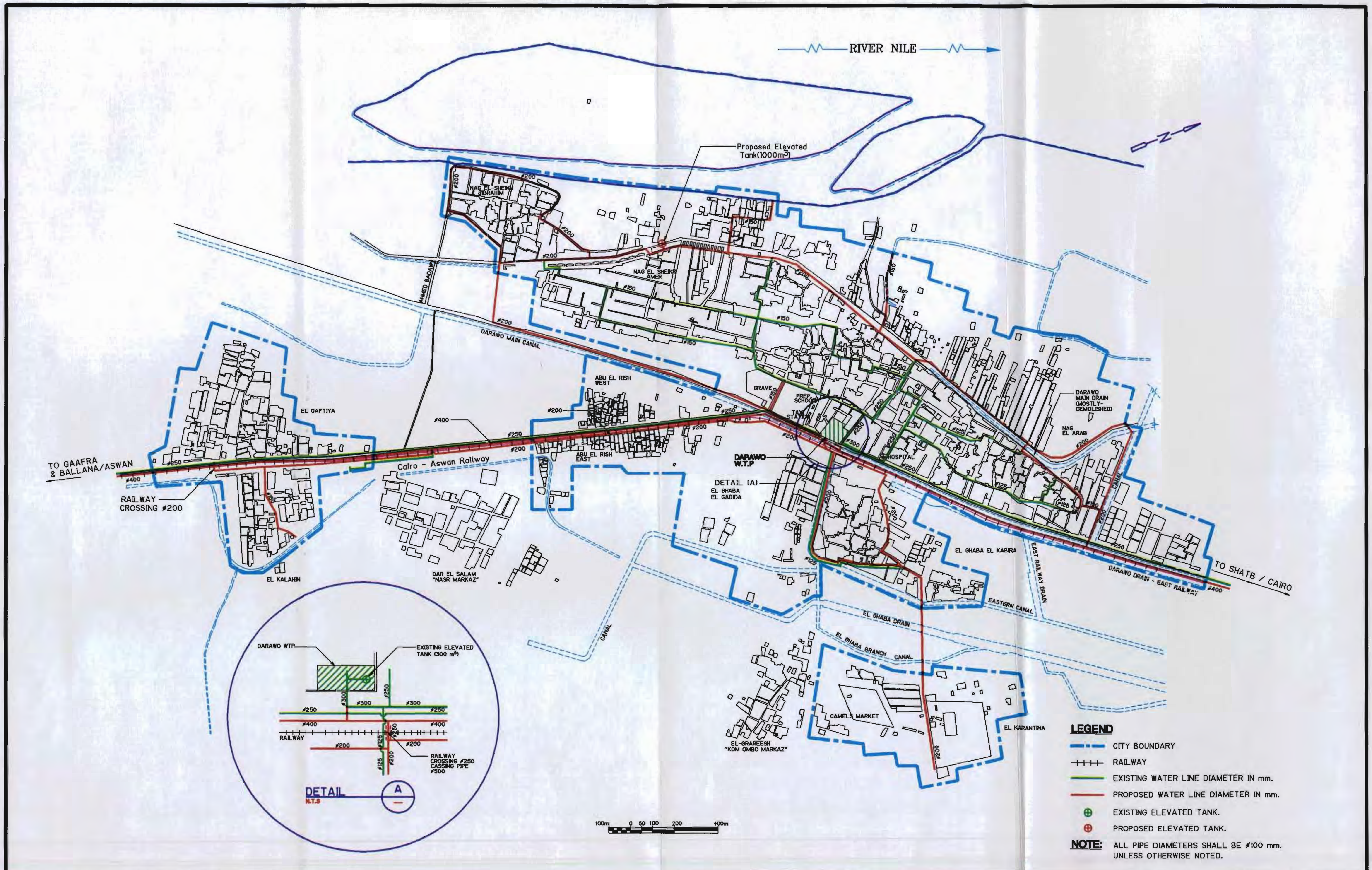
This has been covered in Section 1.3 for each project activity, in turn.

1.3.8 Operation and Maintenance Activities

This has been covered in Section 1.3 for each project activity, in turn.

1.3.9 Abandonment Plans

This has been covered in Section 1.3 for each project activity, in turn. Demolishing of the existing informal sewers, septic and holding tanks, etc... Cleaning out, disinfecting and backfilling the septic and holding tanks in these areas will be of concern.



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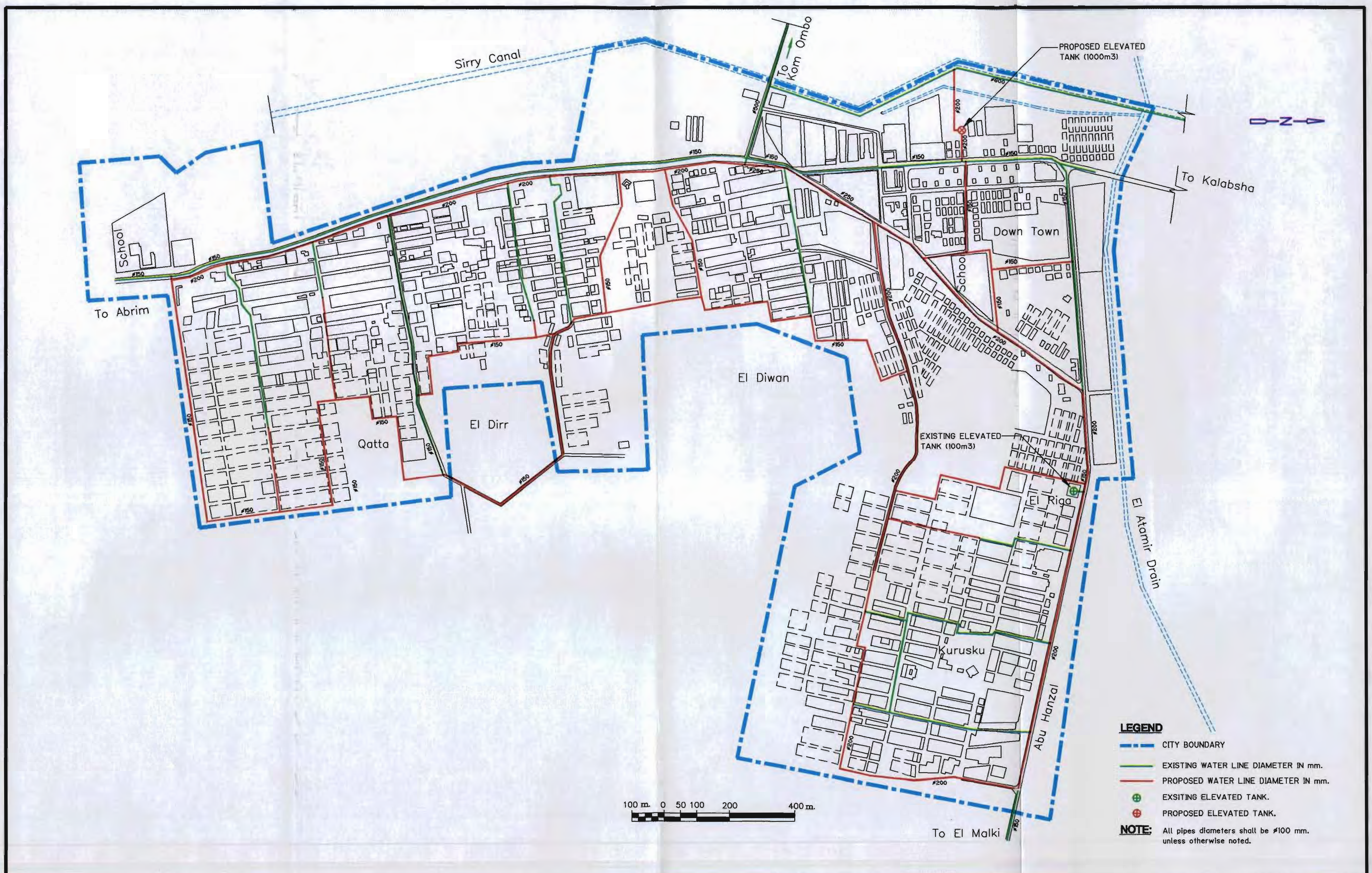
SECONDARY CITIES ED/CM PROJECT

USAID GRANT No. 263-0236

ENVIRONEMENTAL ASSESSMENT
DARAWO
PROPOSED WATER DISTRIBUTION SYSTEM

PROJECT NO. 3055-008
FILE: ENAR\CWPPL003

FIGURE NUMBER
1 - 10



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USAID GRANT No. 263-0236

ENVIRONEMENTAL ASSESSMENT
NASR CITY
PROPOSED WATER DISTRIBUTION SYSTEM

PROJECT NO. 3055-009
FILE: ENAR\CWPPL001

FIGURE NUMBER
1 - 11

Table 1-8 Rehabilitation and Expansion of Water Distribution Systems

Activity	Description
Construction Activities	
Occupation of construction area	Occupation of rights of way along streets for pipelines and transmission lines, and about 10 ha of land for pump stations and storage tanks
Preparation and drainage of site	Likely to involve mechanical earth excavation, plantation removal, asphalt cutting and dewatering
Transportation and other services	Movement of people, equipment and construction materials through the main roads close to the site. Water supply, wastewater system, electricity, and telephone would be supplied via the city utilities
Construction, piling, material handling and storage	Pipelines will be laid 1 m to 2 m below the ground surface. Storage tank structures will be built on the ground surface
Presence of temporary structures and equipment on site	Offices, guard houses and storage sheds
Supply of materials and other resources	Locally manufactured construction materials from cement, aggregate, pipelines etc.
Supply of facility equipment	From USA to Alexandria then by road to the site
Waste disposal	Removal of excess soils, construction materials
Work force	About 200 local workers
Construction schedule	To start June 1997
Operation Activities	
Supply and transportation of materials and other resources	Spare parts
Material handling and storage	Use of warehouses and stores
System operation and maintenance	Storage tanks, pipelines and valves, facility equipment for maintenance
Waste disposal	Waters for flushing water mains
Work force	Around 65 qualified technical staff and operators (see Table 1-12).
Presence of the system	Increase of water quantities and pressures

Table 1-9 Influent and Effluent Characteristics Projected for the New Wastewater Stabilization Ponds

Parameter	Projected Influent	Effluent Design Criteria	Discharge in Non-Potable Water Standards [1]	Reuse Standards (Secondary Treatment) [2]
Total Suspended Solids (mg/l)	360	50	50	40
Biological Oxygen Demand (mg/l)	360	40	60	40
Chemical Oxygen Demand (mg/l)	500	80	80	80
Total Dissolved Solids (mg/l)	250	2,500	2,000	2,500
Nitrates (mg/l)	N/A	50	50	N/A
Fecal Coliform /100 ml	5,000,000	5000	5000	10,000
Intestinal Nematodes, no./liter	100	<1	1	1
Dissolved Oxygen (mg/l)	<1	>4	>4	N/A

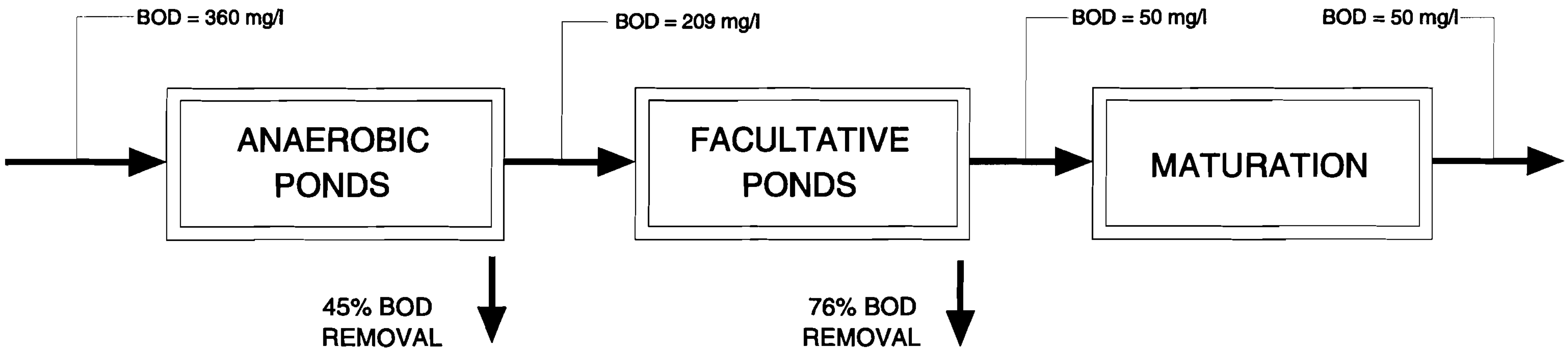
Notes: 1. Egyptian Standards, Article 66, Law 48.

2. Ministry of Housing and Utilities Guidelines

1.4 Project Alternatives

1.4.1 No Action Alternative

Future conditions without the project are described in Sections 2.6 and 3.5.2 where it is illustrated that the no action alternative was not a viable option.



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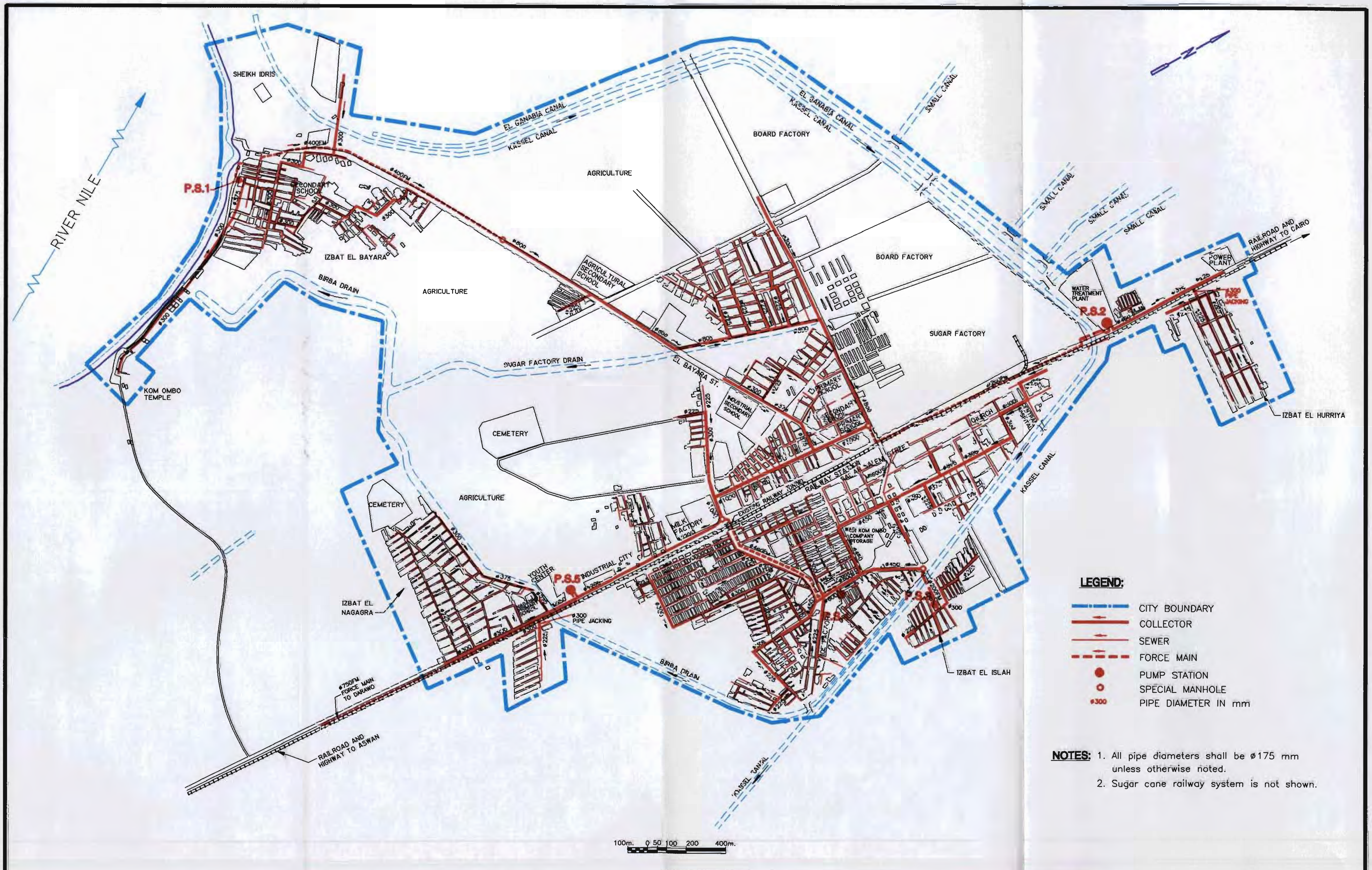
	SECONDARY CITIES ED/CM PROJECT — USAID GRANT No. 263-0236		FIGURE NUMBER 1 - 12

Table 1-10 New Wastewater Stabilization Ponds Activities

Activity	Description
Construction and Installation Activities	
Occupation of construction area	about 160 ha of desert land in Ballana and 22 ha in Nasr City
Preparation and drainage of site	Likely to involve mechanical earth excavation, plantation removal
Transportation and other services	People and raw construction materials through the main roads close to the site, water supply and wastewater system, electricity, etc., through the city systems
Construction, piling, material handling and storage	Desert and scattered cultivated areas are surrounding the plant site
Presence of temporary structures and equipment on site	Offices, guard houses and storage sheds
Supply of materials and other resources	Locally manufactured construction materials from cement, steel bars, bricks, aggregate, etc.
Supply of facility equipment	From USA to Alexandria port and then by road to the site
Waste Disposal	Removal of excessive soils, construction materials
Work Force	About 200 of local workers
Construction schedule	To start on June 1997
Operation Activities	
Supply & transportation of materials, spare parts and other resources	Types, sources & transportation methods.
Plant operation & maintenance	See process diagram Figure 1-12, facility equipment for maintenance
Waste Disposal	Treated effluent, flow quality control and sludge from treatment process
Work Force	Around 23 of qualified technical staff and operators (see table 1-12) for operating and maintaining the plant
Presence of plant	Treatment of city and villages wastewater availability



NOTES:
1. All pipe diameters shall be ø175 mm unless otherwise noted.
2. Sugar cane railway system is not shown.

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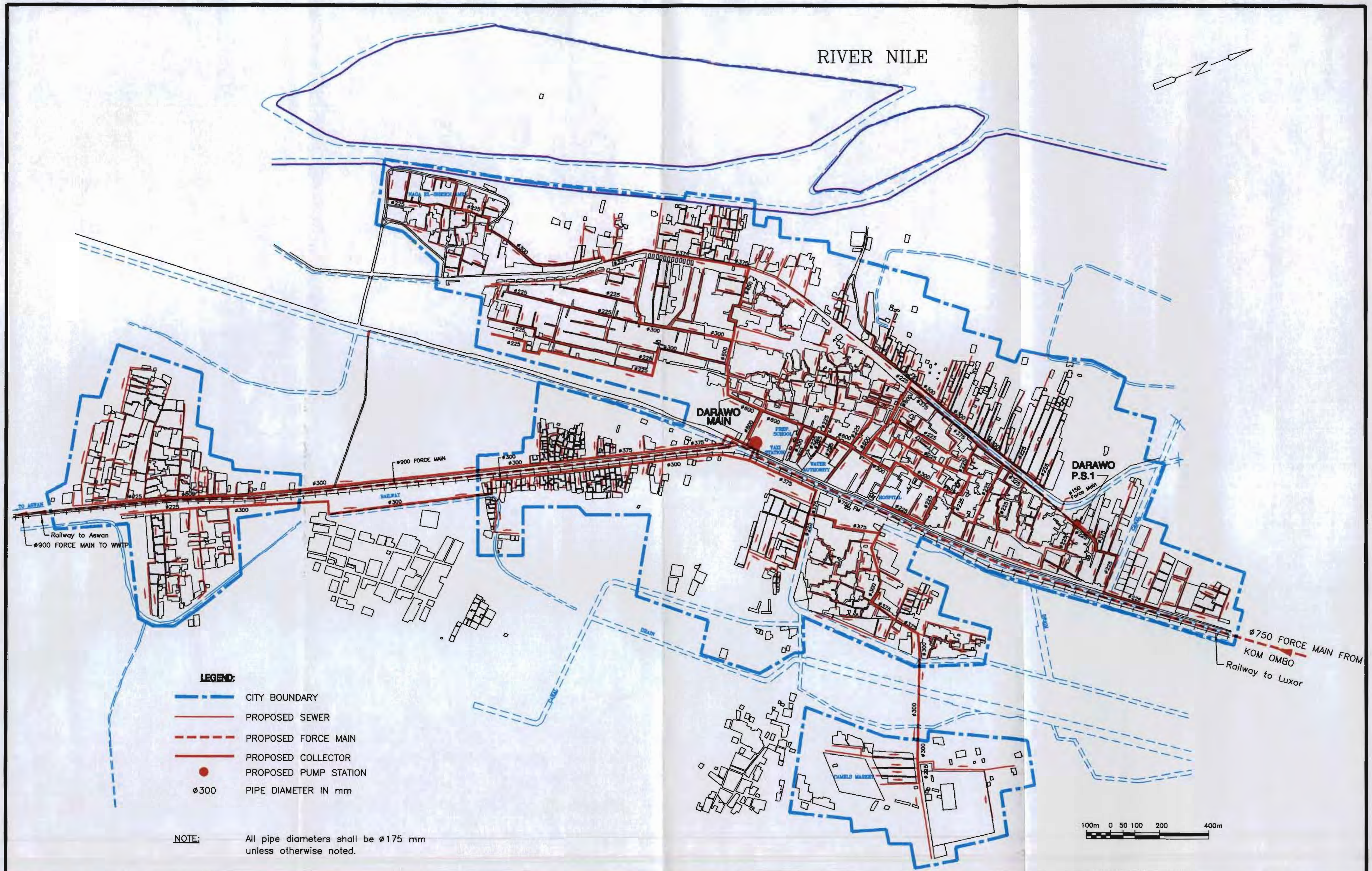

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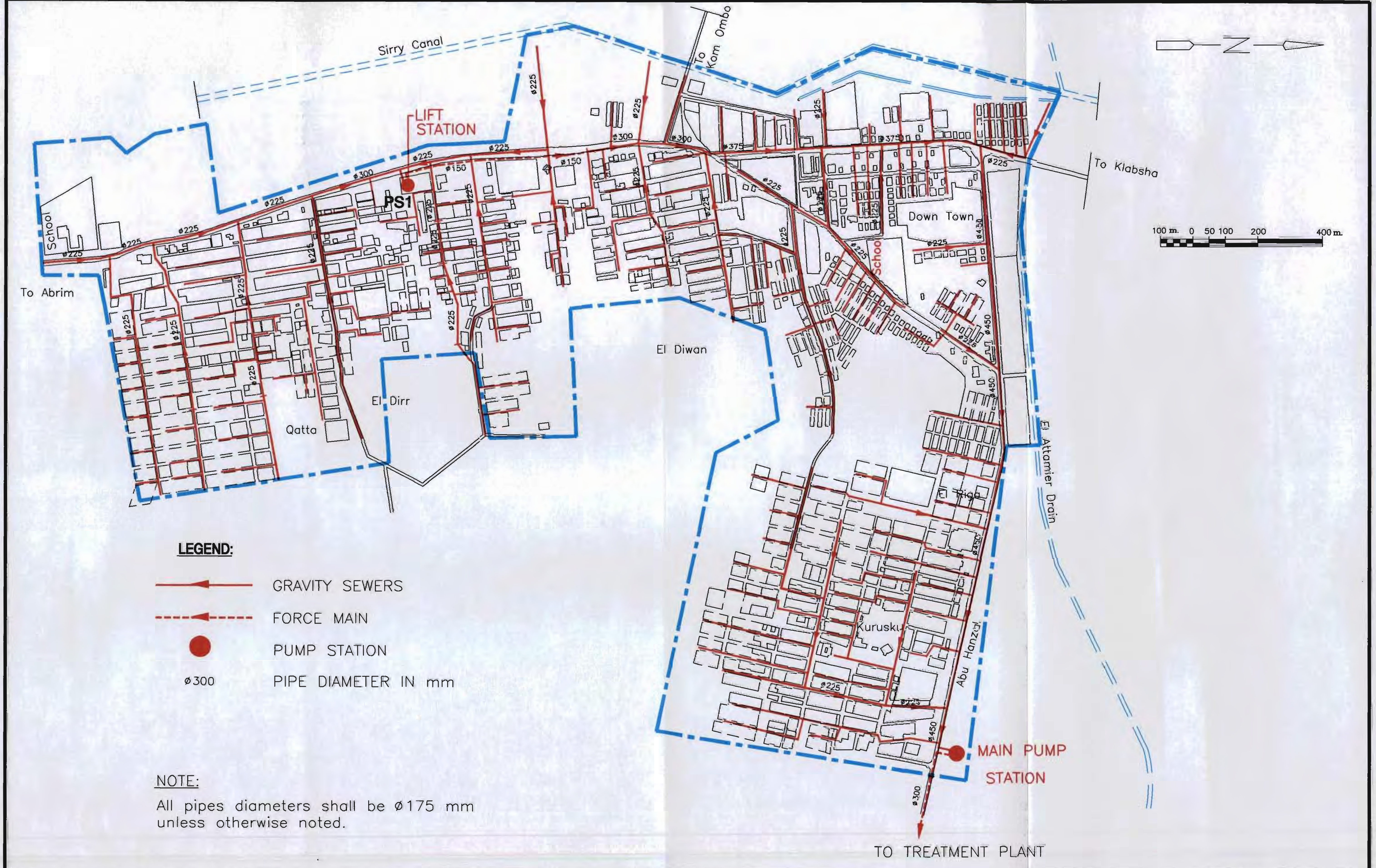

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جمهورية مصر العربية
الهيئة القومية لمياه الشرب والصرف الصحى

SECONDARY CITIES ED/CM PROJECT

USAID GRANT No. 263-0236

ENVIRONEMENTAL ASSESSMENT
NASR CITY
RECOMMENDED WASTEWATER COLLECTION SYSTEM

PROJECT NO. 3055-009
FILE: ENAR\CWWPL001

FIGURE NUMBER
1 - 15

Table 1-11 Wastewater Collection System Activities

Activities	Description
Construction Activities	
Occupation of construction area	Occupation of rights of way along streets for sewer lines and transmission lines, and about 13 ha of land for pump stations
Preparation and drainage of site	Likely to involve mechanical earth excavation, plantation removal, asphalt cutting, dewatering and demolition of cess-pits
Transportation and other services	Movement of people, equipment and construction materials through the main roads close to the site. Water supply, wastewater system, electricity, and telephone would be supplied via the city utilities.
Construction, piling, material handling and storage	Sewer lines will be laid at depths that could reach 6 meters, or more, below the ground surface, pump stations will be below ground level to depths of 8 meters, whereas warehouses and other structures will be built on the ground surface
Presence of temporary structures and equipment on site	Offices, guard houses and storage sheds
Supply of materials and other resources	Locally manufactured construction materials from cement, aggregate, sewer lines etc.
Supply of facility equipment	From USA to Alexandria port and then by road to the site
Waste Disposal	Removal of excessive soils, construction materials
Work Force	About 100 local workers
Construction schedule	To start June 1997
Operation Activities	
Supply and transportation of materials, spare parts and other resources	Diesel fuel, oil, greases, and spare parts
Material handling and storage	Intermittent use of diesel fuel, use of warehouses and stores
System operation and maintenance	Pump station, force mains and sewer lines, facility equipment for maintenance
Waste disposal	Solids and sludge
Work force	Around 175 qualified technical staff and operators (see Table 1-12)
Presence of the system	Increase of collected wastewater quantities

Table 1-12 Work Force Required for Operation and Maintenance

Description	Number
Rehabilitation and Expansion of Existing Water Treatment Plants	
Plant Manager (Sr. Engineer)	2
Operations Manager (Sr. Engineer)	2
Mechanical Maintenance Engineer	2
Electrical Maintenance Engineer	2
Chemist	1
WTP Operation Shift Engineers	8
WTP Operation Technicians	24
Laboratory Technician	1
Mechanical, Electrical & Instrumentation Maintenance Technicians	9
Secretary/Clerk	1
Storekeeper	2
Security Guards, Messenger, Drivers & Laborers	40
Rehabilitation and Expansion of Water Distribution Network	
Water Distribution District Manager	3
Mechanical Maintenance Engineer	1
Supervisors	3
Plumbing Technicians	12
Meter Technicians	6
Leak Detection Technicians	6
Storekeepers	3
Laborers	24
Drivers	4
Storekeeper	3
New Wastewater Stabilization Ponds	
Operation Manager	1
WWTP Operations Technicians	8
Mechanical and Electrical Maintenance Technicians	2
Drivers	2
Laborers	10
New Wastewater Collection Network	
Wastewater Collection District Managers	3
Supervisors/Technicians	3
Plumbing Technicians	10
Pump Station Operation Technicians	36
Mechanical Cleaning Equipment Operations Technicians	6*
Network Civil Repairmen	12
Mechanical & Electrical Maintenance Engineers	3
Mechanical & Electrical Maintenance Technicians	6
Storekeepers	3
Drivers	8
Laborers	85

Note 1 The staffing for WTPs, water distribution and wastewater collection are for the complete systems, to include new, rehabilitated and unmodified facilities.

Note 2 The staffing for mechanical cleaning equipment operations technicians is based on the assumption that mechanical cleaning equipment will be available for use.

CHAPTER 2

Environmental Setting

2.1 Introduction

2.1.1 Field Study Methodology; Data Review; Interviews; Scoping Session; Field Surveys

In this chapter the environment in the vicinity of the project is described as it exists prior to the commencement of the project, from both a local and regional perspective. This information is critical to the assessment of environmental impacts as it allows identification of resources that are rare or unique to the Kom Ombo, Darawo and Nasr City areas.

Information on baseline environmental conditions in the area was obtained through background data review, discussions and interviews with regulatory agencies and technical specialists, and a series of water quality sampling and testing and other field studies. These are discussed in greater detail below.

Data Review

Considerable background information was obtained from previous studies and reports. References used for this study are included in the 'References' section. An in-depth review of Egyptian environmental laws and regulations and the possible implications of this regulatory framework on the project was initiated at an early stage.

Interviews

Discussions were held with a number of Egyptian agencies in relation to environmental issues, including:

- Ministry of Water Resources and Public Works
- Ministry of Housing, Utilities and New Communities (National Organization for Potable Water and Sanitary Drainage)
- Ministry of Health
- Ministry of Culture
- Ministry of Tourism
- Egyptian Environmental Affairs Agency

In addition, consultations were held with the Office of the Governor of Aswan; the Kom Ombo, Darawo and Nasr City Municipalities; the Aswan Housing and Utilities Department; and the Potable Water and Wastewater Authorities in the three cities.

Close coordination was maintained with the cognizant USAID environmental officer regarding the procedures to be followed in preparing the environmental assessment.

Scoping Session

An environmental scoping session was conducted on 14 October 1995. The purpose of the meeting was to identify those attributes of the environment for which there are concerns related to the proposed project. The document resulting from this meeting is the Environmental Scoping Report which is attached hereto as Appendix B.

Attendees at the scoping session included USAID; NOPWASD; the Governor of Aswan; representatives from numerous other relevant ministries and universities; representatives from Aswan Governorate and the cities of Kom Ombo, Darawo and Nasr City; and representatives from the press, consulting engineers and others.

Based on the data review, interviews and scoping session comments, sensitive environmental and social issues were identified and sensitive locations were pinpointed.

Field Surveys

Field visits and sanitary surveys were undertaken at Kom Ombo, Darawo and Nasr City to identify areas that are environmentally sensitive and/or of critical importance to the proper functioning of the system. (Please refer to Figures 1-2 and 1-3).

On 13 and 14 October 1995, the EA team toured the the three cities; visited the water treatment plants in Kom Ombo, Darawo and the new water treatment plant at Fatira, north of Kom Ombo; the drain receiving the sugar cane factory industrial waste effluent and its connection with the River Nile; and Nasr City wastewater cesspool fields.

During the trip, the effect of the sugarcane drain discharging to the River Nile upstream of the Kassel Canal was obvious. Obnoxious odors, dark color and dead plants were observed at the connection point to the River Nile. Samples of the sugar cane factory discharges into the drain were obtained. The results are reported in Appendix J.

The EA team took samples of water from the Nile River, the Darawo and Kassel Canals, the finished water produced at the existing water treatment plants, the Darawo groundwater field and treated water from several points in the distribution system. The sampling program, results and analysis are reported in Appendix J.

Public Correspondence with Non-governmental Organizations

No correspondence has been received from non-governmental organizations (Appendix C).

2.1.2 Life of Project

Construction of the water and wastewater facilities will begin in 1998, and will continue for three years.

The new wastewater stabilization ponds are designed to enable the Kom Ombo, Darawo and Nasr City wastewater treatment systems to handle demands until year 2015. Based upon typical industrial experience the pond structures are expected to last about 50 years, with equipment being upgraded or replaced every 15 to 20 years.

The water distribution system, including pipelines and storage tanks, will be expanded to handle 2025 demands and to serve new areas. Pipelines have a useful life of typically 30 to 40 years.

The new wastewater collection and conveyance system will be designed to serve the cities through the year 2025. Based upon industry experience sewer lines have a life time of typically 30 to 50 years, and may last longer.

2.1.3 Study Area

A map of the regional study area showing the limits of the water supply system is presented on Figure 1-2, while the limits of the wastewater systems are shown on Figure 1-3.

Kom Ombo.

The city of Kom Ombo, located in the Aswan Governorate, lies along the eastern edge of the River Nile valley plain, approximately 45 km north of the city of Aswan and 2 km east of the river. Kom Ombo is primarily a residential, commercial and industrial area. There is an industrial zone at the north of the city which contains a major sugar cane processing factory and board production facilities. The city has several archaeological sites which attract modest tourist visits.

Darawo

The city of Darawo is located along the eastern shore of the River Nile approximately 35 km north of Aswan in the Aswan Governorate. Darawo is a commercial area and is the center of the camel trade with the Sudan. Although located in a rich historical area, Darawo does not have any known archaelogical sites which would attract tourist development.

Nasr City

Nasr City is located along the eastern edge of the River Nile valley plain approximately 50 km north of Aswan and 15 km east of the River Nile in the Aswan Governorate. It was established in the mid-1960s as a relocation center for the Nubian people displaced from the River Nile basin flooded by Lake Nasr behind the Aswan High Dam. There are no known archaeological sites which would attract tourist development.

2.2 Current Land Use and Regional Planning

Kom Ombo

The city contains a random mixture of residential, commercial, industrial, and village type zones. Six of the adjacent districts can be classified as villages, while the seventh, the Temple district, is a zone dominated by tourist business. The city is characterized with a random pattern of planned and un-planned development areas. An overview of the existing and projected land use is shown on Figure 2-1. Categories of land use include residential, archeological, commercial, industrial, agricultural, recreational, touristic, and institutional.

Very large areas of Kom Ombo are allocated to residential use. The existing residential and mixed residential/commercial developments have different standards of construction and population densities.

Governmental and institutional lands have been allocated to public utilities, offices, schools, hospital and police establishments.

The nothern area of the city is designated for the sugar cane and the board companies which occupy around 125 ha. The industrial facilities are discussed more in section 2.3.2.

Around 275 ha of sugar cane fields are located to the east and the south of the city. These areas are owned partially by the sugar company (125 ha) and the remaining area is private (Section 2.3.2).

Darawo

The existing and projected land use for Darawo is shown on Figure 2-2. About 83 percent of the area is classified as residential. Around 12.5 percent of the land use is allocated for the different services in the city, (education, health, religion, recreation, and cemeteries). Institutional, commercial and industrial represents about 4.5 percent only of the city land use.

Nasr City

An overview of the existing and projected land use is shown on Figure 2-3. Categories of land use include residential, commercial, and institutional.

Around 70 percent of the land in Nasr City is residential. The city consists of two different zones, each having distinct population density characteristics. The downtown, high density area, consists of 4 to 5 story buildings, whereas the low density surrounding villages or districts are comprised of one story buildings.

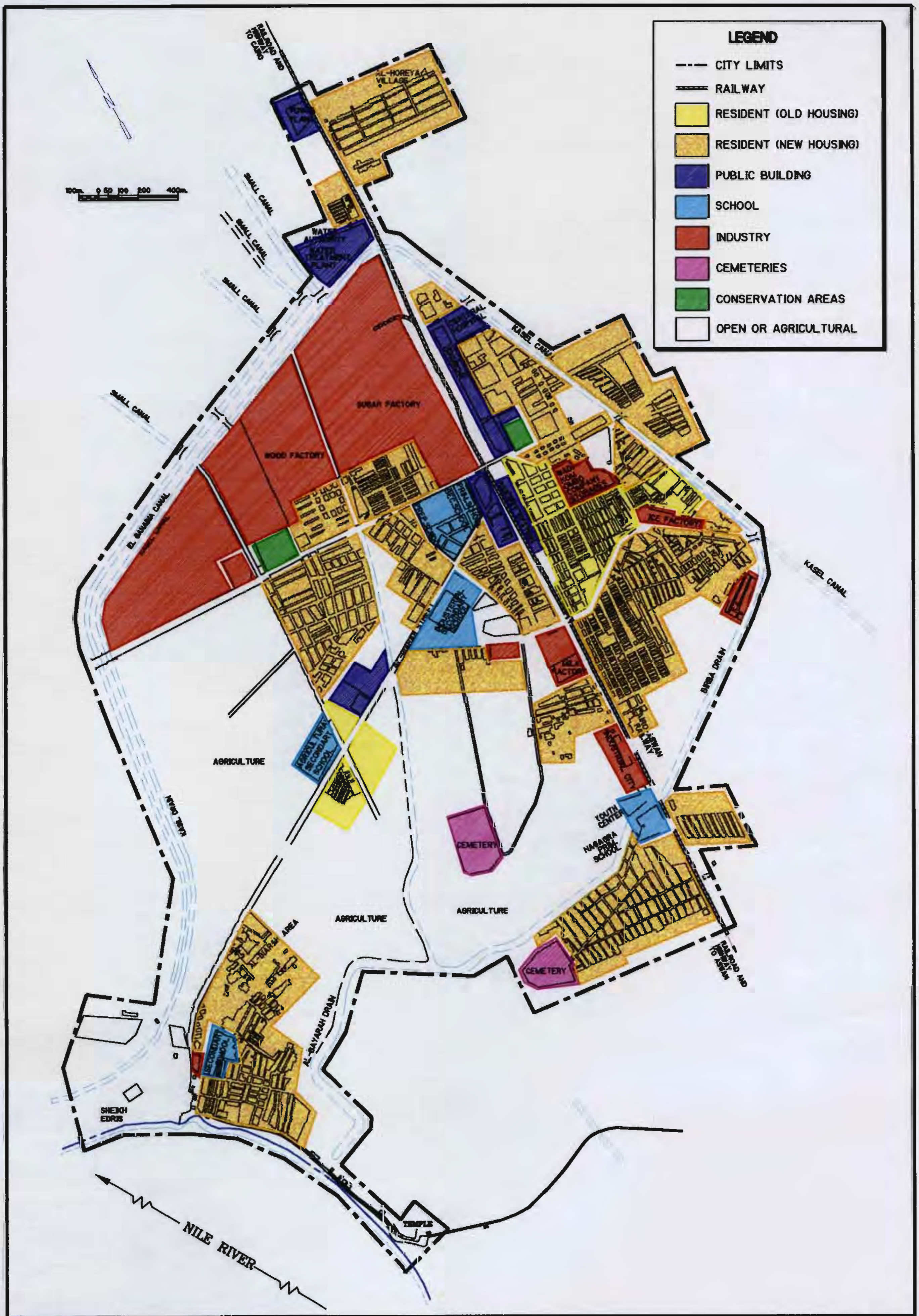
The commercial and institutional sectors occupy around 13 percent of the land while the remaining 17 percent of the city area is undeveloped.

2.3 Socio-Economic Conditions of the Project Site

2.3.1 Demography and Migration Patterns

Kom Ombo

Kom Ombo is a relatively new city, built with the implementation of a huge reclamation project in the Kom Ombo valley around the year 1902. River Nile water is pumped to a canal system that is used in irrigating the valley. The city became the center of the region's governmental, commercial, and industrial activities. Immigrants from different governorates such as Menya and Sohag



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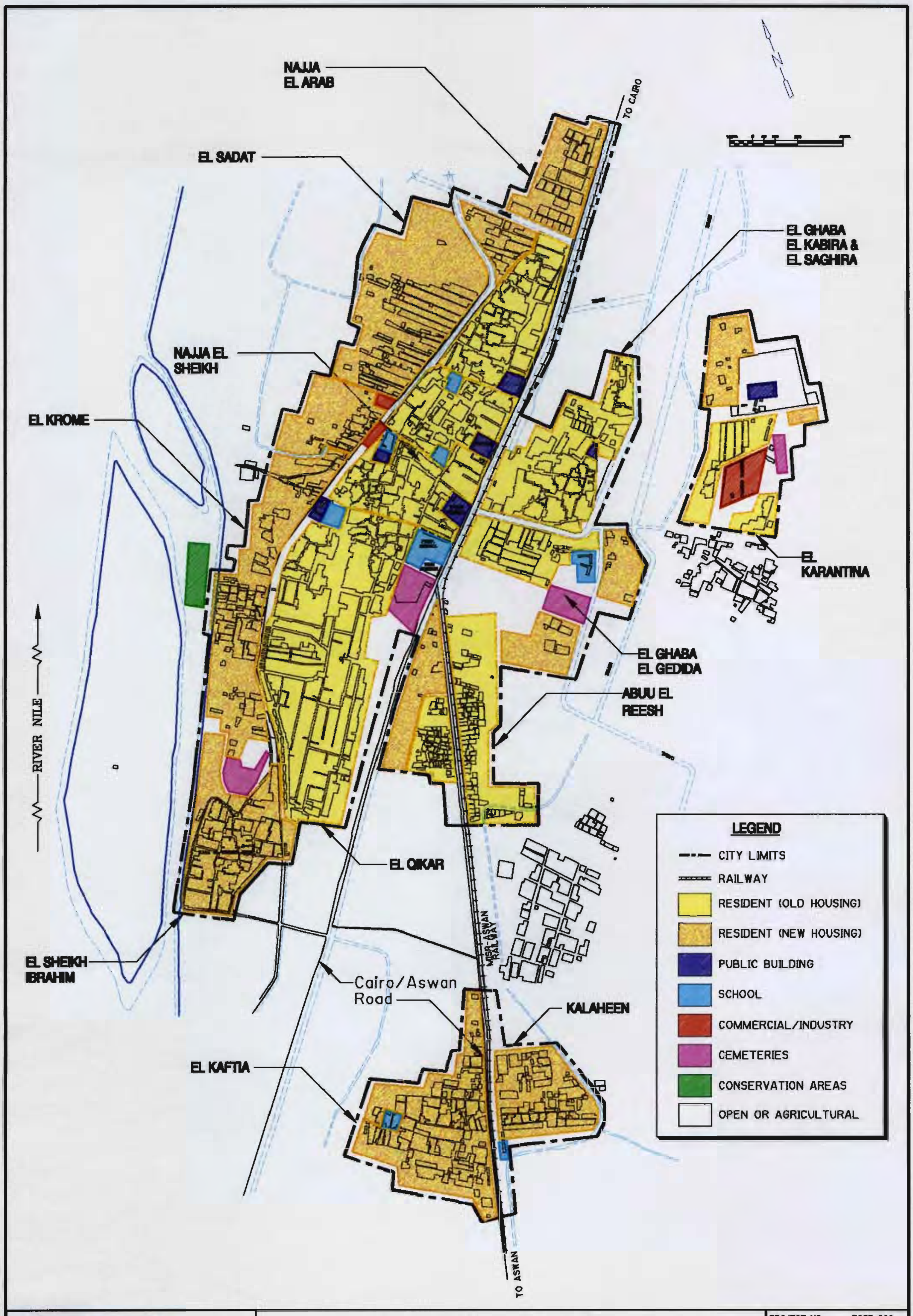
ENVIRONMENTAL ASSESSMENT
KOM OMBO
LAND USE

PROJECT NO. 3056-007
FILE: ENAR\CLUPL001

FIGURE NUMBER

2 - 1



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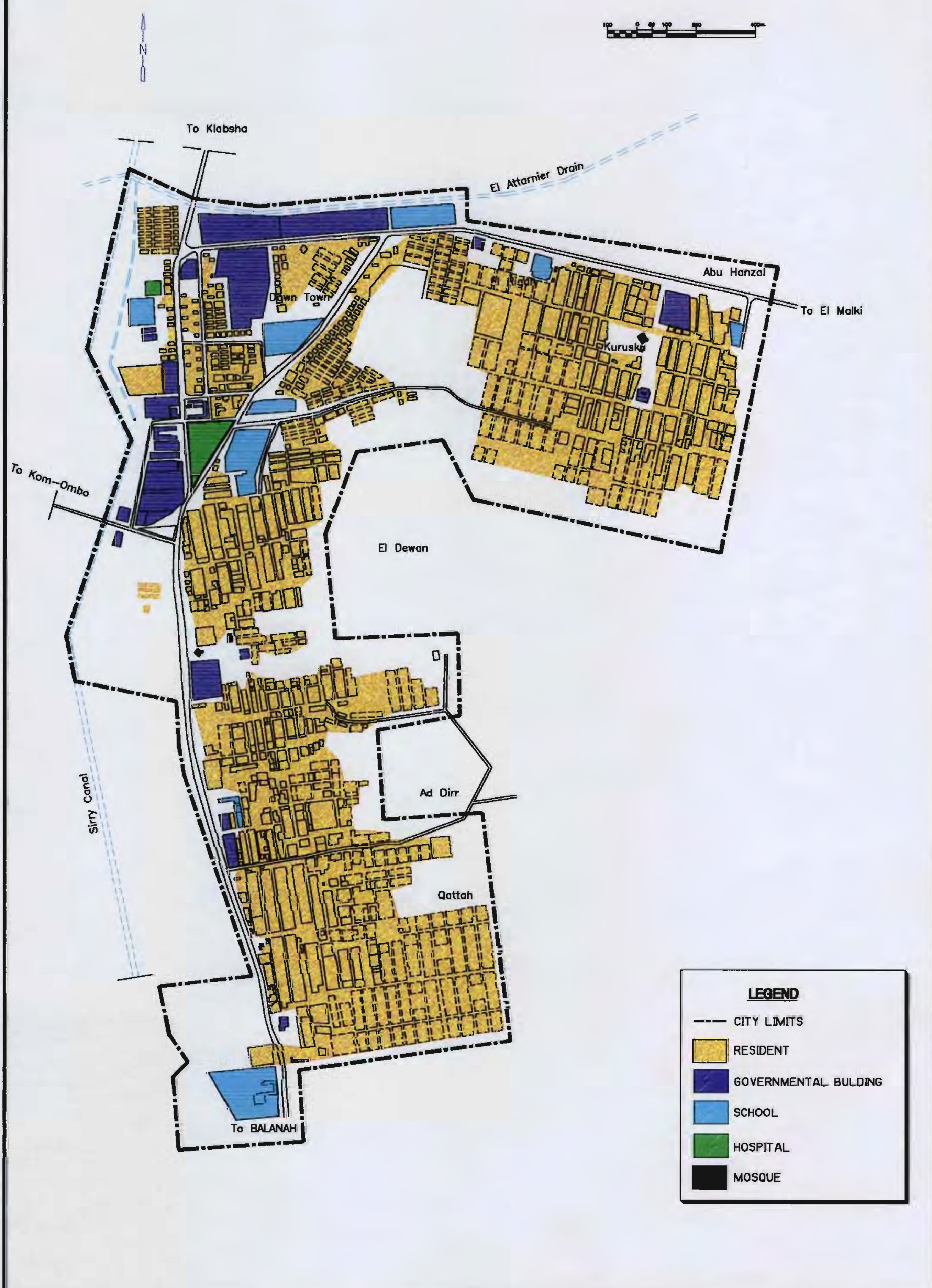
DARAWO
LAND USE

PROJECT NO. 3055-008
FILE: ENAR\CTRPL001

FIGURE NUMBER
2-2



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NASR CITY
LAND USE

PROJECT NO. 3055-009
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FIGURE NUMBER
2-3

(upper Egypt) settled in the Kom Ombo valley project area.

The present population of Kom Ombo is approximately 66,800 and is expected to reach about 113,700 by the year 2015, and 148,500 by the year 2025. These population figures are based on an estimated growth rate of 2.7 percent since the 1986 government census.

Darawo

Darawo is a commercial area and is the center of the camel trade with the Sudan. The present population of Darawo is approximately 31,100 and is expected to reach about 50,000 by the year 2015 and 63,300 by the year 2025. The population projections are based on an estimated annual growth rate of 2.4 percent since the 1986 government census.

Nasr City

Nasr City is a new city established in the mid-1960s as a relocation center for the Nubian people displaced from the River Nile basin flooded by Lake Nasser behind the Aswan High Dam.

The present population of Nasr City is approximately 6,151 and is expected to reach about 9,500 by the year 2015 and 11,900 by the year 2025. These population figures are based on estimated annual growth rate of 2.2 percent since the 1986 government census.

2.3.2 General Character of the Economy and Principal Sources of Employment

Tourism and Recreation Areas

Kom Ombo has several archaeological sites, including the frequently visited Temple of Kom Ombo. These sites are located on the River Nile banks, about 3 km from the city center. These ancient sites attract modest tourist visits, where tourists either stay at Aswan and come for a day to visit these sites or arrive by cruise-ship. Modest touristic/commercial activities are available in the city at the touristic places. The main touristic season is the winter and spring.

The River Nile front in Kom Ombo and Darawo is a very valuable recreation area for the tourists and local residents. City officials have recently developed recreational areas for local residents.

Darawo and Nasr City have no touristic activities except the travelers passing by. Local recreation activities are very limited.

Industry

Kom Ombo has three major industrial activities; the Egyptian Sugar and Distillation Company, Board Production Company, and the Milk and Food Company. Table 2-1 summarizes some information regarding these industries (UEC, 1986). The proposed project facilities will not be designed to accept any industrial discharges from the Egyptian Sugar and Distillation Company.

Table 2- 1 Major Industrial Activities

	Egyptian Sugar and Distillation (ESDC)	**Fiber Board ESDC.**	**Milk and Food**
Raw materials	Sugar cane, limestone and sulphur dioxide.	Bagasse	Dry milk
Solid waste	Bagasse		
Gasous waste	Smoke, particulates	None	
Utility products	Sugar, molasses	Fiber boards	Milk, yoghourt and cheese
Water supply	Kassel Canal, 14,160,000 m^3/year	Kassel Canal 72,000 m^3/year	Nile, 20,000 m^3/year
Wastewater flows	13,680,000 m^3/year	64,800 m^3/year	12,000 m^3/year
Wastewater treatment	None	None	None
Receiving environment	El Bayara drain	Nile	El Bayara drain
Critical pollution parameter	BOD, TSS, Oil	TSS	BOD
Number of employees	1,600	400	250
Number of working days/year	120	360	270

The sugar industry is the most serious polluter of the River Nile in this area. A visual inspection of El Bayara Drain, where the sugar company is disposing its waste, and the discharge point of the drain to the River Nile, show serious environmental deterioration. The industrial wastewaters have high concentrations of BOD and contain oil. There are also serious air pollution problems caused by the plant when processing sugar cane.

Some other industries in the city, mainly handicrafts shops for the tourist trade, cause minor environmental effects (see Table 2-2).

Agriculture

Kom Ombo is in the center of the Kom Ombo valley and is surrounded by agricultural lands (about 40,000 feddans). About 8,820 feddans of agriculture lands is located around Darawo on the south edge of the valley closer to the Egyptian Eastern Desert and 1,609 feddans is located close to Nasr City on the east edge of the valley, where it is surrounded by desert lands.

The crops that are cultivated in the area are sugar cane, wheat, corn, barseem (alfalfa) and beans. In addition, vegetable and fruit crops such as tomato, egg plant, mango and banana are grown.

Table 2- 2 Industrial/Commercial Activities

Description	Kom Ombo	Darawo	Nasr City
Bakery	17	4	4
Sweets	4	4	
Carpenting	100	45	30
Car Repair	43	9	9
Car Repair (Body Shop)	4	1	
Electric Machine Repair	29	1	
Metal Forming	1	8	
Blacksmith	4	4	
Welding	26	6	3
Ceramics	3	3	2
Macaroni Factory	2		
Shoe maker	20		
Aluminum Shop	1		

2.3.3 Quality of Life Indices

A number of waterborne diseases are associated with impure water supply and improper wastewater disposal. Among them are cholera, diarrhoea and enteritis, infectious hepatitis, typhoid and paratyphoid.

In a study performed in the Qena and Aswan Governorates (UEC, 1986), it was reported that the child population of the governorates is faced with at least three severe diseases, two of which have high mortality rates. Diarrhoea is prevalent throughout the year, especially in the hot summer season. During the relatively cold winter season respiratory diseases are dominating. A third important cause of death in infancy is tetanus.

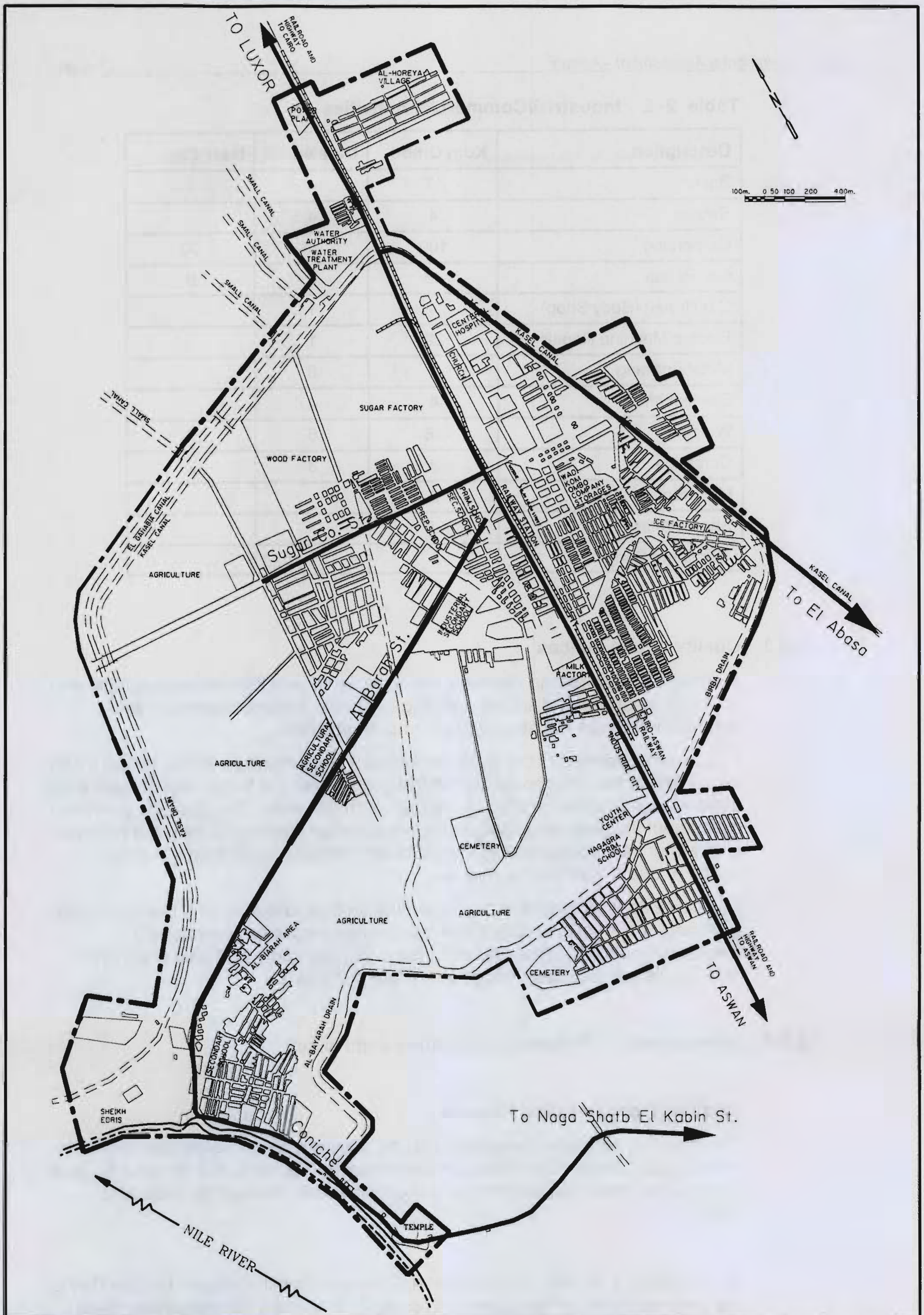
The consultant undertook a programme to sample chemical and bacteriological parameters in the River Nile, the existing water treatment plants and the distribution network. The effluent of the sugar company was also analyzed. The results are included in Appendix J, parts 2 and 3.

2.3.4 Transportation, Telecommunications and Power

Existing Transportation Network.

The main transportation networks, (roads, railways, tourist boats and ferries) in Kom Ombo, Darawo and Nasr City are shown in Figures 2-4, 2-5 and 2-6. Most Upper Egypt cities are connected to the main roads connecting Cairo and Aswan.

Kom Ombo. The main road between Cairo and Aswan divides the Kom Ombo city into two parts; east and west. The city is connected via secondary roads with the surrounding villages, Nasr City, Abbasah and Nagaa Shatb El Kabli.



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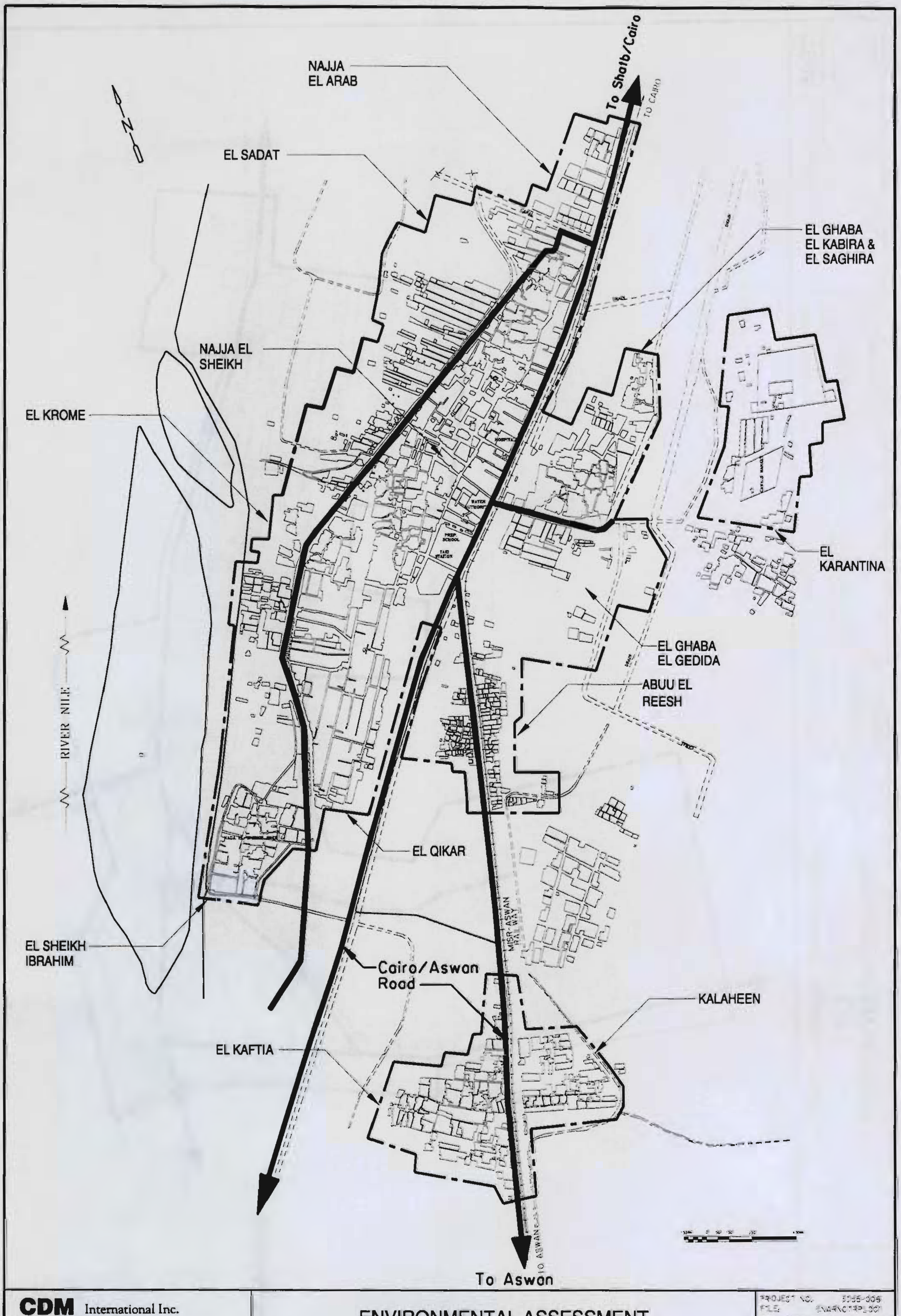
ENVIRONMENTAL ASSESSMENT
KOM OMBO
TRANSPORTATION NETWORK

PROJECT NO. 3055-007
FILE: ENAR\CTRPL001
FIGURE NUMBER 2-4



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ENVIRONMENTAL ASSESSMENT
DARAWO
TRANSPORTATION NETWORK

PROJECT NO.
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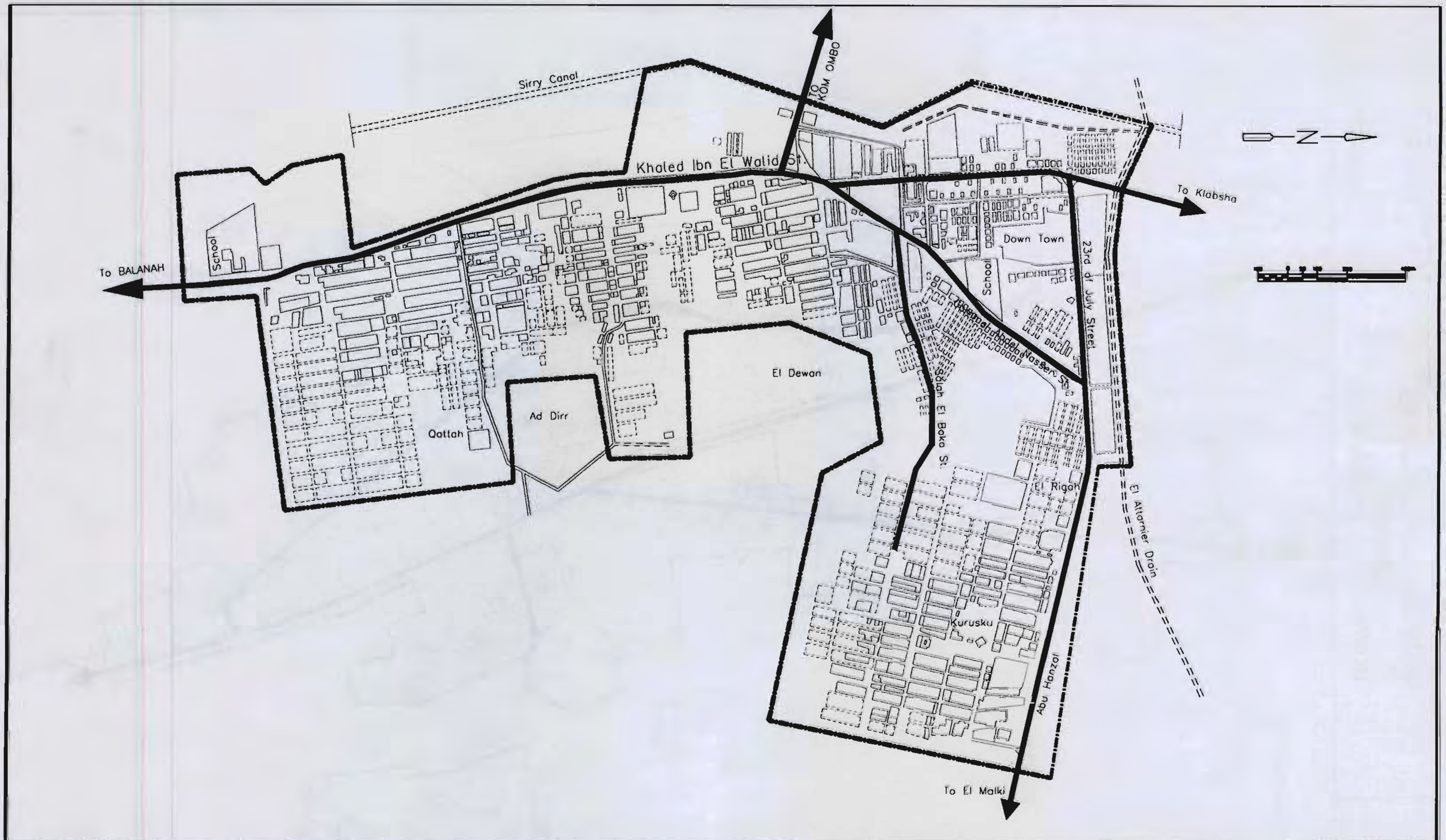
FIGURE NUMBER
2-5



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National Organization for Potable Water and Sanitary Drainage (NOPWASD)
الهيئة القومية لمياه الشرب والصرف الصحي

SECONDARY CITIES ED/CM PROJECT
USAID GRANT No. 263-0236

ENVIRONMENTAL ASSESSMENT
NASR CITY
TRANSPORTATION NETWORK

PROJECT NO. 3055-009
FILE: ENAR\CTRPL001
FIGURE NUMBER
2 - 6

There are about 35 km of paved streets and about 35 km of unpaved road ways in the city. El Bayara, Sugar Company and Corniche streets are the main streets in the city. Through the Cairo-Aswan railway, Kom Ombo is connected to other cities of upper Egypt, and to Cairo. There is a dock on the River Nile where tourist cruise vessels stop. This dock is used intermitlently for commercial transportation.

Darawo. The Cairo Aswan road also divides Darawo into two parts; east and west. The city is connected via secondary roads with the surrounding villages, Gaafrah and Ballana. There are about 18 km of paved streets and 18 km of unpaved roadways in the city. Sadat, Gomhoria, School and El Kalahin streets are the main streets in the city. Through the Cairo-Aswan railway, Darawo is connected to other cities of Upper Egypt, and to Cairo.

Nasr City. The city is connected via secondary roads with the surrounding villages and the cities of Kom Ombo, Ballana and Kalabsha. These secondary roads also connect the city with the main Cairo-Aswan road. There are 19 km of paved and 12 km of unpaved streets in the city. Gamal Abdel Nasser, 23rd July, Khaled Abn El Walid and Salah El Bakar streets are the main streets in the city.

Existing Telecommunication Network.

Kom Ombo, Darawo and Nasr City are served through the Upper Egypt system that is centered in Assuit. Kom Ombo is served through four tele-communication centers and two telegram offices. Darawo has only one tele-communication center and one telegram office. Nasr City has one telecommunication center and two telegram offices.

No problems are anticipated regarding the provision of telephone service to the various project facilities that require it.

Existing Power Network.

Electricity generation in Egypt is primarily by fossil fuels (oil and natural gas) and hydropower (Aswan High Dam), with hydropower comprising 24 percent in 1988 (Black & Veatch, et al., 1990). Electric energy supplied to Kom Ombo, Darawo and Nasr City are through the Egyptian system 500/132 kV supplied largely by the Aswan High Dam.

Since 1985, Egypt has been increasing commercial and residential electricity prices, but they remain well below the long-range marginal cost of new power generation (Black & Veatch 1990). Over the past 10 years, U.S. residential consumers have paid about 7.5 cents/kWh and commercial users about 6-6.5 cents/kWh, while Egyptian users have paid 3.5 cents/kWh.

2.3.5 Education, Health and Social Services

Education. There are about 16 primary schools, 7 preparatory schools, 2 high schools, and 4 technical high schools in Kom Ombo.

Darawo has about 8 primary schools, 2 preparatory schools, 1 high school, and 2 technical high schools.

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There are about 4 primary schools, 1 preparatory school, 1 high school, and 3 technical high schools in Nasr City.

Health and Social Services. There is one hospital in each city, four social offices (2 in Kom Ombo, 1 in Darawo and 1 in Nasr city), 22 community associations in Kom Ombo, 12 community associations in Darawo and 18 Community associations in Nasr City. There are also 12 youth social and athletics centers (4 in Kom Ombo, 2 in Darawo and 6 in Nasr City; Statistical Notes, Aswan Governorate, 1994).

Darawo has a special hospital "Karantina" to check humans and camels entering the country through the Sudan border for any diseases. Different medical investigations are done and necessary actions to stop diseases from entering the country are taken.

2.3.6 Ethnic and Tribal Factors

Aswan governorate has a number of ethnic groups that are distinct from other Egyptians. The most important of these are the Nubians, who are themselves divided into three different groups, the Kenuz, the Fedija, and the Arab. Nubian Identity is very strong and there is a high degree of community solidarity and self-help among them. Other smaller ethnic communities are the Ababdas and the Bishara, both of which are nomadic in origin, but have settled en masse in the vicinity of Darawo and Kom Ombo.

2.4 Physical Environment

2.4.1 Climate

The climate of an area is the result of the inter-action of major air streams and their associated characteristics, and the radiation regime and physical features of the locality.

Kom Ombo, Darawo and Nasr City lie in a desert climate, with hot summer temperatures, large temperature differences during the day and very little rainfall, with the exception of some major rain storms. The climate changes during the different seasons: during the summer and the winter, the weather is stable, while during the spring and autumn the weather is unstable with sand storms and occasional rain storms.

Table 2-3 provides monthly and annual climatological data for Kom Ombo for the period between 1931-1960; similar values are expected to pertain throughout the region. Average daily temperatures in the region normally range between 15.3°C in January to 31.7°C in July (Figure 2-7) with high recorded temperatures of 49°C and low recorded temperatures of -2°C.

The annual rainfall is about 0.6 mm. Evaporation rates varied between 5.3 mm/d in the winter time to 14.9 mm/d in the summer time with an annual mean of about 10.5 mm/d. The annual evaporation of over 3800 mm is much larger than the annual rainfall.

Cloudiness is generally low in Egypt with mean monthly values below 4 oktas. For the Kom Ombo region, cloudiness varies from 0.1 oktas to 0.9 oktas with an annual mean of 0.5 oktas. The relative humidity showed variation from 33

Table 2-3: Kom Ombo Climatological Data

Months	Temperature			Rainfall (mm)			Daily Mean Evaporation (mm)	Relative Humidity	Total Sky Cover
				Monthly	No. of Days with rain				
	Max	Min	Mean	Total	>0.1	>1.0		6:00	6:00
January	23.4	7.2	15.3	Tr.	0.0	0.0	5.4	57	0.9
February	25.5	8.1	16.8	Tr.	0.0	0.0	6.6	51	0.7
March	30	11.4	20.7	Tr.	0.0	0.0	9.2	42	0.7
April	34.8	15.7	25.2	0.0	0.0	0.0	11.9	33	0.6
May	39.1	20.6	29.8	Tr.	0.0	0.0	13.8	33	0.7
June	40.5	22.2	31.4	0.0	0.0	0.0	14.9	33	0.1
July	40.5	22.8	31.6	0.0	0.0	0.0	14.6	37	0.1
August	40.4	23	31.7	0.0	0.0	0.0	14.1	38	0.2
September	38.3	20.5	29.4	0.0	0.1	0.0	13.0	42	0.1
October	36	18.2	27.1	4.0	1.0	1.0	10.0	47	0.3
November	29.9	13.7	21.8	0.0	0.0	0.0	7.2	52	0.4
December	25.1	9.5	17.3	0.0	0.0	0.0	5.3	58	0.9
Total Annual				--	--	--			
Annual Mean	33.6	16.1	24.8				10.5	44	0.5

percent in May to 58 percent in December (Figure 2-7).

The mean annual wind speed is 6 km/hr (Figure 2-8), with a range of 5 to 7 km/hr. The most dominant surface wind directions in the area are from the north and northwest (Table 2-4).

2.4.2 Geology and Soils

The geology of the area was determined from the Geologic Map of the Aswan Quadrangle, Egypt, published in cooperation with the U.S. Geological Survey, in 1978.

The geology adjacent to the River Nile consists of quartenary older Nile deposits, silty and sandy clay flood plain deposits, alternating with gravel-filled and mud-filled playas. Further east, in the desert areas, the geology is of the Mesozoic upper cretaceous formation consisting of clay, shale, marl and chalk, and Campanian or older Taref sandstone and Queseir variegated shale. To illustrate the geological features of the project area a cross section of Nile valley through Kom Ombo and Nasr City is shown in Figure (2-9).

The Hydrogeology of the Kom Ombo and Darawo areas consists of a moderately to highly productive aquifer, sometimes semi-confined, consisting of graded sand and gravel, locally intercalated by clay lenses. Further east is a low productive aquifer, consisting of sandy clay layers.

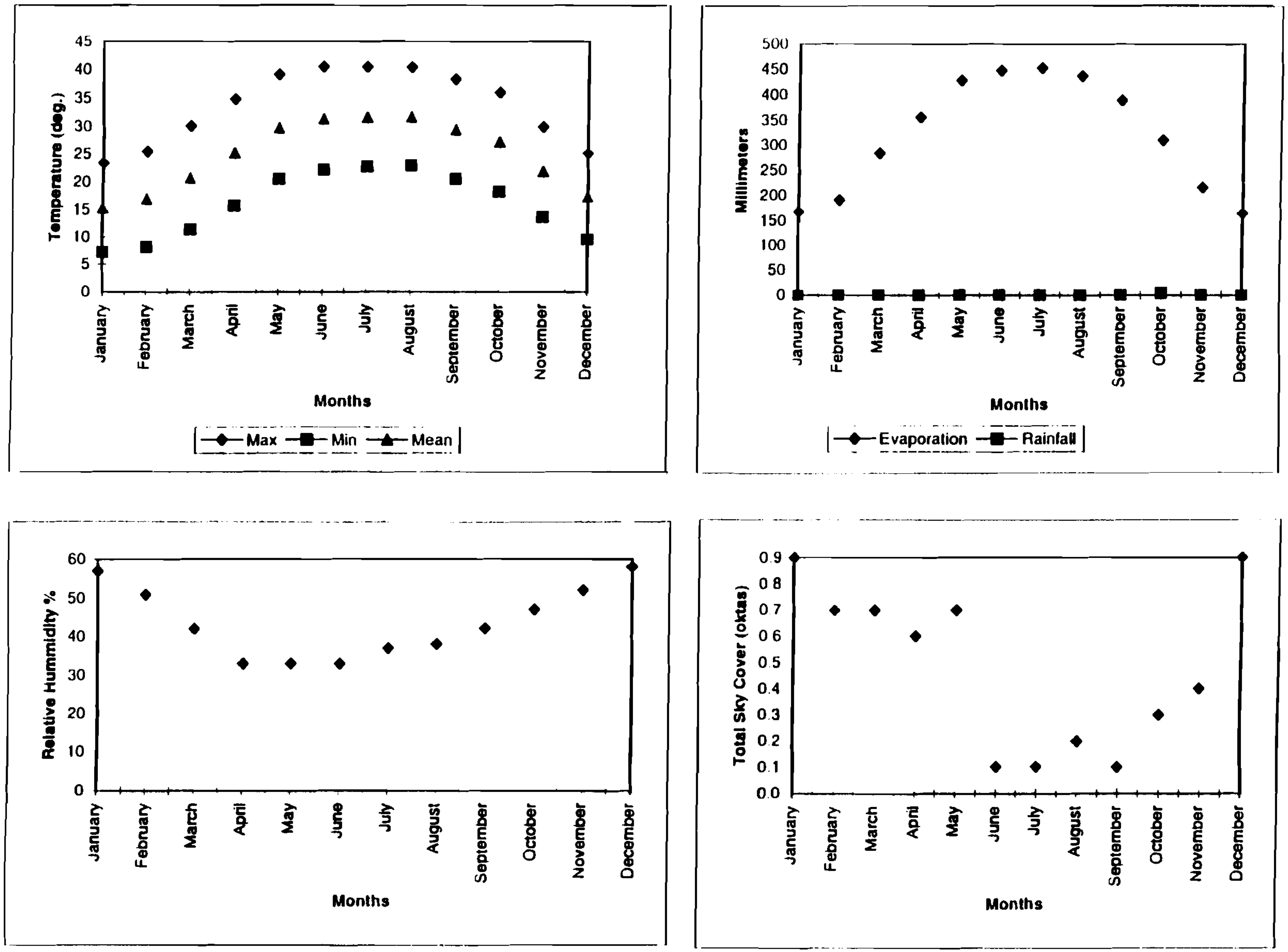
In order to provide information as to the subsurface conditions in the three cities, a subsurface exploration program was performed. The bores were generally performed at the edges of roads, in order to define conditions for the installation of water mains and sewers. Complete details of this program will be presented in a separate document, and are summarized here.

Kom Ombo. The results indicate that the first meter is road construction and fill materials. Following the top layer, the soil is stiff to very stiff clayey silt or silty clay. The depth of this layer is about 9 m. Below the cohesive soils, medium dense to dense, fine to coarse sand with traces of silt and gravel were found. The depth to water level ranges from 1.6 m to approximately 5.5 m.

Darawo, Northern and Southeastern portions. The results indicate that the first half meter is crushed stone, sand and gravels, and road fill materials. The following 8 m is stiff sandy silt/clay and medium stiff sandy clay. Below the sandy clay layer a medium dense silty sand and gravel layer was found.

Darawo, Southern portion. The results indicate that the first half meter is silty sand and gravel, and road fill. The following 8 m is medium dense to dense sand and gravel.

South of Darawo, in the Villages of Callahan and Abolish, soil and rock stratum were encountered. The first meter is sandy silt, gravels, and fill. The following 1.5 m is medium dense silty fine sand. To a depth of about 8 m fractured/decomposed sandstone inter-layered with silty clay was found. The depth to groundwater level is, in general, 1 to 4.3 m below the existing ground surface.



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ARAB REPUBLIC OF EGYPT

جمهورية مصر العربية

National Organization for Potable Water and Sanitary Drainage (NOPWASD)

الهيئة القومية لمياه الشرب والصرف الصحي

SECONDARY CITIES ED/CM PROJECT

USAID GRANT No. 263-0236

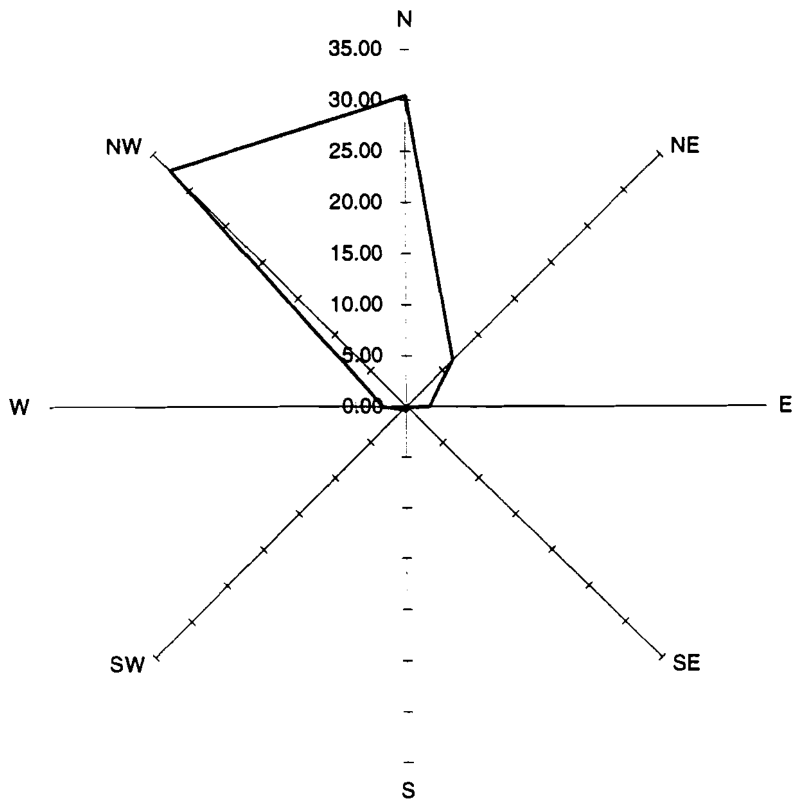
ENVIRONMENTAL ASSESSMENT

ASWAN CITIES CLIMATOLOGICAL DATA

PROJECT NO. 3055-006
FILE: ENAR\CCLD1001

FIGURE NUMBER

2 - 7



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ENVIRONMENTAL ASSESSMENT

ASWAN CITIES

WIND ROSE

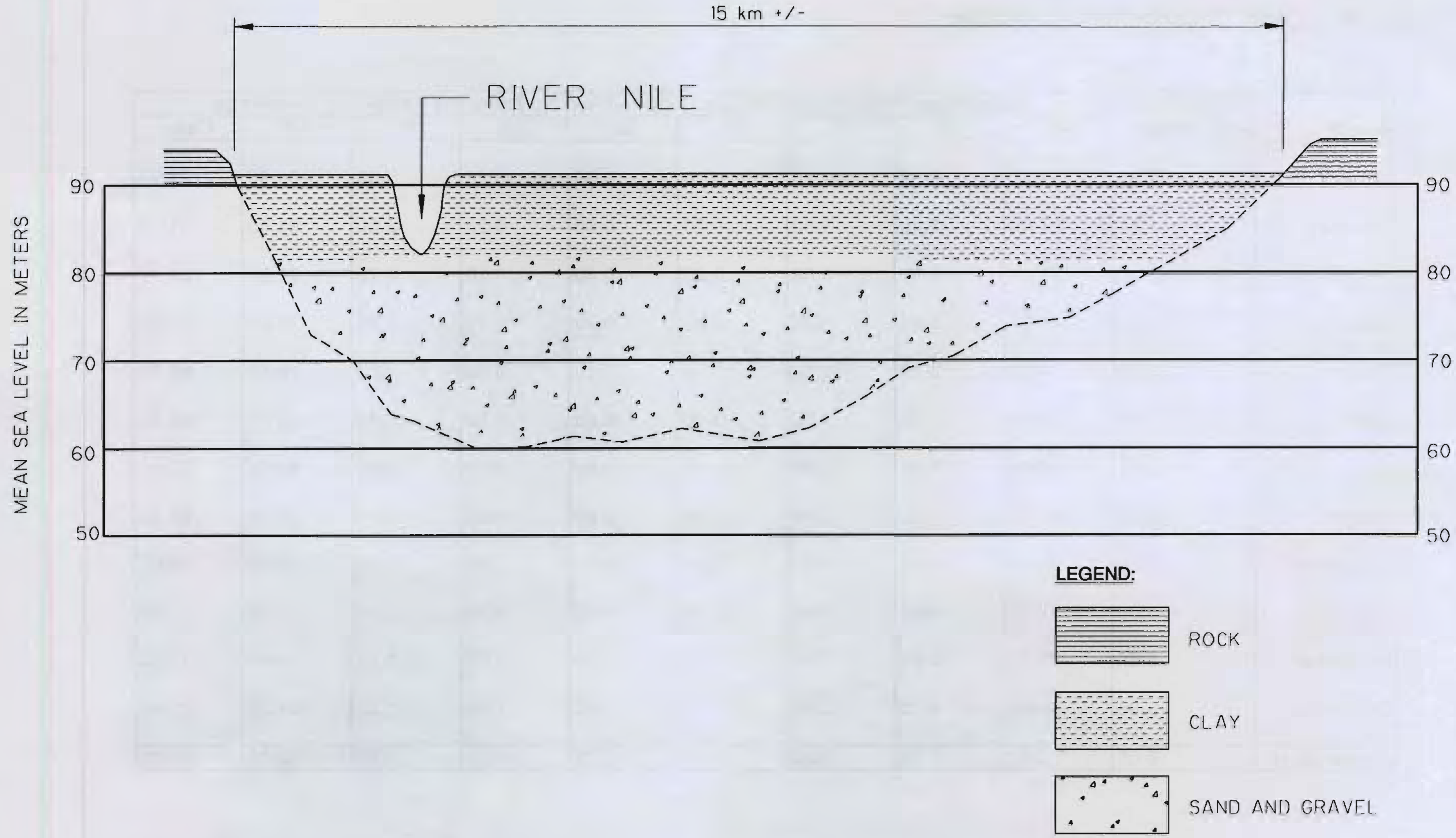
PROJECT NO. 3058-006
FILE: ENAR\CWND001

FIGURE NUMBER

2 - 8

Table 2-4: Kom Ombo Surface Wind Data

Month	Mean scalar wind speed	Percentage Frequency of Surface Winds Blowing From the Following Directions								
		N	NE	E	SE	S	SW	W	NW	Calm
Janaury	5.30	34.80	3.80	1.20	0.10	0.30	0.20	0.80	29.90	28.90
February	5.80	27.00	5.40	1.80	0.20	0.80	0.20	2.60	31.00	31.00
March	7.10	28.00	5.90	2.60	0.20	0.60	0.10	2.70	31.80	28.10
April	6.60	28.20	5.80	4.30	0.30	0.30	0.10	1.60	34.20	25.20
May	5.60	27.30	6.70	3.50	0.10	0.50	0.30	1.70	30.20	29.70
June	6.40	30.40	8.20	1.70	0.10	0.60	0.60	2.40	33.90	22.10
July	5.60	29.30	5.60	0.60	0.10	0.80	0.70	3.30	12.00	27.60
August	6.20	25.50	7.20	0.70	0.50	0.80	1.30	3.10	38.00	22.90
September	5.80	36.80	6.70	0.20	0.00	0.00	0.20	3.40	31.90	20.80
October	5.60	31.70	8.80	2.00	0.50	0.00	0.20	2.70	32.70	21.40
November	6.20	35.50	8.50	2.80	0.80	0.30	0.70	1.50	32.40	17.50
December	5.30	30.60	4.70	3.80	0.10	0.90	1.00	1.80	34.20	22.90
Annual Mean	6.00	30.40	6.40	2.20	0.20	0.50	0.50	2.30	32.70	24.80



CDM International Inc. with Dr. Ahmed Abdel-Warith Consulting Engineers	ARAB REPUBLIC OF EGYPT جمهورية مصر العربية National Organization for Potable Water and Sanitary Drainage (NOPWASD) الهيئة القومية لمياه الشرب والصرف الصحى SECONDARY CITIES ED/CM PROJECT USAID GRANT No. 263-0236	ENVIRONMENTAL ASSESSMENT ASWAN CITIES GEOLOGICAL CROSS-SECTION OF NILE VALLEY	PROJECT NO. 3055-006 FILE: R:\ENAR\CGEOSC01 FIGURE NUMBER 2 - 9

Nasr City. The subsurface soil conditions throughout the city are consistent The first meter is medium dense sandy silt, sand and gravel, crushed stone and fill. To a depth of about 20 meters the soil is stiff to hard sandy silt and hard, silty clay. No groundwater was encountered in the city.

The subsurface soils are of stiff to hard consistency, are dry or slightly moist plastic clays historically known as a swelling soil. These soils swell and expand when in contact with water and become impermeable. Overall, these soils do not provide a suitable foundation for construction.

2.4.3 Air Quality and Noise

In this section a review of the air quality limits and regulations and the existing air quality baseline information is presented.

Regulatory Framework. The Decree of the Prime Minister No. 338 for the year 1995, entitled, "Promulgating the Executive Statutes of the Law on Environment as enacted by Law No. 4 for the year 1994" sets forth the regulatory framework governing both air quality and noise pollution. Several annexes are attached to this decree. Annex No. (5) of the decree discusses the maximum limits of outside air pollutants, while Annex No. (6) sets the permissible limits of air pollutants in emissions. The maximum limits (ceilings) of air pollutants inside places of work, according to the kind of each industry are presented in Annex No. (8). Annex No. (7) shows the permissible limits of loudness of sound and duration of safe exposure thereto. These regulations and limits are shown in Appendix (D).

A list of the installations subject to the provisions on evaluation of environmental assessment is provided in Article 34 of the decree. All infrastructure projects, including stations for sanitary drainage treatment and reuse of their waters, are included. Projects to be sited on the banks of the Nile, its branches, the feeders (main canals), or in tourist and monument areas are subject to this law.

Under Article 36, the installations which are subject to the provision of this law in exercising their activities shall commit themselves to avoiding the emission or leakage of air pollutants up to and not exceeding the limits allowed in the current law. These limits include hydrogen sulphide and chlorine, of relevance to the proposed wastewater and water facilities . The prescribed limits are 10 and 20 milligram/ m^3 respectively.

Article 41 mentions that all quarters and individuals, in carrying out excavation, digging, building, or demolition, or in transporting the waste materials or earth, shall take necessary precautions of storing or transporting these wastes in a safe way to prevent them from being blown about as dust. The noxious and harmful smoke, gases and fumes resulting from burning of any kind of fuel or other materials, whether for purposes of power generation, or for installations, are covered under Article 42. Those in charge of this activity shall take all precautions to minimize the quantity of pollutant combustion product.

Articles 45 to 48 cover the precautions that the owner of the establishment shall take to prevent any leakage of air pollutants inside the place of work (indoor and semi-indoor) and to maintain the temperature and humidity within specified limits.

Article 44 discusses the permissible limits for sound intensity at places of work and indoor public places.

Existing Air Quality. Of the three cities, Kom Ombo, Darawo and Nasr City, Kom Ombo is the worst in air quality. The surface wind speed in the three cities is low, which indicates that the atmosphere does not rapidly disperse those pollutants that are generated.

The Egyptian Sugar and Distillation Company of Kom Ombo burns either conventional fuel or bagasse to generate energy for the sugar process. Heavy pollution from chimneys due to burning bagasse creates health problems (specially with the factory located north of the city). Many people in the city have respiratory problems due to the particulates and smoke from this process.

No air quality monitoring program has been set up in any of the cities; consequently no baseline information is available. However, the Ministry of Public Health, through the Environmental Monitoring Center, monitors the air for smoke, sulphur dioxide and suspended solids at monthly intervals in Aswan city. Table 2-5 summarizes the data available from April 1995 through October 1995 for total suspended solids, sulphur dioxide and smoke.

Table 2-5 Summary of Air Quality Data

Month	Total Suspended Particulates (ug/l)				Smoke(ug/l)				Sulphur Dioxide(ug/l)			
	Max.	Min.	Mean	Std.D.	Max.	Min.	Mean	Std.D.	Max.	Min.	Mean	Std.D.
April	N.A.	N.A.	N.A.	N.A.	287	31	144.8	93.31	99.0	40	62.27	17.74
May	239	188	205.4	23.36	287	287	287	N.A.	77.0	77	77.0	N.A.
June	366	188	244	82.24	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
July	29509	127	6045	13116	N.A.	N.A.	N.A.	N.A.	86.0	22	51.9	17.33
August	291	108	186	67.7	292	106	178.8	55.49	22.0	10	14.63	5.37
September	201	127	167	35.41	53	33	42.3	6.31	55.0	27	42.92	9.96
October	340	212	287	53.73	42.5	8	32.7	9.78	42.0	11	25.15	10.10

A review of the industrial activities undertaken in the cities, described in more detail in Section 2.2 did not identify any major sources of air pollution in the area except the sugar company.

A large number of vehicles pass through the cities of Kom Ombo and Darawo resulting in the increase of carbon monoxide and carbon dioxide and lead concentration in the cities' atmosphere.

2.4.4 Water Resources

The water quality limits and regulations and the existing water quality baseline information is presented in this section.

Regulatory Framework. The following regulations have direct significance on the project in relation to the water and wastewater systems:

▪ Decree No. 108/1995:	Ministry of Health standards for drinking water.
▪ Decree No. 338/1995:	The executive regulations of Law No. 4/1994.
▪ Ministerial Decree No. 08/1983:	The executive regulation of Law No. 48/1982.
▪ Decree No. 649/1962:	The executive regulations for Law No. 93 for 1962.
▪ Ministerial Committee organized under law No. 276/1994	Reuse of wastewater in irrigation

In addition, Law No. 57/1978, relating to the drainage of pools and swamps and regulating excavation is relevant to the project. NOPWASD's proposed water and wastewater standards are also of importance to the project.

The main elements of the above regulations are summarized below, with further details in Appendix (E).

Decree No. 108/1995: Ministry of Health standards for drinking water. This decree defined the standards and specification to be satisfied by water suitable for drinking and household use . It also specified that the department in charge of carrying out investigations and analyses shall be the Central Department for Laboratories of the Ministry of Health and its branches in governorates; and what will be decided by the Minister of Health.

Decree No. 338/1995: The Executive Regulations of Law No. 4/1994, the Law on the Environment, "Protection of Water Environment from Pollution". Although marine discharges are not relevant to Kom Ombo, Darawo and Nasr City, this new law is mentioned for completeness of reference. This decree specifies that any marine disposal shall be prohibited to drain the pollutant sanitary drainage waters inside the territorial sea and the exclusive economic zone of the Arab Republic of Egypt. In all cases, draining in marine environment shall not be permissible except at a distance of not less than 500 meters from the shoreline. Nor shall drainage be permitted in zones of fish catching or sea bathing, or nature preserves. All effluents must meet the criteria and specifications when disposed of in the marine environment. This decree also takes into consideration all the provisions prescribed in Law No. 48 of the year 1982 on protection of the River Nile and its executive statutes, Decree No. 8 of the year 1983.

Ministerial Decree No. 08/1983: The executive regulation of law No. 48/1982, Re protection of the River Nile and Waterways from Pollution. Law 48/1982 and its executive regulations focus on protecting potable water and non-potable/agriculture use water from pollution. In this regard, the law was principally enacted to protect Egypt's inland waters. These waters include the River Nile, all irrigation canals, drains and lakes. The law does not explicitly refers to marine water bodies or discharge to such bodies, which is covered under Law 4/1994. The law sets the standard measures and specifications for the discharge of treated fluid wastes into potable or non- potable waterways. These standards are summarized in Appendix E2.

Decree No. 649/1962: The executive regulations for the law No. 93 for 1962. Law 93/1962, concerning the discharge of liquid wastes, defines the criteria, standards and specifications which should be met by liquid wastes which are authorized to be drained into public sewers. It also sets forth the conditions and criteria that should be met by liquid wastes which are drained by surface irrigation or by irrigating cultivable land. These conditions and standards are summarized in Appendix E3.

NOPWASD, through the WWISP, in November 1990, proposed environmental standards for potable water and wastewater discharges. These standards pertaining to water and wastewater include drinking water standards; domestic wastewater discharge standards; industrial wastewater discharge pretreatment standards; bathing water standards; shellfish-growing water standards; and wastewater reuse standards. These standards are considered as goals for adoption in the next few years as part of a long-term program. A summary of these standards is in Appendix F.

Surface Water. Surface water resources originate from the River Nile, and include the River Nile main stream, canals, and drains.

Flow volumes in the River Nile are metered and controlled upstream at the Aswan High Dam and the Aswan Dam by the Ministry of Public Works and Water Resources. The flows at Kom Ombo and Darawo vary during the course of the year between 80 million m^3/d during the month of January and February to 150 million m^3/d during July and August. With the completion of the Upper River Nile projects (for example the Jungla Canal in Sudan), these flows will be increased.

The irrigation system in the area is supported basically by the Darawo and Kassel Canals where water is pumped from the River Nile to these canals. The canals provide irrigation waters to the farm lands in region. Sirry Canal in Nasr City is a branch from Kassel Canal that supplies the area surrounding Nasr City.

A network of open drains carries drainage waters as well as domestic and industrial wastewater to a main drain back again to the River Nile. El Bayara drain is the main drain in the Kom Ombo area. Darawo and El Ghaba drains are the drains in Darawo. El Atameer and Nazaz drains are two of the main drains in Nasr City area.

No wastewater system is available in the three cities. Wastewater is discharged to the drains.

Groundwater. Based on the nature of the water-bearing strata the aquifer systems in the project area can be classified in two main categories: the alluvial sand and gravel sediments of the Nile valley which constitute a shallow aquifer system with a very high potential for water supply, and the Nubian sandstone which constitutes the only significant aquifer system in the western desert area (UCE, 1986).

The main aquifer system in the Nile valley consists of coarse sand and gravel deposited by the pre-Nile, overlain by a silty clay cap of modern Nile deposits. Where the clay-silt cap is present the aquifer is semiconfined, and where the clay-silt cap is absent, the aquifer is unconfined. The lateral and lower boundaries of the aquifer can be regarded as an essentially no-flow boundary. A cross section of the Nile valley aquifer system is shown in Figure (2-9).

Kom Ombo is encompassed by the Kassel Canal on the east and north sides, by El Bayara Drain on the south side, and the River Nile on the west side. Groundwater levels in Kom Ombo are influenced by the water levels in the canals and drains. The canals are used for the distribution of water from the Nile to the agricultural fields, primarily for growing sugar cane, and the use of water is highest in the spring and summer months. During the winter months, when the sugar cane is being harvested, the water levels in the canals are at their lowest.

Groundwater, in Kom Ombo, was encountered at depths ranging from 1.6 to 5.4 m below the existing ground surface. The groundwater gradient direction is from northeast to southwest, towards the River Nile.

In Darawo, groundwater levels encountered during the exploration program, and further monitored through the installed observation wells was, in general, 1 to 4.3 m below the ground surface.

In Nasr City, ground water was not encountered. Seeped surficial water was encountered in several bores at depths ranging from 1.0 to 3.8 m below the ground surface. In all of the locations in which it was encountered, this surficial water is present in the moderately sandy silt layer, and corresponds to the water level in nearby canals and drains.

Existing water quality data: Records for conventional water quality parameters in the influent surface water and finished water have been kept at the Kom Ombo and Darawo water treatment plants. Records of the groundwater in Darawo City has been also kept. Data are presented in Appendix H, Part 1. The Ministry of Health has monitored the River Nile close to the area under consideration for many years; results for two stations, at the start of the Kassel Canal and the end of the Kassel Canal, are presented for the year 1994 in Appendix H, Part 2.

Studies of the groundwater quality were performed in the past for a part of the main chemical parameters. The results of these studies showed that the groundwater quality is, in general, within the standards except that the water is very hard (UEC 1986).

Wastewaters from the different cesspool fields in Kom Ombo and the Egyptian Sugar and Distillation Company discharges were analyzed in the Kom Ombo water treatment plant Laboratory and the results are shown in Appendix H, Part 2.

New water quality sampling program. As part of this project, water from several points in the river, the treatment plant, the distribution system, and the Egyptian Sugar and Distillation Company effluent was sampled for sanitary parameters, microbiological parameters, heavy metals, and disinfection byproducts. A scan for synthetic organic contaminants was also included. The layout of this program, including a map of the sampling points and a tabulation of which parameters were sampled at each, is presented in Appendix J, Part 1.

The program consists of three sampling rounds. The first round covers the sanitary parameters, microbiological parameters, heavy metals, organic parameters, disinfection by product parameters and radioactive parameters at ten different locations, (as mentioned in Appendix J, Part 1). The locations are the Kom Ombo water treatment plant intake on Kassel canal, the Kom Ombo water treatment proposed intake on the River Nile, the Kom Ombo finished water, the new water treatment plant intake at Fatira, the sugar cane factory wastewater, the Darawo water treatment plant intake on the Darawo canal, the Darawo water treatment plant finished water, the proposed Darawo water treatment plant intake on the River Nile, the ground water at Darawo, and the Kom Ombo, Darawo and Nasr City distribution network.

The second and third rounds focuses on the sanitary parameters since the first round did not show concerns related to the other parameters. Kom Ombo water treatment plant raw water intakes from Kassel canal and from the River Nile, and Darawo water treatment plant raw water intakes from the Darawo canal and the River Nile were sampled through these two rounds.

The sampling was undertaken by the General Organization for Greater Cairo Water Authority Central Laboratory, Dar el-Salaam, Cairo (known as the "GOG Laboratory", for short). Their results are presented in Appendix J, Part 2.

Interpretation of water quality data. A summary of the results of the water quality sampling program, along with the recommended standards for drinking water are presented in Appendix J, Part 3 , Part 4 and Part 5. Comments relative to the results are as follows:

Sanitary Parameters. The WTP finished water results are considered acceptable, though the algae levels are somewhat higher than desirable (Table J3-1). The recommended rehabilitation actions should help to reduce these levels. The raw water analysis did not show any water quality concerns, except round three show moderate concentration (1.69 µg/l compared to Egyptian standards of 2 µg/l) of phenol at the Kom Ombo Nile proposed intake water (Table J3-1c).

First round results show that the sugar factory effluent has high levels of fecal coliform, total coliform and total count of bacteria (Table J3-2). Total organic carbon, oil and grease and chemical oxygen demand (COD) analysis show high concentration levels. Such results are expected since the effluent is not treated.

Organic Parameters. The existing Kom Ombo and Darawo intakes and samples from the proposed Nile intakes water were tested for organic parameters during the first round. None of the tested compounds were detected except for Methomyl (0.522 µg/l, Carbamates method 431.1) (Table J3-3) which was detected at the Darawo water treatment plant raw water intake. The Methomyl was not required through the reviewed standards. It should be noted that these results represent the conditions at the time of the sampling. No further sampling was required.

Disinfectant Byproducts. The results reported for total trihalomethanes are within existing and proposed drinking water quality standards. However, it should be noted that the standards are based on a procedure in which a running average of samples is collected on a quarterly basis. For example, each quarter, four samples are to be collected from the distribution system. The samples are to be analyzed and the average result recorded. This is repeated on a quarterly basis and the results of four consecutive quarters averaged, to evaluate compliance with the standard. The objective of quarterly standards is to capture seasonal variations in THM formation.

The sample collected at the existing WTP along with three others in the distribution system in Kom Ombo and Darawo result in a quarterly average of 38 ug/l for total THMs (Table J3-4). The sample from the distribution system in Nasr City is 41.4 ug/l (Table J3-4).

It was also noted that THM levels did not significantly increase over time. This was noted in the distribution system samples compared to those taken at the WTP (Table J3-4). This is unusual unless free chlorine is completely consumed or converted to chloramines by reacting with ammonia. A free chlorine residual was detected in all samples. In addition, the low ammonia levels in the source water do not support the premise that chloramines would be formed. Regardless, the lack of continued formation is advantageous from a public health standpoint.

The THM results are sufficiently good that any additional sampling is only recommended to develop a more representative data base. The primary objective of chlorination is disinfection. Even if elevated disinfection byproducts had been noted, the impact of any disinfection changes would have to be given careful consideration relative to the potential of increasing the possibility of water borne diseases.

No further investigation were recommended during the second and third rounds of analysis.

Heavy Metals. The purpose of this sampling campaign is to screen for evidence of troubling levels of contaminants. As for any water quality parameter or constituent, the concentration of a heavy metal in the water column is variable from moment to moment, and the concentration value obtained in a single grab sample of the water is but one point in a possibly wide range of values that could be sampled from the same location.

It happens that heavy metals, when present, are most commonly adsorbed to solid particles, which may be in suspension, or which have settled to join the other bottom sediments. Therefore, it is a good strategy, when screening for the presence of heavy metals, to sample the sediments beneath the water column rather that the water column itself: If heavy metals are present, they will be present in greater, therefore more detectable, concentrations than would normally be found in the water column; and their concentration in the sediments will represent a time-average value, integrated over a long time period of solid particle deposition from the water column. Such a strategy has been followed in this sampling program (Table J4-1).

What remains, of course, is to interpret the resulting concentrations of heavy metals, reported in units of ug/g, or micrograms (of the metal) per gram (of the dry solid to which it is absorbed). This has been done in two ways:

- By comparing the metal-in-sediment (ug/g) concentration criteria for metals concentrations in soils to be applied on agricultural land, as is explained more fully in Appendix J, Part 4, and
- By assuming that the metal-in-sediment (ug/g) concentration is, on average, applicable to those solids suspended in the water column that are or will be taken into the water treatment plant for treatment. For example, if the sediment analyses shows 1 ug of Cadmium per every g of sediment, and the concentration of suspended solids entering the plant is 10 mg/l, it has been assumed herein that 1 ug of Cd would be

adsorbed to each gram of suspended solids entering the plant; hence 0.01 ug/l of Cd would be entering the plant. The application of this procedure is explained more fully, based on actual test results, in Appendix J, Part 4.

The results of the sampling and testing indicate that although heavy metals are present in the sediments at the intake, they are present in low concentrations, and well below the standards. Based on this results, no further sampling and analysis were recommended during the second and third rounds.

Other Metals. Aluminum and iron levels in the source water appear to be somewhat elevated relative to levels recommended for drinking water (Table J3-5). These levels are primarily set for aesthetic reasons (as is true for the other metals tested in this group). No further sampling were recommended during the second and third rounds.

2.4.5 Terrestrial Ecology

Regulatory Framework. During the 19th and 20th centuries Egypt established institutions, passed laws and initiated activities to protect a variety of plant and animal species, initially within the Ministry of Agriculture, and recently within the Egyptian Wildlife Services, established in 1970.

EEAA, the Egyptian Wildlife Services, and environmental offices in the governorates coordinated their contribution towards implementing Law 102/1983 concerning the establishment and management of natural protectorates.

Egypt has signed a number of international conventions that commit the country to conservation of biological resources. In June 1992 Egypt signed the Convention on Biological Diversity. Immediately afterwards, a National Biodiversity Unit (NBU) was established within the Department of Natural Protectorates, Egyptian Environmental Affairs Agency.

Law 4/1994 under Article 23 prohibits all hunting, killing, catching, transport, or selling of wild birds and animals. Article 24 discusses the procedure for issuing a license for catching and trapping wild birds and animals.

Flora. The agricultural land in and surrounding Kom Ombo, Darawo and Nasr City is cultivated mainly with sugar cane with some areas cultivated with vegetables and fruits. Corn, wheat, alfalfa, and clover are some of the field crops that are cultivated in the Kom Ombo region. The desert close to Darawo and Nasr City has very sparse plantations.

Fauna. The terrestrial habitat supports invertebrate fauna which includes insects and arachnids, and vertebrate fauna which includes birds, mammals, amphibians and reptiles.

Insects: More than 10,000 species of insects are recorded in Egypt. A list of the world-recognized 32 insect orders, number of species and their occurrence in Egypt is shown in the Egypt Country Study on Biological Biodiversity

(National Biodiversity Unit, 1995). A great many insect species have great economic, agricultural, veterinary and medical importance; others are destructive to crops, stored grain, seeds and stored products. Some are pests of cloths and furs. Several species attack shade trees, shrubs, wood, timber and may serve as vectors of plant diseases. Other groups of insects include mosquitoes and disease-transmitting flies.

Arachnida: This group includes about 60,000 species classified in 11 extant and 5 extinct orders. Seven of the eleven orders are represented in Egypt. Arachnida are divided into three categories, *Scorpionida* (Scorpions and Spiders), *Acarina* (Tick), and Mites. Ticks infest a wide variety of vertebrate animals, including man, where they feed on the host blood and therefore act as vectors and reservoirs of numerous pathogenic organisms.

Birds: Because of Egypt's unique and strategic geographical position along migratory routes of Palaearctic birds wintering in Africa, many Palaearctic bird species migrate through Egypt in internationally significant numbers. While Kom Ombo, Darawo and Nasr City have no particular significance for migrating birds, the area lies along the migrating route.

The resident avian habitats in the Kom Ombo Valley and the surrounding areas are confined and adapted to the agricultural landscape of the valley and wadis and mountains of the eastern desert. The characteristic birds of the valley include *Elanus caeruleus* (Black-shouldered Kite), *Falco tinnunculus* (Kestrel), *Bubulcus ibis* (Cattle Egret), *Vanellus spinosus, Burhinus senegalensis* (Senegal Thick-knee), *Toyto alba* (Barn Owl), *Pinia Gracilis* (Graceful Warbler), *Hippolais pallidaed, Carduelis carduelis* (Goldfinch), and *Corvus corone* (Hooded Crow).

The birds of the eastern desert include *Falco pelegrinoides* (Barbary Falcon); *Strix butleri* (Hume's Tawny Owl); *Ammoperdix heyi* (Sand Partridge); *Ammomanes deserti* (Desert Lark); *Bucanetes githagineus* (Tempeter Finch); *Oenanthe lugens* (Mourning Wheatear); *Oenanthe monacha* (Hooded Wheatear); *Cercomela melanura* (Blackstart); and *Hognathus tristramii* (tristram's Grackel).

Among the species that migrate along this part of the Nile Valley are Black kites, Red-backed shrikes, Swallows, White strokes, and Harriers (Visiting Birds Poster, 1990).

In addition are the domesticated fowl such as chicken, geese, ducks, pigeons and quail.

Mammals: Around twenty species of terrestrial mammals belonging to seven orders are likely to be found in the Kom Ombo valley and the vicinity. These orders are *Chiroptera*: Bats; *Rodentia*: Rats, Mice and Gerbils; *Carnivora*: Dogs, Cats and Foxes, *Hyracoidea*: Hyraxes, *Perissodactyla*: Horses and Asses, and *Artiodactyla*: Goats, Sheep, and Gazelles.

Examples of the mammals of this area include *Rousettus aegyptiacus* (Egyptian Fruit- Bat), *Rhinopoma hardwickei* (Lesser Rat), *Rhinopoma microphyllum* (Greater Rat), *Taphozous perforatus* (Tomb- Bat), *Nycteris thebaica* (Egyptian Slit-Faced Bat), *Asellia tridens* (Leaf-Nosed Trident Bat), *Pipistrellus kuhli* (Kuhl's Pipistrelle), *Plecotus austriacus* (North African Long Eared Bat), *Lepus capensis* (Cape Hare), *Rattus rattus* (Black Rat, House Rat), *Mus musculus* (House Mouse), *Rattus norvegicus* (Norway Rat, Brown Rat), *Acomys cahirinus* (Cairo Spiny Mouse), *Arvicanthis niloticus* (Nile Rat, Field Rat), *Gerbillus gerbillus* (Lesser Egyptian Gerbil), *Canis aureeus* (Wolf - Like Jackal), *Vulpes vulpes* (Red Fox), *Mustela nivalis* (Weasel), *Harpists ichneumon* (Egyptian Mongoose), *Procavia capensis* (Hyrax), *Equus asinus* (Nubian Wild Ass) and *Gazella dorcas* (Dorcas Gazelle). In addition there are the domesticated horses, camels, donkeys, buffalo, dogs, cats, sheep, goats and cattle.

Reptiles and Amphibians: The list of herpetofauna of Egypt includes 7 amphibian and 91 reptile species (Lizards, Snakes, Crocodiles, and Turtles), for a total of 98 species, most restricted in their distribution to desert areas. In the Delta and the Nile valley region, of which the Kom Ombo Valley area is a part, about 12 species are found. Examples of these species are *Rana mascareniensis* (Mascarene Frog), and *Bufo regularis* (Reuss's Toad).

2.4.6 Aquatic Ecology

Flora. During recent decades, the River Nile ecosystem has been subjected to many ecological stresses that led to significant changes in the physico-chemical properties of the water, and consequently affected the biological ecosystem. Construction of the Aswan High Dam in the mid-1960s, the presence of large impoundments and pollution of water by domestic, industrial, and agricultural wastes are the most important factors that affect the River Nile environment and its biodiversity. In response to these changes fresh water flora were affected.

The Egyptian Biodiversity Unit surveyed the fresh waters of Egypt for algae. Of 871 species of algae known historically, 77 of these species are now extinct. The 871 species were classified into 8 groups: *Chlorophycophyta, Euglenophycophyta, Pyrrophycophyta, Xanthophycophyta, Rhodophycophyta, Balcillariophycophyta, Chrysophycophyta*, and *Cyanophycophyta*. According to the study, the fresh water *Rhodophycophyta* (red algae) have disappeared: overall, the rate of extinction of Egyptian fresh water algae is around 20 percent.

Fauna Fresh water fauna include *protozoa, rotifera, annelida* (earthworms and leeches), *crustacea, acarina* (mites), *mollusca* (bivalves and snails), *osteichthyes* (bony fishes), and *reptilia* and *amphibia.*

Protozoa play an important role in the household of nature. Flagellates which are capable of photosynthesis represent a basic link in the food chain. There are 141 species of subphyla *Mastigophora, Sarcodina* and *Ciliophera* represented in Egypt.

Rotifera: Wayside pools, drains and even wastewater are prolific sources of rotifers. The free-swimming members of the rotifers constitute a high percentage of the plankton which is the main food for many young and adult fishes. About 118 species have been recorded in the River Nile and coastal lakes.

Annelida: Fresh water annelids in Egypt include two families, Oligochaeta and Hirudinea. Oligochaeta species play an important role in reducing the great masses of aquatic vegetation to a finely comminuted condition. In the River Nile, 22 oligochaeta species have been recorded. The hirudineans are predatory or parasitic and are not only of zoological interest, but also very important for medical and ecological reasons. The hirudinea species are limited; about 19 species have been recorded.

Crustacea: The major crustacean groups are *Cladocera* and *Copepoda*. *Cladocera* have great economic value. Together with the *Copepoda*, they constitute the chief agent for converting the smaller algae into a form edible by the carnivorous aquatic animals. They are themselves of great value as food for young fishes. Forty-three species of *Cladocera* have been recorded in the River Nile. On the other hand, 47 *Copepod* species have been recorded.

Acarina: Fresh water mites compose an important part of aquatic fauna. The majority of them are parasitic. Around 84 species of acarina are recorded in the River Nile.

Mollusca: Most of the studies done in Egypt have been directed towards understanding the principal snail group which transmit schistosomiasis and fascioliasis (liver flukes) in cattle, sheep, and man (such as *Bulinus*, *Biompholaria* and *Lymnaea* species). Mollusca prefer living among aquatic plants and in mud. In the River Nile, 40 species are recorded; of these 24 are common and 16 are rare.

Osteichthyes: The present number of species recorded in the River Nile is about 70. This number shows a marked decline from the previous counts due to the changes of the River Nile environment. Furthermore, most riverine fish are becoming rare; these represent 51 species. Cichlids (Tilapia species) contributes the highest percentage of fresh water production. Nine species of fish have been introduced in Egypt mainly for the use in aquaculture and aquatic weed control.

Reptilia and Amphibia: Only 4 aquatic reptile species have been recorded in Egypt. Three of them are considered rare and the fourth has disappeared entirely. Seven amphibian species have been recorded, of which 3 are common and the other 4 are rare.

2.4.7 Solid and/or Hazardous/Toxic Wastes

Prime Ministerial Decree No. 338 for the year 1995 establishes the regulatory framework for waste disposal.

All solid waste is currently disposed of at several disposal areas in each city. The city council collects wastes from the city and delivers it to the disposal areas. A project to deliver the solid wastes to a specific site and to recycle the wastes is under study.

2.5 Aesthetic and Cultural Conditions

2.5.1 Aesthetic Conditions

The following description relates to the aesthetic setting of the areas in the immediate vicinity of the project facilities. The new wastewater treatment plants are situated out of the cities' limits at the desert ridge. No residential or any other activity is close to the designated plant areas. Overall, the locations have relatively low scenic value in view of the surrounding land utilization.

The wastewater treatment plant effluent will be reused for reclaiming new desert lands which will help in increasing the scenic and aesthetic value of the area.

The expansion facilities in the water treatment plants will be on the existing treatment plant sites.

The water distribution network and the wastewater collection and conveyance system will be installed in principally urban areas along existing transportation roads, or across open land.

2.5.2 Cultural Conditions

Archeology: Kom Ombo has several ancient sites, which are considered very valuable. The temple of Kom Ombo, on the banks of the Nile, and the ancient townsite to the east of the temple are some of these ancient sites.

In Darawo City, there is no published evidence of archaeological material in the area. However, the areas near the Nile and the desert edge east of the modern camel market are likely to contain archaeological material.

Nasr City is far from the River Nile and is new construction that was built in the sixties on desert land without any known archaeological sites. A full archaeological report by Dr. Kent Weeks is presented in Appendix G.

Culture. In addition to the antiquities themselves, Kom Ombo has a cultural center, two libraries, and a cinema and theater. Darawo and Nasr City have cultural centers. (Statistical Notes, Aswan Governorate, 1994).

2.6 Future Conditions without the Project

The scope of works to be carried out for Kom Ombo, Darawo and Nasr City was based upon the May 1994 Project Paper, and has been described earlier. If a decision were made not to proceed with the project elements, a No-Action Alternative, and if the Government of Egypt, through NOPWASD, was unable to provide the necessary facilities, the following effects could be expected:

- Overall reduction in per capita water supply. Although total quantities of water supplied without expanding the water treatment plant would remain unchanged, projected population increases would have the effect of reducing the per capita quantity of water available to the residents of Kom Ombo, Darawo and Nasr City, and the villages within the service area.

- The failure to rehabilitate and expand the distribution system would prevent treated water supplies from being delivered to areas of the cities which are presently expanding, thus forcing the residents of these areas to obtain their water from alternative sources of inferior quality. In the villages, it would be necessary to continue to rely on the use of the compact treatment plants for water supplies. These plants are not considered reliable, due to lack of proper maintenance.
- Delays in implementing distribution system improvements such as new storage tanks will extend and aggravate the extremely low pressures experienced in some areas of the existing system. The result will be the increased use of direct pumping from the system by users, cause an increased potential of negative pressures and the introduction of contamination of the water supplies from groundwater.
- Without the construction of the wastewater collection system, the current practice of installing septic tanks or cesspits, which need to be pumped out, will continue. This simple technology works well in lightly populated areas, but generally fails in urban areas for several reasons related to loading rate per unit area of land. The results are the often under-met need for frequent pumpout, the contamination of groundwater, and even ponding of wastewater.
- The lack of adequate sewer systems can contribute to problems of surface flooding and ponding of sewage near residences and businesses. Such conditions can result in increased concentrations of flies and mosquitoes, recognized vectors of cornmunicable diseases.

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CHAPTER 3

Environmental Impacts

3.0 The Summary Matrix

The specific elements of Kom Ombo, Darawo and Nasr City water and wastewater facilities which have potential environmental impacts can be summarized as follows:

- Expansion of Kom Ombo water treatment plant
- Rehabilitation of existing conventional water treatment plants in Kom Ombo and Darawo
- Rehabilitation and expansion of the water distribution system including associated storage tanks
- Construction of new wastewater stabilization ponds, including facilities for effluent disposal
- New wastewater collection network and conveyance systems

In this chapter the predicted short term and long term impacts of the proposed works on the various environmental issue areas are described, both in terms of negative and positive impacts. Consideration is given to construction and operation phases. Both the direct and indirect effects of the projects and their relative significance are addressed. Any irreversible and irretrievable commitment of resources is noted. Finally, the likely future conditions for the Kom Ombo, Darawo and Nasr City areas if the project is not implemented (the no action alternative) is reviewed.

For each project component, the extent of the foreseen environmental effects is mapped in a summary matrix (Tables 3-1 through 3-4), which serves as an outline and guide for the accompanying text.

Each summary matrix table examines construction activities and operation activities (in the left marginal column); each activity is examined for the likelihood of a positive or negative effect in each of several environmental categories (listed in the header row). The major environmental categories are:

- Physical Environment (with the sub-categories of Land, Water, Air, Energy, and Biota)
- Socio-Economic (Human and Services subcategories)
- Aesthetic and Cultural (including any archaeological aspects)

For each of the environmental sub-categories, the table prompts one to consider and evaluate possible effects, beneficial as well as adverse, in each of the eight categories of construction activity, and six categories of operational activities. The numbers cited in the matrix of the table take positive values if the effects are beneficial, and negative values if adverse. A "1" denotes a minor effect, a "2" denotes a major effect. The absence of any entry implies that no impact is anticipated in this category by this activity.

The notation, " +/-1" denotes that the construction activity could be mildly adverse if not conducted with care, but could also be mildly beneficial if proper mitigation, monitoring, and measurement actions are taken. A "+/-2" denotes a more major effect in the balance.

Table 3-1: Expansion and Rehabilitation of Water Treatment Plants (Kom Ombo and Darawo)

Activity	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural & Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aesthetic
Construction Activities											
Transport of materials			-1			-1	-1				
Construction activities	-1		-1				-1	+1			
Supply of materials and other resources							-1				
Waste disposal	-1					-1	-1				-1
Work force and economics						+1					
Construction schedule						-1	-1				+/-2
Operation Activities											
Material handling and storage		-1	-1			-2					
Sludge disposal	-1	-1									
Supply of materials and other resources		+/-2				+/-2	+/-1				-1
Plant operation and maintenance		+/-2			-1	+/-2	+/-2				
Work force						+2	-1				
Presence of facility	+1	+2				+2	+2	+1		+1	+2
No Action Alternative	-1	-2				-2	-2	-1		-1	-2

Table 3-2: Rehabilitation and Expansion of Water Distribution Network

Activity	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural & Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aesthetic
Construction Activities											
Occupation of land	-1						-1				
Preparation and drainage of site	-1		-1	-1		-1				-1	-1
Transport of materials						-1	-1				
Construction activities	-1		-1			-1	-1	+1		-2	-1
Supply of materials and other resources							-1				
Waste disposal	-1					-1	-1				-1
Work force and economics						+1					
Construction schedule						-1	-1				+/-2
Operation Activities											
Material handling and storage						-1					
Sludge disposal	-1	-1				-1					
Supply of materials and other resources		+/-2				+/-2	+/-1				-1
System operation and maintenance		+/-2			-1	+/-2	+/-1	-1			
Work force						+2					
Presence of facility	+1	+1				+2	+2	+1		+1	+2
No Action Alternative	-1	-1				-2	-2	-1		-1	-2

Table 3-3: New Wastewater Treatment Plants

Activity	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural & Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aesthetic
Construction Activities											
Taking and occupation of land											
Preparation and drainage of site	-1		-1	-1							
Transport of materials			-1			-1	-1				
Construction activities	-1		-1			-1	-1	+1			
Supply and storage of materials and other resources							-1				
Waste disposal	-1					-1	-1				-1
Work force and economics						+1					
Construction schedule						-1	-1				+/-2
Operation Activities											
Material handling and storage						-1					
Supply of materials and other resources		+/-2				+/-2	+/-1				-1
Plant operation and maintenance		+/-2	-1				+/-1				
Effluent and sludge disposal	-1	-2	-1	-2		+/-2			+/-1		-1
Work force						+2	-1				
Presence of facility	+1	+2	+1	+1		+2	+2		+2	+2	+2
No Action Alternative	-1	-2	-1	-1		-2			-1	-2	-2

Table 3-4: New Wastewater Collection Systems

Activity	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural & Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aesthetic
Construction Activities											
Occupation of land	-1					-1	-1				
Preparation and drainage of site	-1		-1	-1						-1	-1
Transport of materials						-1	-1				
Construction activities	-1		-1			-1	-1	+1		-2	-1
Supply of materials and other resources							-1				
Waste disposal	-1					-1	-1				-1
Work force and economics						+1					
Construction schedule						-1	-1				+/-2
Operation Activities											
Material handling and storage	-1					-1					
Supply of materials and other resources		+/-2				+/-2	+/-1				-1
System operation and maintenance		+/-2	-1	-1	-1	+/-2	+/-1	-1	+/-1		
Sludge disposal	-1	-1				-1					
Work force						+2					
Presence of facility	+1	+1				+2	+2	+1	+1	+1	+2
No Action Alternative	-2	-2	-1			-2	-2	-1	-1		-2

The absence of any entry implies no or negligible impact. This notation therefore focuses one's attention immediately to the most environmentally important items.

The determination of significance is based on a number of factors, including the relevant Egyptian and USAID legislation, the severity of the environmental effect in the context of local or regional interests, and the relative importance of the environmental issue concerned. In general, impacts are regarded as significant if they fall into the "+2" (beneficial) or "-2" (high adverse) categories. However, it is also possible that "-1" (moderate) adverse impacts would be considered significant if they are associated with particularly sensitive issues.

Emphasis is placed on those environmental issues considered to be of significance to Kom Ombo, Darawo and Nasr City and the main issues that were raised in the Scoping Session held in Aswan on the 14th of October, 1995.

As environmental effects are introduced and discussed, the appropriate mitigation, monitoring and measurement actions will also be mentioned. These will be recapitulated in Section 5.

The reader is asked to understand that Tables 3-1 through 3-4 are not spreadsheets whose cell values are to be summed in any way. Rather, they are an attempt to devise a sort of three-dimensional checklist of potential environmental impacts of:

[construction and operation activities]

on

[physical, social, etc. environmental attributes]

in each

[program component (new plant, rehabilitated pipelines, new sewerage, etc.)]

In the following sections of Chapter 3, the impacts of activities on environmental attributes often can be found in several or even all four of the program components.

Such common elements in Tables 3-1 through 3-4 are discussed more or less simultaneously, once for all tables.

3.1 Land Use and Regional Planning

The project will impact land use to the extent that it will enable planned expansion of the urban area. The new wastewater services and the extension of water services to the cities will beneficially impact and greatly conserve the land use (+1).

No impacts will occur from the implementation of the new wastewater treatment plants since they will be constructed on desert land. The development of an agriculture reuse area in the desert land close to the treatment plant will positively impact the land use of this arid land.

The water distribution, wastewater collection and conveyance system will be underground and will follow the routes of existing roads. No significant change in land use or loss of land will result. New pump stations will be implemented where no significant change or loss of land will occur.

3.2 Socio-Economic Impacts

3.2.1 Demographic and Migration Impacts

Presence of the project facilities. No appreciable impacts on the size or distribution of the population of any of the three cities at present or in the future is anticipated. The improved living conditions may result in slight population increases.

3.2.2 Economic and Employment

Workforce. All project components will require a cadre of workers at various skill levels. Naturally, upper management of the projects, specialists, and skilled operators of equipment will come from Cairo and even overseas; but to some extent the workforce can be recruited locally (+2). The socio-economic benefits of local recruitment are:

- Direct benefit to the local economy, not only for the duration of this project, but for as long as the workers are paid for the skills acquired on this project
- Improved local understanding of the project
- Greater local interest in, and collaboration with, the project

Tourism activities. Improving the water and wastewater facilities in the city of Kom Ombo will beneficially impact the tourism activities and will help in developing the tourism industry. Increased number of tourists will be expected and consequently work opportunities and economic conditions for the city will be improved (+1).

Industrial activities. The Secondary Cities Project facilities are not designed to accept the industrial discharges from the Egyptian Sugar and Distillation Company and accordingly industrial wastewater will be discharged to El Bayara Drain and eventually to the River Nile (-2). Measures to mitigate the industrial wastewater discharges are needed.

Wastewater generated from the small industrial activities in the project area will be connected to the sewage collection system. Wastewater from hospitals and other commercial premises should be suitable for treatment and these will be connected to the system also. Benefits would arise from not discharging the industrial wastes to the agriculture drains.

Some short term benefits to local industry would arise from the purchase of materials needed in the construction of the project facilities (+1).

Agricultural activities. The wastewater collection system and wastewater treatment plant will result in collecting the domestic and industrial wastewater and discharging it to the wastewater treatment plants where it will be treated and then pumped to new agricultural lands to be reused for irrigation. Doing so will improve the quality of the drainage water (+2).

Effluent wastewater and sludge will be reused in cultivation of around 630 hectares, (1,500 feddans). With proper system design, a water management plan and health precautions, the reuse of the effluent will have some beneficial impact on agricultural activities in the area.(+/-1).

3.2.3 Quality of Life Impacts

The project as a whole is expected to have positive effects for public health, aesthetics, and improvement in quality of life generally, in its provision of more water to more people, and effective sewerage to more people (+2).

Note, however, the importance of balance among the project components: to wit, expansion of the water supply system, without provision of a sewerage system as well, leads to an unaesthetic, as well as unhealthful, local environment with odorous blackwater standing in puddles or flowing though a neighborhood's ditches (+/-2).

Also, there typically is a critical need to ensure that not only are sewer mains and laterals installed, but that the house connections are all made to the sewer as well. The socio-economic forces for ensuring that every house and place of business is properly connected to a sewer sometimes must be aided or expedited by an appropriate local fiscal policy, in which the local house or business owner pays for his connection, but is aided if and as necessary by the government.

Preparation of the site. Scenic and aesthetic impacts will rise during the preparation of the sites of the project facilities, especially the distribution and sewer lines. The impacts will be short term and minor (-1).

Supply and transportation of materials and other resources. The supply of construction materials, and construction resources such as fuel for vehicles and other construction equipment, can have a minor adverse effect if not stored properly on the site (-1). The supply of construction materials if not on time will delay the construction and accordingly several environmental impacts will arise.

The present system for the supply of spare parts and replacement parts to water and wastewater plants is extremely dysfunctional across Egypt. Procedural safeguards, presumably against pilfering, severely stifle the timely distribution of parts to sites where they are needed for continued efficient operation of facilities, much to the frustration of the dedicated people trying their best to keep operations going. Radical, yet possibly simple, institutional restructuring of the parts supply system is a top priority for the water and wastewater sector, and would provide a distinctly beneficial environmental effect (+/-2).

Material handling and storage. The handling of construction materials, and operation resources such as fuel for vehicles and other construction equipment, can have a minor adverse effect if not stored properly on the site (-1).

Construction activities. The construction activities will have minor and short term scenic and aesthetic impacts (-1).

Disposal of construction wastes. Unless properly disposed of, construction wastes have a minor adverse impact of being unsightly, possibly dangerous for children at play, and possibly a health hazard if the materials are habitat favorable to rats, mosquitoes, or other pests (-1).

Construction schedule. Construction equipment mobilized to a site, with open excavations and materials stockpiled, has an adverse effect on any community, in that roadways are partially blocked, and children are in danger of injury if they play, despite any warnings not to, on the equipment, or the materials stockpiled, or in trenches (-1).

System Operation and Maintenance. Operation of the water and wastewater system will result in improved water and wastewater services. Negative impacts could be raised if proper monitoring and maintenance programs are not established to effectively operate the system (+/-2).

Effluent and sludge disposal. The reuse of the effluent wastewater with proper design and precautions will have significant long term benefits (see appendix E4). Improper operation that does not follow the precaution standards will lead to health hazard problems (+/-2).

3.2.4 Transportation, Telecommunications, Power and Energy Impacts

Supply of materials and other resources. The transport of construction materials to construction sites, and removing debris, will entail considerable truck traffic on local roads. The social/economic impact will be relatively minor for sites adjacent to a major highway, and of increasing importance for sites in congested residential areas (-1).

Construction activities. The construction of the different facilities will present some significant, but short term, impacts to the road network. The trenching operation for lines will result in traffic diversions and congestions likely at certain locations. Access to homes and businesses may be affected for short periods of time (-1).

The construction will also involve the relocation of existing underground utilities in a number of places. This relocation will have minor effects on services (electricity, and telephone). There should be no impact on electricity, or telephone, as long as no lines are accidentally cut, for example during excavation (-1).

System operation. Operation of the different facilities will result in improved water and wastewater services. No operation impacts will be experienced by the other services, beyond electric power demands increasing to pump the increased water and sewage flows.

Energy will be consumed at the existing water treatment plants and at the wastewater pump stations and treatment facilities, at a modest rate, imposing a very minor adverse effect on the power network (-1).

3.2.5 Education, Health, and Social Service Impacts

Within this category, it is sufficient to say that the project will in general raise the standard of public health throughout the city as a whole, and in the newly - served areas in particular.

It is within this context that there would be indirect beneficial impacts to education and social service.

Please refer to Section 3.2.3, Quality of Life Impacts, for a discussion of those aspects of the project which must be addressed carefully to ensure that the beneficial impacts are maximal and the adverse impacts minimal.

3.3 Physical Environment

3.3.1 Climate

None of the activities associated with the construction and operation phases of the project is considered to be of sufficient magnitude to adversely impact local weather and climate. The proposed activities will have no effect on the local climate.

3.3.2 Geology and Hydrogeology

Taking of land, mobilizing construction, and preparing the site. The new wastewater treatment plants will take up to several hectares of arid land. While these areas are not considered to have any significant resource value now, effluent reuse in reclamation activities could render this land more valuable, which would be considered a positive impact on the surrounding area.

There will be no land taking, and hence no impact, during the expansion and the rehabilitation of the existing water treatment plants. Storage tanks and pump stations associated with the construction of the water and wastewater system are expected to take a small amount of land that would have adverse impact. The water system and sewerage system will be constructed in existing and proposed roads, so minor intermediate impacts are expected (-1).

Construction activities. Any soil excavation in the city to install water pipes, sewer lines or building pump stations could result in negative impacts on the soil stability (-1).

Soil subsidence during the excavation and dewatering of water and sewer lines' trenches could result in damage to buildings if no engineering controls were implemented (-1). Mitigation measures are needed to address this impact.

Soil excavation and removal during the construction period is highly unlikely to have any significant geological impacts, in terms of disturbance of soils (0).

For the Kom Ombo/Darawo wastewater treatment plant the top 1.5 meters consists of sandy silty soil and the next 8 meters are sandy soils. Such soils are common throughout the area and are not considered to have any significant resource value (0).

At the wastewater treatment plant site at Nasr City, the first 3.5 m consists of fine sand, silt and some fine gravel with low organic content. Such soils are common throughout the area and are not considered to have any significant resource value (0). The following 3 to 4 meters are silty clayey soil that swell with water and become impermeable, stopping seepage to the ground water.

Disposal of construction wastes. The top soil that will be removed during the construction of the new wastewater treatment plant, pump stations, distribution network and the sewer lines will be largely sand and silty sandy soil. These wastes will dumped in the cities' disposal lands.

The disposal of construction material wastes and other wastes will have minor negative impacts (-1). Mitigation measures are needed to address these impacts.

Disposal of operation wastes. The new stabilization ponds will generate sludge only slowly, requiring removal from some of the ponds perhaps every four to five years.

If the agricultural developments are not on time with treatment plant construction and/or there is no proper design of the irrigation system, several environmental impacts will occur. The effluent will be disposed to the land without any organized use and will have negative impacts.(-1).

Presence of facility. With the construction and operation of the project facilities, using good engineering practices, the land conditions will be improved. Wastewater pooled on the lands and streets will disappear and no stability problems will appear (+1).

3.3.3 Air Quality and Noise

Preparation of sites, transportation of materials and construction activities. The impacts to the air quality during the construction phase of the project will be generally limited to dust generation and vehicle and mechanical equipment emissions (-1). The new wastewater treatment plants are to be constructed on desert land away from the residential areas. Emissions and any dust generated at the site during site preparation and facilities construction will be of minor significance. Dust will also arise during the earth excavation activity associated with the installation of the water distribution network and the sewer collection networks, but will be localized and minor in nature (-1). Nevertheless, the contractors will be required to employ dust suppression measures during construction (as discussed in the mitigation measures).

The removal of the cesspits, and other such-on site sewerage systems and the drying up of any ponds that had resulted for pipeline leakage or non existence of sewage systems in the project area will eliminate the problem of nuisance odors which are of particular concern in the more densely populated districts (+1).

Noise will be generated by heavy construction equipment and any drilling and excavation during this phase of work. This noise pollution is localized, short term and will have no expected impacts on humans (-1).

Material handling and facilities operation. The use of chlorine gas for disinfection of the treated water might have significant impacts on the air quality in the area, if accidental leakage occurs. But by applying the mitigation measures in the material handling, storage and operation, the negative impacts could be minimized (-1).

System operation. Raw sewage has the potential to generate strong odors. The treatment train designed for the wastewater treatment plant will greatly reduce the generation of the noxious gases that produce undesirable odors by removing the BOD and sulphide constituents. The wastewater treatment plants are sited away from residential areas and heavy public utilization. No significant odor impacts are anticipated (-1).

The pump stations are designed to minimize the detention time of wastewater in the wet well to alleviate septage conditions; and to minimize turbulence in order to minimize releases of entrained gas. Large pump stations will be designed with positive ventilation devices to circulate the air inside the station and minimize nuisance odors (-1).

Noise levels will be generally low throughout most of the wastewater treatment plants sites during operation, except within a few meters of generators, motors and pumps, all of which will be located within building structures. Noise levels are expected to be very low beyond the site boundary. The noise levels at the water supply and sewage pump stations will be more significant since these pump stations are located in residential areas (-1).

Effluent and sludge disposal. Effluent wastewater and sludge will be reused as irrigation water and soil conditioner respectively. If the agricultural developments are not on time with treatment plant construction and/or there is no proper design of the irrigation system, effluent will be disposed to nearby drains (-1).

Presence of facility. The new project interventions will decrease the existence of strong odors from improper and insufficient wastewater system. Moderate noise levels due to pump stations may exist but these noise levels are far lower than wastewater disposal trucks emptying septic tanks.

3.3.4 Water Supply and Quality

Material handling and storage. The expansion and rehabilitation of the existing water treatment plants will seek to minimize the occurrence of leaks and spills of chemicals, in conformance to applicable Egyptian and US standards for the safety to plant workers and nearby residents, and to minimize the contamination of groundwater, surface water and air (-1).

Supply and transportation of materials and other resources. The present system for the supply of spare parts and replacement parts to water and wastewater plants is extremely dysfunctional across Egypt. Procedural safeguards, presumably against pilfering, severely stifle the timely distribution of parts to sites where they are needed for continued efficient operation of facilities, much to the frustration of the dedicated people trying their best to keep operations going. Radical, yet possibly simple, institutional restructuring of the parts supply system is a top priority for the water and wastewater sector, and would provide a distinctly beneficial environmental effect (+/-2).

System operation and maintenance. Expansion of the water supply system will improve the water quality and quantity in the cities' systems. Also new sewerage systems, including wastewater treatment plant, will result in less wastewater pooled on the ground in residential areas, and in less raw wastewater flowing to drains untreated. Nevertheless, monitoring and maintenance of the systems will be established to enable the systems to be assessed and modified. This is a distinctly beneficial effect (+/-2).

Effluent and sludge disposal. Effluent from wastewater treatment plants will be discharged to new reclaimed areas, where it will be used for irrigation (+/-2). Appendix E4 presents the guidelines for the effluent reuse and the precautions that have to be undertaken during operation.

The water treatment plants presently discharge sludge and backwash water to the river. Present expansion and rehabilitation activities of these plants includes the construction of a sedimentation tank for washwater where the decanted water will be discharged to the head works of the treatment plant and the waste will be discharged back to a drain (+/-2).

Presence of facility. With the implementation of the proposed project, the water service in the city will improve and the water supplied to the users will be of higher quality.

3.3.5 Terrestrial Ecology

Preparation of the site and the construction of the new facilities. The wastewater treatment plant facilities are located in a desert area that is extremely sparsely vegetated. No sensitive wildlife habitats appear to be present. No unique species of biota are expected to occupy areas that will be impacted by the project facilities (-1).

Expansion of the Kom Ombo water treatment plant will be on the existing water treatment site. This area has no biological resources.

The water and wastewater distribution and collection facilities will be constructed in urban areas generally along established roads i.e., areas not typically frequented by biological resources.

Effluent and sludge disposal. Unless a proper irrigation system is established the balance of the indigenous biotic population will be altered in the disposal area (-1).

Presence of project facilities. The project facilities will improve the conditions in the areas that will be served. The project will decrease the number of harmful insects such as mosquitoes (+1).

3.3.6 Aquatic Ecology

Effluent and sludge disposal. River Nile aquatic life, at and downstream of Kom Ombo and Darawo will be improved, since any present wastewater discharges to the river will be eliminated.

Presence of project facilities. The project facilities will stop the damage of the aquatic biota in the water ways due to the direct discharge of the raw wastewater (+1).

3.3.7 Solid and/or Hazardous/Toxic Wastes

The effects of sludge that is generated during construction and operation activities on each environmental attribute are addressed at different location in this chapter. No other solid waste or hazardous wastes are foreseen to be generated by this project.

3.4 Aesthetic and Cultural Resources

3.4.1 Aesthetics

Preparation of the site. Scenic and aesthetic impacts will increase during the preparation of the sites of the project facilities, especially the distribution and sewer lines. The impacts will be short term and minor (-1).

Supply of materials and other resources. The supply of construction materials, and operation resources such as fuel for vehicles and other construction equipment, can have a minor adverse effect if not stored properly on the site (-1).

Construction activities and schedule. The construction activities will have minor and short term scenic and aesthetic impacts (-1). Proper scheduling of the different construction activities will help in overcoming these impacts.

Disposal of construction wastes. Unless properly disposed of, construction and operation wastes have a minor adverse impact of being unsightly, possibly dangerous for children at play, and possibly a health hazard if the materials are habitat favorable to rats, mosquitoes, or other pests (-1).

Presence of the facility.. The project as a whole is expected to have outstandingly positive effects on aesthetics (+2).

Note, however, the importance of balance among the project components: to wit, expansion of the water supply system, without provision of a sewerage system as well, leads to an unaesthetic, as well as unhealthful, local environment with odorous blackwater standing in wide puddles or flowing through a neighborhood's ditches (+/-2).

3.4.2 Cultural

Preparation of the site and construction activities. Kom Ombo is known for one of the world's oldest and best known archaeological ruins, the Kom Ombo Temple. The temple area and the land east of it have been continuously inhabited for 4000 years.

Accordingly, engineering and archeological controls must to be implemented to minimize the negative impacts of the construction activities on the archaeological remains (-2).

It should be noted that no sewers or water distribution facilities are planned to be installed at the Temple site, but only at areas adjacent to the Temple.

Presence of project facilities. The project facilities will decrease the ponding and surface waters in the city limits and should greatly alleviate water logging problems. These conditions will improve the situation around the monuments (+1).

3.5 Assessment of Overall Impacts

3.5.1 Short and Long Term Impacts on Resource and Environmental Productivity

Reviewing the summary matrix (Tables 3-1 through 3-4), the presence of the facilities will improve the environmental conditions in the project area, where it will have long term beneficial impacts. The discussions in sections 3.1 through 3.4 define the long and short term adverse impacts of the specific elements of the Kom Ombo, Darawo and Nasr City water and wastewater facilities.

Expansion and rehabilitation of the water distribution network will have positive impacts on the environment. Examples are public health improvements, improved quantity and quality of water delivered to the city and adequate water pressure in the network.

In addition, improved water supply facilities will have a long term impact on the sewerage system and the power network.

Improper measures of operation and maintenance activities of the distribution network will have adverse impacts. Low drinking water quality and low water supply pressures and quantities are some of these negative impacts.

Analysis of the available raw water quality data in the Kom Ombo and Darawo area (River Nile and finished water), shows that the water quality is quite good, in general. No metals or heavy metals exist in high concentrations in the raw water; with the possible exception of aluminum, which could have an adverse impact on the quality of finished water from the treatment plants (old and new).

The construction of new wastewater treatment plants will have positive impacts. Public health improvements and improved quality in the River Nile and the drains are some of the beneficial impacts. The wastewater treatment plant effluent will be reused in the irrigation of newly reclaimed land. A reuse scheme must be developed for proper management of this effluent. This scheme must consider the seasonal use of the available effluent for irrigation and swelling clays problem.

Beneficial impacts will develop with the implementation of the wastewater network and conveyance system and treatment plants since this will decrease the discharge of untreated sewage water direct to the drains. Doing so will benefit the water quality of the end discharge point (River Nile).

In general, engineering and archeological controls have to be taken to minimize or eliminate any long or short term archeological impacts.

3.5.2 No-Action Alternative

Land Use and Regional Planning Impacts. Planned provisions for municipal water and wastewater services are basic to regional planning and development of land use guidelines in urban areas. If the no-action alternative is selected, long term benefits of expanded and improved water and wastewater services will not be provided, and unplanned extensions and expansion of the urban areas toward the agriculture lands and antiquities areas can be expected to continue. If the no-action alternative is selected, there would not be any temporary disturbance to regional planning and land use programs from construction activities for the improved services. These temporary benefits, however, would be at the expense of significant long-term benefits from planned improvements to services.

Demographic and migration impacts. In a developing country such as Egypt, expanding water and wastewater facilities does not in itself induce new residential construction or attract new industry to a city. By themselves, environmental improvements incurred by constructing the proposed facilities will only modestly attract more people to live in the area, or attract more tourists. Nor will failure to build the facilities necessarily keep the city from growing. Under the no-action alternative, more residents would suffer from ailments resulting from exposure to incompletely treated wastewater, but the adverse health effects would not significantly change the city's demographic future. Failing to build the proposed facilities will have little impact on presently projected population growth.

Economic and Employment. Under the no action alternative, the economy of the cities and the employment rate in the cities will not increase (-2).

Quality of Life Impact. Selecting of the no-action alternative leads to an unaesthetic, as well as unhealthy situation with serious public health problems, and deteriorated local environment (-2).

Without implementation of new sewerage system (sewerage network and treatment plants), the presently unsewered areas would continue to suffer overflowing or otherwise failing septic systems and/or wastewater flows to open drains, with serious public health consequences.

Without the expansion of the Kom Ombo water treatment plant, the population of Kom Ombo, Darawo and Nasr City and adjacent areas would in time suffer occasional loss of water, on an allocated rotational basis; perhaps more important, the occasional loss of pressure during a water shortage, leading to probable contamination of the supply due to infiltration (-2).

Without expansion of the water supply system, neighborhoods not yet served will still be denied access to plentiful, safe water at reasonable cost, with severe public health consequences.

Without rehabilitation of the existing water supply system, there would be more instances of water main breaks, with flooded streets, wastage of water, temporary loss of supply to some areas, and probable contamination of the supply in some areas.

Transportation, Telecommunications, Power and Energy Impacts. The negative impacts arising from the construction activities of the proposed project on the different utilities (road network, telecommunication, power and energy) will not occur. The no-action alternative will represent a benefit from the standpoint of traffic rate, telecommunication services and power and energy consumption, but at the price of deteriorating water and wastewater services and increased health hazards. The benefit is inconsequential compared to the significant adverse impacts of the no-action alternative on the environment (-2).

Education, Health, and Social Service Impacts. The no-action alternative will have an adverse impact on the public health (-2) and will indirectly impact the education and social services (-1).

Geology and Hydrogeology. Under the no-action alternative no soil stability or soil subsidence problems due to construction activities will occur. Water and wastewater pooled on the lands and streets will continue to appear and will have adverse impacts on the land conditions (-1). Swelling-clay problem will be worse where there is water supply but no sewers.

Air Quality and Noise. Raw sewage has the potential to generate strong odors, and therefore, without the implementation of the wastewater improvement facilities continuous production of nuisance odor problems will occur (-1).

Under the no-action alternative, high levels of dust and noise interrnittent impacts due to construction activities will not occur. The no-action alternative will be beneficial from this standpoint but at the price of low quality of life.

Water Supply and Quality. The no-action alternative will have a severely adverse impact on the water distribution within the city (-2). The existing water distribution system is not supplying the city with sufficient quantity of drinking water. The pressures in the system are very low, affecting proper supply of water. The areas that are not yet served will still be denied access to plentiful, safe water.

With the anticipated growth in population and in the absence of the proposed project, increasing quantities of treated and untreated sanitary and industrial wastewater will be discharged into the desert and into the drains and from there flow to the River Nile. Lacking a wastewater system (wasterwater collection network and treatment plants) raw wastewater discharges into the drains will continue.

Terrestrial Ecology. No changes to the wildlife ecology in the wastewater treatment plant sites and agriculture reuse areas will occur. Without the presence of the project facilities no biological improvement conditions will happen in the areas that will be served. The number of harmful insects such as mosquitoes will continue to increase (-1).

Aquatic Ecology. Without the project facilities the aquatic biota will be negatively impacted (-1). Damages to the aquatic biota in the water ways due to direct discharge of the wastewater, washwater and sludge will continue to occur.

Aesthetics. Without the project, no improvement in quality of life, are expected (-2). However the intermittent aesthetic and scenic impacts during the construction activities of the project will not occur.

Cultural. The no-action alternative means that buried, undiscovered resources in the cities will remain undisturbed until future developments or antiquities searching occurs at the different sites. This could be considered as being a benefit to the cultural resources.

CHAPTER 4

Project Alternatives

4.1 Site Selection for Water Storage Tanks and Wastewater Pump Stations

As noted in Section 1.4, selections among two or more alternatives were made in two instances in the course of this project: in the selection of sites for new elevated storage tanks in the water supply system (Figure 1-2) and new pump stations in the wastewater collection system (Figure 1-3). Potential sites were identified for each facility, in the general neighborhood where they are needed. Local officials assisted in the screening of these candidate sites, on the basis of ownership, ease of access, and general acceptability in their respective neighborhoods. In a straightforward manner, and with no distinctive environmental or social issues in the balance, a final site selection has been possible for each facility.

The new wastewater stabilization pond treatment plants have been sited without environmental controversy in otherwise unused arid land.

4.2 Selection of Appropriate Treatment Technology

Early planning for the Secondary Cities Project (1994 WASH Report) considered the issue of appropriate treatment technology. The report found that the following treatment systems are, in descending order, the most appropriate for conditions in the secondary cities:

- Waste stabilization ponds (no mechanical aeration)
- Trickling filter systems
- Aerated lagoons/ponds (mechanical aeration)
- Activated sludge systems

This ranking of technologies is based upon the following factors:

- **Complexity**—Activated sludge systems are complex in nature both in terms of process control and equipment operation and maintenance. In addition, activated sludge systems require sludge withdrawal on a regular basis, thereby requiring additional systems for sludge thickening, dewatering, and disposal. The high skill level required to operate and maintain activated sludge plants is not available in the secondary cities, as evidenced by the poor performance and condition of the Luxor STP. By contrast, waste stabilization ponds are simple to operate in terms of process control and monitoring, have a minimum of mechanical equipment to maintain, and have been applied successfully throughout Egypt and other developing countries. The complexity of trickling filters and aerated lagoons would fall between that of waste stabilization ponds and activated sludge treatment plants.
- **Cost**—Activated sludge systems are far more expensive than pond systems, both in terms of capital and operating costs. It has been estimated that annual costs for an activated sludge system (including amortized capital and operation/maintenance costs) are four to six

times higher than for a comparable stabilization pond system (*Sewage Treatment in Hot Climates*, Mara, 1977). Cost curves presented in the WASH report show the capital cost of a conventional activated sludge plant to be more than twice that of a comparably sized stabilization pond system.

- **Performance**—A properly designed and operated stabilization pond system can achieve BOD removal efficiencies of 80 to 90 percent or greater (with algae correction) and fecal coliform reductions in excess of 99.9 percent. These efficiencies are equal to or greater than those achieved with a conventional activated sludge system. It should be emphasized that an activated sludge system requires chlorine (in addition to other chemicals) to achieve these levels of treatment. If, as is often the case in rural parts of Egypt, chlorine is not readily available, coliform reduction achieved by an activated sludge system would be much lower than that achieved by a properly designed stabilization pond system. Therefore, under the most likely operating scenarios (no chlorine available), a properly designed stabilization pond system would out-perform an activated sludge system by a wide margin with respect to fecal coliform reduction.

  The major quality concern regarding stabilization pond effluent is the potential for high algae concentrations. The presence of algae in stabilization pond effluent may exert an excessive oxygen demand if discharged to a small stream or river, but the high nutrient value of the algae is actually a benefit if effluent is to be used for irrigation or other agricultural reuse applications. Therefore, the presence of algae in the stabilization pond effluent is not considered a major factor in evaluating treatment systems for the Secondary Cities Project.

- **Energy Requirements**—Activated sludge system are very energy intensive, with energy requirements typically exceeding 30 kW per 1,000 m^3 treated. By contrast, energy requirements for a stabilization pond system are limited to effluent pumping (if required), site lighting, and administration building/laboratory requirements. This is an important consideration, as many of the secondary cities would not have the electrical generation and distribution facilities required to support an activated sludge plant.

Provided that sufficient land is available, the case for selecting a stabilization pond system over an activated sludge system is overwhelming in warm climate countries. Advantages of a pond system over an activated sludge system are summarized in Table 4-1.

4.3 No-Action Alternative

Under some circumstances, the option of taking no action at all must be compared with more assertive proposals for action, usually when such proposals have evident serious adverse environmental impacts.

However, based on the Environmental Scoping Session (described in Appendix B), and as described in Sections 2.6 and 3.5.2, all proposed actions are seen to promise distinctive benefits, with only minor and ameliorable adverse effects. Therefore, in no instance is the no-action alternative a viable or interesting option in Kom Ombo, Darawo and Nasr City.

The impacts of the no-cation alternative are repeated as follows:

Table 4-1 Comparison of Sewage Treatment Systems

Criteria	Activated Sludge System	Trickling Filter System	Aerated Lagoon System	Waste Stabilization Pond System
BOD Removal	Excellent	Excellent	Excellent	Excellent
TSS Removal	Excellent	Excellent	Fair	Fair
Fecal Coliform Removal	Poor *	Poor *	Excellent	Excellent
Virus Removal	Fair *	Fair *	Excellent	Excellent
Effluent Reuse Quality	Poor *	Poor *	Excellent	Excellent
Construction Cost	High	High	Moderate	Low
Maintenance Costs	High	High	Moderate	Low
Land Requirement	Low	Low	Moderate	High
Operational Complexity	High	High	Moderate	Low
Energy Demand	High	Moderate	Moderate	Low
Sludge Minimization	Poor	Poor	Moderate	Excellent

* Assumes chlorination or ultraviolet disinfection not available

Land Use and Regional Planning Impacts. Planned provisions for municipal water and wastewater services are basic to regional planning and development of land use guidelines in urban areas. If the no-action alternative is selected, long term benefits of expanded and improved water and wastewater services will not be provided, and unplanned extensions and expansion of the urban areas toward the agriculture lands and antiquities areas can be expected to continue. If the no-action alternative is selected, there would not be any temporary disturbance to regional planning and land use programs from construction activities for the improved services. These temporary benefits, however, would be at the expense of significant long-term benefits from planned improvements to services.

Demographic and migration impacts. In a developing country such as Egypt, expanding water and wastewater facilities does not in itself induce new residential construction or attract new industry to a city. By themselves, environmental improvements incurred by constructing the proposed facilities will only modestly attract more people to live in the area, or attract more tourists. Nor will failure to build the facilities necessarily keep the city from growing. Under the no-action alternative, more residents would suffer from ailments resulting from exposure to incompletely treated wastewater, but the adverse health effects would not significantly change the city's demographic future. Failing to build the proposed facilities will have little impact on presently projected population growth.

Economic and Employment. Under the no action alternative, the economy of the cities and the employment rate in the cities will not increase (-2).

Quality of Life Impact. Selecting of the no-action alternative leads to an unaesthetic, as well as unhealthy situation with serious public health problems, and deteriorated local environment (-2).

Without implementation of new sewerage system (sewerage network and treatment plants), the presently unsewered areas would continue to suffer overflowing or otherwise failing septic systems and/or wastewater flows to open drains, with serious public health consequences.

Without the expansion of the Kom Ombo water treatment plant, the population of Kom Ombo, Darawo and Nasr City and adjacent areas would, in time, suffer occasional loss of water, on an allocated rotational basis; perhaps more important, the occasional loss of pressure during a water shortage, leading to probable contamination of the supply due to infiltration (-2).

Without expansion of the water supply system, neighborhoods not yet served will still be denied access to plentiful, safe water at reasonable cost, with severe public health consequences.

Without rehabilitation of the existing water supply system, there would be more instances of water main breaks, with flooded streets, wastage of water, temporary loss of supply to some areas, and probable contamination of the supply in some areas.

Transportation, Telecommunications, Power and Energy Impacts. The negative impacts arising from the construction activities of the proposed project on the different utilities (road network, telecommunication, power and energy) will not occur. The no-action alternative will represent a benefit from the standpoint of traffic rate, telecommunication services and power and energy consumption, but at the price of deteriorating water and wastewater services and increased health hazards. The benefit is inconsequential compared to the significant adverse impacts of the no-action alternative on the environment (-2).

Education, Health, and Social Service Impacts. The no-action alternative will have an adverse impact on the public health (-2) and will indirectly impact the education and social services (-1).

Geology and Hydrogeology. Under the no-action alternative no soil stability or soil subsidence problems due to construction activities will occur. Water and wastewater pooled on the lands and streets will continue to appear and will have adverse impacts on the land conditions (-1). Swelling-clay problem will be worse where there is water supply but no sewers.

Air Quality and Noise. Raw sewage has the potential to generate strong odors, and therefore, without the implementation of the wastewater improvement facilities continuous production of nuisance odor problems will occur (-1).

Under the no-action alternative, high levels of dust and noise intermittent impacts due to construction activities will not occur. The no-action alternative will be beneficial from this standpoint but at the price of low quality of life.

Water Supply and Quality. The no-action alternative will have a severely adverse impact on the water distribution within the city (-2). The existing water distribution system is not supplying the city with sufficient quantity of drinking water. The pressures in the system are very low, affecting proper supply of water. The areas that are not yet served will still be denied access to plentiful, safe water.

With the anticipated growth in population and in the absence of the proposed project, increasing quantities of treated and untreated sanitary and industrial wastewater will be discharged into the desert and into the drains and from there flow to the River Nile. Lacking a wastewater system (wasterwater collection network and treatment plants) raw wastewater discharges into the drains will continue.

Terrestrial Ecology. No changes to the wildlife ecology in the wastewater treatment plant sites and agriculture reuse areas will occur. Without the presence of the project facilities no biological improvement conditions will happen in the areas that will be served. The number of harmful insects such as mosquitoes will continue to increase (-1).

Aquatic Ecology. Without the project facilities the aquatic biota will be negatively impacted (-1). Damages to the aquatic biota in the water ways due to direct discharge of the wastewater, washwater and sludge will continue to occur.

Aesthetics. Without the project, no improvement in quality of life, are expected (-2). However the intermittent aesthetic and scenic impacts during the construction activities of the project will not occur.

Cultural. The no-action alternative means that buried, undiscovered resources in the cities will remain undisturbed until future developments or antiquities searching occurs at the different sites. This could be considered as being a benefit to the cultural resources.

CHAPTER 5

Management, Mitigation and Monitoring

5.1 Introduction

This chapter presents the mitigation and monitoring measures developed by the consultant to effectively minimize the adverse impacts of the Project. In addition, proposals to monitor the impacts are described. Monitoring will enable any problem areas to be identified at an early stage so that corrective actions can be implemented in a timely fashion.

Table 5-1 provides a summary of the environmental impacts discussed in Chapter 3 and shows the proposed mitigation and monitoring measures designed to reduce, minimize or eliminate any adverse impacts identified and to closely monitor the environmental changes over time.

Sections 5.2, 5.3, and 5.4 list the measures to be taken to protect the physical, socio-economic, and cultural environments in the course of this project.

The rating system used in Tables 3-1 through 3-4 is repeated here:

A "1" denotes a minor effect; a "2" denotes a major effect. The numbers take positive values if the effects are beneficial, and negative values if adverse.

The notation "+/-1" denotes that the activity could be mildly adverse if not conducted with care, but could also be mildly beneficial if proper mitigation, monitoring, and measurements actions are taken. A "+/-2" denotes a more major effect in the balance. A "0" denotes nil or negligible effect.

5.2 Mitigation and Monitoring of Physical Impacts

5.2.1 Construction Issues

Preparation of site and construction activities (-1). The contractor commissioned for the construction will be required to undertake dust control measures for dust suppression. The dust control would be generally achieved by water spraying.

Construction equipment needs to be operated with care to decrease noise levels. Hours of working will be restricted in urban areas. This has to be coordinated with the fact that in some areas, which have traffic conflicts and narrow streets, working at night would be the most applicable method of constructing the facilities.

Excavation in urban areas will require engineering control by the contractor to prevent soil subsidence or collapse and damage to adjacent buildings. This work should be monitored during construction.

The soil type in some of the project areas is swelling clay. When this soil becomes wet, it swells and otherwise changes its soil properties, including bearing capacity. This phenomenon can be structurally devastating, when water leaks to soils in built-up areas. In Nasr City, for example, a four-story hospital stands empty (and dangerous), with cracked and failing walls, ceilings, and staircases. In areas where these soils are found, special care must be taken with the installation of water and sewer lines.

Table 5-1 Summary of Environmental Impacts and Proposed Mitigation and Monitoring Measures

Environmental Attribute	Type of Impact	Location	Work Phase	Proposed Mitigation Measures	Proposed Monitoring Measures	Significance and Characteristics of Impact
Land Use and Regional Planning	Change in land use of 200 ha of desert land to wastewater stabilization ponds	Ballana and Nasr City Ponds	Construction			No Impact
Land Use and Regional Planning	Change in land use of 10 ha of urban land to pump stations and storage tanks	Kom Ombo, Darawo and Nasr City	Construction			No Impact
Land Use and Regional Planning	Change in land use of 500 ha of desert land to agriculture reuse	Agriculture farms near Ballana and Nasr City	Operation	Following proper reuse scheme and standards for protecting the land quality	Bi-annual soil sampling for heavy metals, coliform, nematodes, TDS.	Beneficial/ Long term
Climate	Climate changes	Project facilities	Construction /Operation			No Impact
Geology, Soil	Soil subsidence	PS, Sewer and pipe trenches	Construction	Engineering control by contractor to prevent soil subsidence	Photographic records for sensitive buildings in proximity of excavation before and after to monitor any possible resulting damage	No Impact
Geology, Soil	Excavation and Removal of Soil	WSP, PS	Construction	Project facilities located away from good quality or unique soil types		No impact
Geology, Soil	Soil disturbance	WSP, PS Sewer and pipe trenches	Construction		The contractor should inform proper authorities if any items of geological interest be incountered	No Impact
Air Quality	Dust and vehicle emmision	Project facilities	Construction	Dust suppression by water spraying		Minor adverse/ Short term

Table 5-1 Summary of Environmental Impacts and Proposed Mitigation and Monitoring Measures (Continued)

Environmental Attribute	Type of Impact	Location	Work Phase	Proposed Mitigation Measures	Proposed Monitoring Measures	Significance and Characteristics of Impact
Air Quality	Removal of septic tanks and improper systems resulting in intermittent odor generation	Within Cities	Construction	Mobilize finish and demobilize as quickly as possible to minimize odor problems Dump the construction wastes in designated disposal area		Minor adverse/ Short term
Air Quality	Removal of septic tanks and improper systems resulting in elimination of odors	Within Cities	Operation			Benificial/ Long Term
Air Quality	Noxious odors (H_2S etc..)	WSP, PS	Operation	Removal of sludge from the screens and grit chambers areas of the WSP Proper design of the PS to minimize odor and addition of positive ventilation if needed	Monitoring of H_2S every month	Minor adverse / Long term
Air Quality	Noxious odors	Effluent disposal	Operation	Proper reuse scheme to minmize odor		No impact
Noise	Equipment Noise	Project facilities	Construction	Care during operation of constructure equipment to minimize noise levels		Minor adverse/ Short term
Noise	Facility noise, pump stations	PS	Operation	All major noise generating at PS will be enclosed in buildings		Minor adverse/ Short term
Water Supply	Impact on quantity and quality	Cities water distribution network	Operation	Proper maintenance of the system and following of inspection plan	Quarterly monitoring of THM, and Cl residual, (see the monitoring plan, Table 5-5)	Benificial/ Long term

Table 5-1 Summary of Environmental Impacts and Proposed Mitigation and Monitoring Measures (Continued)

Environmental Attribute	Type of Impact	Location	Work Phase	Proposed Mitigation Measures	Proposed Monitoring Measures	Significance and Characteristics of Impact
Water Supply	Effect of spare parts and other materials availability on the sustainability of the system	City water distribution networks	Operation	Restructuring of the spare part supply system		Benificial/ Long term
Groundwater quality	Effects of wastewater infiltration to the groundwater aquifer.	Groundwater aquifer	Operation	Proper maintenance of wastewater network and following of inspection plan		Benificial/ Long term
River Nile water	The cessation of the wastewater dispoal to the Nile River.	Nile River	Operation	Proper reuse scheme and following standards	Bi-annual monitor of groundwater in areas close to the Gulf for TSS, BOD, Total nitrogen, Phosphorus	Benificial/ Long term
Terrestrial habitat	Damage to habitat	WSP	Constructio n	Facilities away from environmently sensitive areas		No impact
Terrestrial habitat	Impact of ponds and effluent water on migratory birds and other species	WSP, agriculture farm	Operation	Mutual contact between interested agencies Wildlife rescue tranning for facility workers Permitting qualified personnel to enter the facility		No impact
Aquatic habitat	Impact of effluent reuse	Nile River	Operation	Proper effluent reuse scheme following the standards	Monitor of the effluent every two weeks, for TSS, Total Nitrogen, Total phosphprus, BOD, Colifor, see Table 5-5	Benificial/ Long term

Table 5-1 Summary of Environmental Impacts and Proposed Mitigation and Monitoring Measures (Continued)

Environmental Attribute	Type of Impact	Location	Work Phase	Proposed Mitigation Measures	Proposed Monitoring Measures	Significance and Characteristics of Impact
Solid wastes disposal	Disposal of construction and operational wastes to a disposal area	Dedicated disposal area	Construction /operation	An engineered disposal area is required		No impact
Demographics	Effect on size and distribution of population	Kom Ombo, Darawo and Nasr City	Operation			Benificial/ Long term
Work force	Impact on local workers	Kom Ombo, Darawo and Nasr City	Construction /Operation			Benificial/ Long term
Public Safety	Impacts on public safety	Kom Ombo, Darawo and Nasr City	Construction	Strigent safety procedures to be enforced to protect workers and members of public		Minor adverse/ Short term
Tourism activities	Improvement of the water and wastewater facilities	Kom Ombo	Operation			Benificial/ Long term
Industrial activities	Opportunities for local industries to supply materials	Upper Egypt	Construction			No impact to Benificial/ Long term
Agriculture activities	Impact of effluent reuse on agriculture production	Balana, Nasr cities	Operation	Proper agricultural and irrigation measues to acheive clean crop products	Sampling of the agriculture crops	Benificial/ Long term
Aesthetic	Preserving the agriculture area	Agriculture area	Operation	Precaution for safe reuse scheme		Benificial
Quality of life	Improvements to public health due to the improved water supply and wastewater facilities	Kom Ombo, Darawo and Nasr City	Operation	Proper maintenance of the system following inspection and monitoring plans		Benificial/ Long term

Table 5-1 Summary of Environmental Impacts and Proposed Mitigation and Monitoring Measures (Continued)

Environmental Attribute	Type of Impact	Location	Work Phase	Proposed Mitigation Measures	Proposed Monitoring Measures	Significance and Characteristics of Impact
Solid wastes disposal	Disposal of construction and operational wastes to a disposal area	Dedicated disposal area	Construction /operation	An engineered disposal area is required		No impact
Demographics	Effect on size and distribution of population	Kom Ombo, Darawo and Nasr City	Operation			Benificial/ Long term
Work force	Impact on local workers	Kom Ombo, Darawo and Nasr City	Construction /Operation			Benificial/ Long term
Public Safety	Impacts on public safety	Kom Ombo, Darawo and Nasr City	Construction	Strigent safety procedures to be enforced to protect workers and members of public		Minor adverse/ Short term
Tourism activities	Improvement of the water and wastewater facilities	Kom Ombo	Operation			Benificial/ Long term
Industrial activities	Opportunities for local industries to supply materials	Upper Egypt	Construction			No impact to Benificial/ Long term
Agriculture activities	Impact of effluent reuse on agriculture production	Balana, Nasr cities	Operation	Proper agricultural and irrigation measues to acheive clean crop products	Sampling of the agriculture crops	Benificial/ Long term
Quality of life	Improvements to public health due to the improved water supply and wastewater facilities	Kom Ombo, Darawo and Nasr City	Operation	Proper maintenance of the system following inspection and monitoring plans		Benificial/ Long term

Table 5-1 Summary of Environmental Impacts and Proposed Mitigation and Monitoring Measures (Continued)

Environmental Attribute	Type of Impact	Location	Work Phase	Proposed Mitigation Measures	Proposed Monitoring Measures	Significance and Characteristics of Impact
Transportation	Traffic impacts due to transportaion of construction materials and construction activities	Kom Ombo, Darawo and Nasr cities	Construction	Minimize unnecessary disruption by close coordination and scheduling with Police and Traffic departments Public awarrness for the project activities		
Transportation	Traffic impact due to reduction of septage haulage waste	Kom Ombo, Darawo and Nasr cities	Operation			
Telecomunication	Affect on existing network	Kom Ombo, Darawo and Nasr cities	Operation			
Power Network	Affect on existing network	Upper Egypt Power network	Operation	Coordination between the authorities to resolve any power shortage problems.		No impact
Utilities	Disruption to utilities, temporary or permanent relocation of utilities	Kom Ombo, Darawo and Nasr cities	Construction	Contract responsible for coordinating work with utility services authorities and making good any damage Public awarness concerning schedules		Minor adverse/ Short term
Education and social services	Impacts to education and social services	Kom Ombo, Darawo and Nasr cities	Operation			No impact to benificial
Aesthetics	Impacts of construction activities on the senic and aesthetics	Kom Ombo and Darawo cities	Construction	Store material safely Proper scheduling of activities Public awarness for the project activities		Minor adverse/ Short term

Proper storage and transportation of materials and fuels (-1). Provide adequate space for convenient and safe storage of construction materials, and construction resources such as fuel for vehicles and other machinery, to avoid leaks and spills. Monitor during construction.

Proper disposal of construction wastes (-1). Include in the contract language clauses to the effect that the contractor shall identify and use an approved disposal site and disposal method for all construction wastes to be removed from the site. Monitor during construction.

5.2.2 Operation issues

Effluent disposal system. Effluent from the new wastewater stabilization pond plants, to be designed under this contract, will be discharged through pump stations to the reuse areas in the desert.

Design and layout of the reuse area is beyond the scope of this project, and will be planned, designed and managed by others. It is recommended that the planning and design be carried forward, and approved, in such a manner that the construction of the facility shall be ready for operation at the same time that the wastewater stabilization ponds are placed into service.

An alternative disposal method of the effluent will be designed to convey the effluent to a nearby drain. This alternative will be used for times when no water is needed for irrigation.

However, this Environmental Assessment takes the opportunity to note the importance of proper management of the effluent all the year round considering seasonal variations in water requirements.

The development of a well designed reuse plan is an important part of the wastewater treatment process, although it is not a part of the Secondary Cities Project. Special care has to be taken to schedule the completion of implementation of this plan with the scheduled completion of the wastewater treatment plants facilities (+/-2).

Operator training. Discussed elsewhere herein as a socio-economic measure, will greatly serve the primary objectives of the project, among them the protection of the physical environment, through effective project facilities operation (+/-2).

Supply of materials, and other resources (+/-2). Institutional restructuring of the parts supply system, so that parts can be swiftly supplied when and where they are needed, is a top priority for the water and wastewater sector.

Facility operation and maintenance (+/-2). Sewerage network pump stations and treatment plants are susceptible to odor generation, mainly at the grit chambers and screens. Small pump stations will be designed to minimize odor while in large pump stations positive ventilation will be added.

Water supply distribution pipelines and the sewerage network will be monitored for leak detection. Effective maintenance procedures are needed. Institutional restructuring and operator training are the tools for effective monitoring and maintenance to stop any leaks before they increase.

Wastewater treatment plant operation will be monitored through recorded measurement of the influent and effluent flows and water quality. Flow will be measured using flow meters. A composite sample of the influent will be analyzed for the basic parameters (total suspended solids, volatile suspended solids, biochemical oxygen demand (BOD), pH, temperature, total nitrogen, ammonia nitrogen). Metals, total phosphorus, and organics will be sampled periodically (Table 5-5).

Materials handling and storage (-1). To minimize the occurrence of leaks and spills, in conformance to current US standards, to minimize the contamination of groundwater, surface water, and air:

- Adopt proper operating procedures, developed during and for the commissioning of each facility
- Adequately train operators, both on the job and at training centers
- Supply parts and materials in a proper and timely fashion, as discussed above
- Monitor compliance in matters of code and procedures, by appropriate authorities, and
- Develop a contingency plan which has to be followed in the event of chlorine leak during plant operation

5.3 Mitigation and Monitoring of Socio-Economic Impacts

5.3.1 Construction issues

Work force (+1). To the greatest reasonable extent, recruit the construction work force locally.

Phasing: Construction activities and schedule (-1). Mobilize to a site, build, finish, demobilize, and withdraw completely all equipment, excess materials, and wastes as quickly from possible from any given site.

If work forces and funds are limited in extent so that all project components cannot be executed at full speed simultaneously, a priority list should be drawn up so that the forces and funds available are directed to only a limited number of sites at a time, so that workers can proceed with all deliberate speed at these sites, and withdraw when complete, and not invade other sites until work there can be funded.

This mitigates the issues of residential hazard and nuisance, and permits the first-constructed elements to come into service sooner than would happen otherwise. An added benefit is that there is steady, full employment of an increasingly skilled and experienced workforce, moving from one site as it is finished to the next site to be begun, rather than intermittent and partial employment of many whose skills will not be developed as well.

Schedules for different construction activities must be communicated to the public so to minimize any adverse intermittent impacts. Doing so will decrease the impacts of changing any services (change of routes, water supply closure, etc...).

Storage of materials and other resources (-1). Mitigate health and safety hazards by storing construction materials, and construction resources such as fuel for vehicles and other machinery, in a proper manner. Monitor compliance during construction.

Disposal of construction wastes (-1). Mitigate health and safety hazards by including in the contract language clauses to the effect that the contractor shall identify and use an approved disposal site and disposal method for all construction wastes to be removed from the site. Monitor compliance during construction.

Transport of construction materials (-1). Safety to operators, equipment, and other people on the highway can be addressed by observing local and national codes regarding the covering and securing of cargoes on trucks. Contribution to traffic congestion can be minimized by as much as possible avoiding trips during peak traffic hours; this benefits job productivity as well.

5.3.2 Operation issues

Workforce (+2). All project components will require a cadre of workers at various skill levels, largely drawn from the local area. Workers newly hired as plant operators will acquire enhanced skills, which will be of value not only on this project but wherever they work in the future, a significant net positive social and economical effect. This can be enhanced by operators taking relevant courses among the many offerings at NOPWASD's Training Center.

Maintenance, supply of materials, and other resources (+/-2). As noted in Section 5.1.2, institutional restructuring of the parts supply system is a top priority for the water and wastewater sector.

Materials handling and storage (-2). To minimize the occurrence of leaks and spills of chemicals, in conformance to current US standards for the safety to plant workers and nearby residents:

- Adopt proper operating procedures, developed during and for the commissioning of each plant;
- Adequately train operators, both on the job and at the Damanhour Training Center;
- Proper and timely supply of parts and materials, as discussed above; and
- Monitor for compliance in matters of code and procedures, by appropriate authorities.

Effluent disposal. Several specifications, and precautions have to be

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undertaken for the reuse scheme, with respect to workers, plantation, animals, to land and air (see Appendix E4). Decisions about plant type and method of irrigation must be according to the recommendations and standards given in Appendix E4.

Daily monitoring of effluent is important to minimize health hazards. The agricultural product should be monitored periodically to evaluate its quality and to raise an alarm for any negative signs.

Aquaculture in the ponds. It has been suggested that fish could be raised in one or more of the stabilization ponds, as a secondary beneficial use of the facility.

Pilot studies for this sort of activity have been carried out at Suez under the sponsorship of the Academy of Scientific Research and Technology. Their reports may be consulted as a first step to deciding the feasibility of such a program.

5.4 Mitigation and Monitoring Cultural and Aesthetic Impacts

Aesthetic environment. It is often the case that public health issues are also aesthetic issues. During construction, to store materials safely, to minimize the generation of dust, smoke and noise, will also help maintain aesthetics. Proper scheduling of the different construction activities will improve the aesthetic environment, too.

The boundary of the wastewater treatment plants will presumably carry the conventional wall provided to Egyptian government installations, an attractive wall of concrete posts and brick infill. To plant trees by this wall will further enhance its aesthetics.

Archaeology. According to the archaeological report (Appendix G) Kom Ombo and Darawo have areas that contain ancient ruins. Engineering and archaeological controls have to be taken to minimize any negative impacts (destroying of any ruins or buildings). Caution should be used in excavation, and contracts written so as to provide standard procedures to be followed without any economic harm to the contractor, should artifacts be encountered.

Excavation should be minimized by designing the water and sewer pipelines to lie as close as possible to the ground surface, where the pipeline routes cross areas likely to be rich in buried antiquities.

5.5 Environmental Plan of Action

All components of the project will provide significant natural, social, and economic environmental benefits to Kom Ombo, Darawo and Nasr City. All the environmental effects identified and discussed can be satisfactorily mitigated, as discussed above and summarized below. To maximize the benefits:

- Train the workforce, as an investment that will return benefits over a long time horizon, and for the benefit of the whole country, and the local region in particular

- Eliminate institutional barriers to supplying parts as and when they are needed to keep facilities operational
- To the greatest extent feasible, set a construction priority among the project components and execute them rapidly in series, rather than trying to execute many projects simultaneously, with funding severely limiting the progress of any project
- Sewerage of a district, with fiscal and administrative provision to ensure that all house connections are made, should not lag far behind water supply to that district
- For those districts in which the Project is to introduce both piped water supply and sewerage for the first time, consider a close coordination of effort that would enable water lines and sewer lines to be laid at more or less the same time. This would reduce installation costs, reduce local disruption during installation, and hasten the provision of both services, and
- Care during the design and operation of the reuse scheme (not designed under this project)

To minimize the adverse effects:

- Store materials and dispose wastes properly
- Design the wastewater treatment plant and effluent force main facilities with special care
- Consideration of the environmental instructions during construction supervision (see Table 5-2)
- Provide for engineering and archaeological controls during the performance of the construction activities (Table 5-3)
- Well planned inspection program (Table 5-4) and
- Follow the monitoring program illustrated in Table 5-5

Table 5-2 Instructions During Construction Supervision

No.	Description
1	Dewatering water should be analyzed and compared to standards before dumping it in drains or sewerage system
2	Construction wastes should be dumped in city dump area.
3	Contractor shall preserve and protect materials of an archaeological, scientific or historical value.
4	Information about activities has to be conveyed to antiquities department. Antiquities control has to be applied during construction in Luxor area.
5	Public awareness program regarding the project activities, interruptions to utilities and change of routes, etc..
6	Avoid as much as possible damaging any plants and trees in the site
7	Safety precaution for the construction staff
8	Disinfected and flush waters coming out of any pipe or storage tanks should not be dumped in sewer line or drains unless it complies with the standards.
9	Dust and smoke control according to standards
10	Noise control according to standards.
11	The contractor should provide and maintain sanitary facilities for his employees and his subcontractors.
12	Construct temporary construction access roads and detours as necessary to mitigate services construction interruptions.
13	Perform all work in a fire safe manner.

Table 5-3 Program for Archaeological Concerns

CDM has considerable background on wastewater projects that pass through areas of archaeological significant. These projects were in the Giza area at Nazlant El Samaan and other adjacent areas.

The suggested archaeology program is as follows:

1- Assign an Egyptologist to monitor the excavation activities.

2- In situations where antiquities are encountered, process involving collaboration with the archaeological authorities will be implemented.

3- An official from the archaeological authorities can be on site with the assigned CDM Egyptologist to facilitate obtaining all important data and its transfer to the archaeological authority.

Table 5-4 Inspection Program

No.	Description
A	**Wastewater Treatment Plants**
	Mechanical and electrical equipment environmental concerns (leaks , uncovered wires etc..)
	Sludge removal (from screen area and sludge drying beds if any).
	Lagoon leaks, level of water for proper treatment.
	Safety precautions during maintenance procedures.
B	**Wastewater collection network, pump stations and force mains**
	Mechanical and electrical equipment environmental concerns (leaks , uncovered wires etc..).
	Sludge removal procedures (from screen area)
	Wet well cleaning and disposal procedures.
	Collection mains
	Control valves, check valves.
	Leakage of force main
	Safety precautions during maintenance procedures.
C	**Water Treatment plants**
	Intake system (screen area)
	Mechanical and electrical equipment environmental concerns (leaks , uncovered wires etc..)
	Disinfection equipment
	Alum equipment
	Sludge removal procedures
	Cleaning of filters, open channels and sedimentation tanks procedures
	Elevated and groundwater reservoirs safety and cleaning procedures
D	**Water system**
	Leakage of pipes (leak detection program)
	Control and valve chambers
	Safety precautions during maintenance procedures.

Table 5-5 Environmental Monitoring Program

Type of Monitoring	Parameters	Frequency	Location
Wastewater Influent and Effluent	pH, settleable solids	Daily	Wastewater Treatment Plant
Wastewater Influent	TSS, VSS, BOD, Total Nitrogen, Phosphorus, COD	Two Weeks	Wastewater Treatment Plant
Wastewater Effluent	TSS, VSS, DO, BOD, Total Nitrogen, Coliform, phosphorus, algae	Two Weeks	Wastewater Treatment Plant
Wastewater Effluent	Organics, metals	Periodically	Wastewater Treatment Plant
Air Emission	H_2S	Monthly	Wastewater Pump Stations
Noise Quality	Loudness	Monthly	Pump Stations
Sludge Quality	Heavy Metals, Coliform, Nematodes	Quarterly	Wastewater Treatment Plant
Raw Water (source water)	pH, turbidity, TSS	Daily	Water Treatment Plant
Raw Water	Heavy Metals, Pesticides, TOC	Quarterly	Water Treatment Plant
Finished Water	pH, Cl residual	Daily	Water Treatment Plant
Finished Water	Alkalinity, Hardness, TDS, Calcium, Magnesium, Iron, Manganese, Chloride	Two Weeks	Water Treatment Plant
Washwater	TSS, TDS, Coliform, pH	Monthly	Water Treatment Plant
Alum	Alum Compounds	Periodically	Water Treatment Plant
Finished Water	TSS, TDS, algae, fecal coliform	Monthly	Groundwater Tanks
Finished Water	Algae, fecal coliform	Monthly	Elevated Tanks
Finished Water	THM's, Cl	Quarterly	Distribution Network

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APPENDIX A

List of EA Preparers and Contributors

APPENDIX A

List of EA Preparers and Contributors

This Environmental Assessment was prepared by Dr. Hesham El Badry under the general directions of Dr. Jonathan A. French and Mr. Louis Marcello.

Other CDM/AAW staff who made significant technical contributions were Dr. Mohammed Hassan, Mr. Karl Mass, Mr. Ahmed Kandil, Mr. Morad Kamel and Mr. Nabil Kamel.

The team also expresses its appreciation to Dr. Essam El-Badry and to Mr. Mohamed Ibrahim, both at the Egyptian Environmental affairs Agency.

APPENDIX B

Scoping Session Summary Report

USAID

UNITED STATES AGENCY for INTERNATIONAL DEVELOPMENT

CAIRO, EGYPT

SCOPING SESSION SUMMARY REPORTS

Project Location: Egypt

Project Title/ID: Secondary Cities Project (263-0236)

Fiscal Year and Amount: FY 95 - FY03, $215,000,000

Prepared by: **Date:** Jan 26, 1996

Anne E. Patterson
Mission Environmental Officer

Decision of Environmental Officer, Bureau for Asia and the Near East:

Approved: [signature]
Disapproved: ______
Date: 16 February 1996

Clearances:

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SCOPING REPORT: ASWAN GOVERNORATE CITIES

1. Introduction

A scoping session related to the environmental assessment report for Kom Ombo, Darawo, and Nasr City, required under the under the Secondary Cities Project (263-0236), was held in Aswan at the Isis Hotel on October 14, 1995. The scoping session was convened by H.E. Gen. Salah Misbah, Governor of Aswan, and Mr. Ernest Rojas, USAID Project Officer of the Secondary Cities Project, to address the anticipated environmental impacts of the proposed water and wastewater interventions in Kom Ombo, Darawo, and Nasr City that are to be funded by USAID under the Secondary Cities Project. A list of attenders, approximately 90 in number, is attached. Representatives of the consulting design team, lead by Camp, Dresser, and McKee, explained the purpose of the scoping session and then presented a brief description of the principal components of the project. A brief project description and alternatives under consideration is listed below:

2. Project Description

The three subject cities are close to each other, and to some extent will share water and wastewater facilities, as shown schematically in Figures 1 and 2, and as outlined further below.

2.1 Kom Ombo and Darawo

Water supply. The existing water supply for the Kom Ombo, Darawo, and Nasr City area is a regional supply system, in that not only are the three cities supplied from the treatment plants, but several smaller villages also receive their water supplies from these plants. A new regional water plant is currently under construction, and is expected to be operational in early 1997. This plant is located about 15 km north of Kom Ombo on the east bank of the Nile River (Figure 1). This new plant is not within the scope of this project, except for its effects on supply requirements.

For Kom Ombo, the proposed water supply improvements include the rehabilitation and expansion of the existing water treatment facilities, and expansion of the water transmission and distribution network. The locations of these activities are shown on Figure 3. The existing water treatment plant, located on the Kassel canal in the northern part of the city, will be the focus of this project's design efforts.

For Darawo, the proposed water supply improvements will include the rehabilitation of the existing water treatment plant, and expansion of the transmission and distribution systems, as shown in Figure 4.

Wastewater. Neither Kom Ombo nor Darawo have a wastewater collection network at present; the project's activities will include the design and construction of a network for Kom Ombo (Figure 5) and one for Darawo (Figure 6). The project will also include the design and construction of a new wastewater stabilization pond treatment plant to serve both cities (Figure 2), together with the means for year-round disposal of the effluent.

2.2 Nasr City

Water supply. Nasr City currently obtains most of its treated water by pipeline from the Kom Ombo water supply system (Figure 1). The project will consist of the expansion of the existing transmission mains and distribution network as required, including additional water booster pump stations, as needed; and construction of additional facilities as needed. The locations of these activities are shown on Figure 7.

Wastewater system. The Project will consist of the design and construction of wastewater stabilization ponds, including the means for effluent disposal; and the construction of sewers, wastewater pump stations and associated force mains, in areas as shown on Figure 8.

In all cases the No Action alternative will be investigated for water and wastewater project elements in Darawo, Kom Ombo, and Nasr City.

3. Environmental Considerations and Key Issues

Potential effects that have been identified, whether positive or negative, are listed in the following subsections. Hollow bullets ("o") denote issues that are routinely to be expected in projects of this nature. Solid bullets ("•") denote issues specifically raised in the scoping meeting:

3.1 Water Supply System

- ● Improvement to water supply services will improve the quantity and quality of the city's water supply, and consequently of the city's public health, and thereby improve conditions in the society and in its economy.

- o The plant will represent an additional electric load on the existing grid.

- Consider operation and maintenance activities including sludge disposal.

- Construction activities will increase the levels of dust and noise.

- Consider public safety, traffic control and interruptions during construction including interruptions of water services. 3-8(1) 3-9

- Consider the stability of structures due to construction activities, e.g. alteration of water table due to site dewatering.

- Consider the quality of raw water at the water treatment plant intake in the Kassel canal, and at the intake pump station for the Kassel canal on the bank of the Nile. Consider the proximity of drain discharges to the Nile, as well as any discharges to drains or the Nile from the sugar processing facility adjacent to the water treatment plant.

- Consider the quality of raw water available in the Nile River during those times that large flows are diverted from the Nile to the irrigation system, particularly during the winter.

- The water distribution network should be of a closed-loop form for redundancy.

- Pipe diameters in the distribution network need to be enlarged, and washout valves added.

3.2 Wastewater System

WONT AN "ISSUE"?

- There will be an improvement in public health.

- Consider the stability of structures, including septic tanks, affected by construction activities.

- Consider the potential impact of construction activities on antiquities. 5-13

- Consider public safety, traffic control and interruptions during construction including interruptions of sewerage and other utility services.

- During construction, ensure the continuation of wastewater disposal, by septic tanks or any other means.

- Consider the impacts of new pump stations on land use, energy consumption, and traffic control.

- o Consider operation and maintenance activities at these new pump stations, e.g. problems of odors and disposal of screenings.
- o Consider the problems of stabilization pond siting, and associated land acquisition.
- o impact of stabilization pond on migratory birds
- o Consider the quality of the treated effluent from stabilization ponds, and its suitability for agricultural use, and for surface disposal in agricultural drains.
- o Consider the impacts of sanitary sludge disposal from the stabilization ponds.
- Consider the impact of the stabilization ponds on the ground water level.
- Consider the specifics of industrial waste disposal.
- Sewerage planning and financing should include the means to include house connections, whether by simple inclusion in the scope of the funded project, or by a funding pool and/or an installment payment system, to help individual property owners pay for the connections.

3.3 General

- Recognize the importance of public awareness campaigns regarding these works.
- There are several parts of Kom Ombo where elevated ground water levels are a significant problem, both with respect to mosquito nuisance and the stability of structures. These require an engineering solution.
- Tourist cruise ships discharge their wastes too close to the water plant intake [presumably meaning the intake from the Nile to the Kassel canal, which in turn supplies the existing water treatment plant.]
- Coordinate plans for facilities and power demands with the electrical department so that the electrical distribution system can be ready to supply the water and wastewater system whenever and wherever power is needed.

4. Significance of the Issues to be Analyzed

The Mission considers all of the issues raised during the scoping process for Darawo, Kom Ombo, and Nasr City to be valid. However, the Mission has determined that several key issues are particularly significant and should received extensive study. These issues for the water supply alternatives include: land use and siting requirements; the quality of raw water;

S3 S4 S-5

operation and maintenance requirements; energy requirements; antiquities. Significant issues to be studied for the ~~wastewater~~ alternatives are: impacts from construction activities; W-1 suitability of treated wastewater for agricultural W-2 re-use; operation and maintenance W-3 requirements; antiquities; and stabilization pond siting.

W-4 W-5

5. Timing of the Preparation of the Environmental Analysis and Environmental Assessment Report

The issues and concerns identified in the Scoping Session Report will be studied in the Environmental Assessment Report which will be written in standard 22 CFR 216 format. Data collection and environmental sampling is expected to last approximately four months. An additional two months will be required for preparation of the draft EA document. A draft EA is scheduled for completion by November, 1996. Collection of samples for laboratory analysis is scheduled to begin in March, 1996

6. Tentative Planning and Decision Making Schedule

The Environmental Assessment should be completed by November, 1996. Selection of an alternative and engineering design work will commence immediately afterwards. Final design work should be completed by early 1997. It is unlikely that construction would begin earlier than late 1997.

7. Approach for conducting the Environmental Assessment

The environmental assessment team will consist of an environmental scientist, environmental engineer, archeologist, sociologist, city planner, biologist, chemist, city planner, and geologist. A detailed description of the location of samples to be collected and the laboratory analyses to be conducted were submitted as an addendum to this report. Data will be collected in order to sufficiently study the significant issues identified as well as to study the issues and to provide background information which is typically found in all USAID EAs.

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Environmental Scoping Session for Kom Ombo, Darawo, Nasr City

held at Aswan, 14 October, 1995

LIST OF ATTENDERS

	Name	Position
1.	H.E. Gen. Salah Misbah	Governor of Aswan
2.	Mr. Farag Abd El Azziz Abd El Rahman	Ministry of International Cooperation
3.	Mr. Fathi Abd El Hamid El Sheikh	Ministry of Planning
4.	Mr. Zein El Abedeen Said Hasan	Head of Governorate Popular Local Council
5.	Mr. Wagih Abd El Ghani	Aswan City & Markaz Chief
6.	Eng. Mohamed El Said El Sehiti	Chairman South Said Electricity Distribution Co.
7.	Eng. Mohamed El Amir Osman	Undersecretary of Irrigation
8.	Eng. Abbas Hegazi Mohamed	Gen. Mgr. Housing & Utilities
9.	Mr. Mohamed Abd El Moneim El Sabee	Director Governor's Office
10.	Mr. Moustafa Abbas Metwalli	Edfu City & Markaz Chief
11.	Mr. Hamed El Husseini	Darawo Markaz Chief
12.	Mr. Ahmed Samir Sultan	Kom Ombo Markaz Chief
13.	Mr. Rabee Hasan Mohamed Yehia	Nasr City Markaz Chief
14.	Eng. Hassan Nassef Hassan	Economic Affairs Director, Aswan Governorate
15.	Mr. Moustafa Abou El Hassan	Financial Affairs Director, Aswan Governorate
16.	Mr. Ahmed Ibrahim Karim	Legal Affairs Director, Aswan

Governorate

17.	Eng. Khaled El Agami	Urban Development Unit Director, Aswan Governorate
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19.	Eng. Abd El Razek Taha	NOPWASD representative
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22.	Eng. Ahmed El Mekkawi	Zoning Section Head, Darawo
23.	Eng. Mahmoud Saleh Ismail	Engineering Director, Kom Ombo
24.	Eng. Abd El Karim Ahmed Saleh	Zoning Section Head, Kom Ombo
25.	Eng. Mohamed Sami Maher	Engineering Director, Nasr City
26.	Mr. Abd El Hadi Ali Ahmed	Zoning Section Head, Nasr City
27.	Mr. Mohamed Abou El Kassem	National Democratic Party, Kom Ombo
28.	Mr. Mohamed Ahmed Gohar	Kom Ombo Council
29.	Mr. Mostafa Youssef Mahmoud	Kom Ombo Council
30.	Mr. Badri Anour Mohamed	National Democratic Party, Darawo .
31.	Mr. Hamed Hussein Mahrous	Public Relations Department, Aswan Governorate
32.	Mr. Abd El Karim Kassem Hussein	Public Relations Department, Aswan Governorate
33.	Mr. Nabil El Rodawi	Housing Committee Chairman, Popular Council, Aswan Governorate
34.	Mr. Abd EL Dayem Hussein Ahmed	Darawo Markaz Popular Local Council

35.	Mr. Hussein Masloub Hussein	Darawo Markaz Popular Local Council
36.	Mr. Hussein Gad El Karim Hussein	Darawo City, Popular Local Council
37.	Mr. Said El Naggar Ali Gouda	Kom Ombo Markaz, Popular Local Counil
38.	Mr. Shawky Abd El Rahim Ismail	Nasr City Markaz, Popular Local Council
39.	Mr. Said Ahmed Suleiman	Nasr City Markaz, Popular Local Council
40.	Mr. Mohamed Abbas Huzein	Nasr City, Popular Local Council
41.	Prof. Dr. Ahmed Ismat Billal	Faculty of Science & Environmental Affairs Dept.
42.	Prof. Dr. Salama Abd El Hadi	Energy Institute
43.	Prof. Dr. Mohamed Hussein Amin	Dean, Faculty of Engineering, South Valley University at Aswan
44.	Mr. Mowafak Abou El Leil	El Ahram Newspaper
45.	Mr. Fathi Mohamed Wahish	El Akhbar Newspaper
46.	Mr. Ahmed Kamali	Middle East News Agency
47.	Mr. Ahmed Awad	El Messaa Newspaper
48.	Mr. Gamal Hashem	Local Radio
49.	Ms. Sahar Ibrahim	Local Radio
50.	Dr. Abd El Hafez Abd El Rassoul	Kom Ombo Hospital Director
51.	Dr. Abd El Nair William Fakhouri	Darawo Hospital Director
52.	Dr. Ali Adli El Demerdash	Nasr City Hospital Director
53.	Dr. Ahmed Kotb	Health Department, Aswan
54.	Dr. Hassan Farrag	Head of Aswan Medical Syndicate

55.	Eng. Abd El Wahab Borai Ahmed	Chairman, Kom Ombo Sugar Co.
56.	Eng. Mohamed Abd El Moatti	Chairman, Misr Dairy
57.	Mr. Ali Abdou Mahmoud	Chairman, Social Welfare Society
58.	Mr. Ahmed Atta Allah	Chairman, Darawo Social Development Society
59.	Mr. Moustafa Mohamed Abd Allah	Mgr. Social Development Society, Kom Ombo
60.	Dr. Bahei El Din	Kom Ombo Health Dept.
61.	Mr. Arrafa El Said El Naghi	Aswan Customs Dept.
62.	Mr. Abd El Razek Abd El Halim	National Democratic Party
63.	Mr. Saber Mohamed Ali Mohamed	Nasr City, Popular Council
64.	Eng. Abbas Hegazi	Housing Director, Aswan
65.	Mr. Zaki Saghir	Darawo Markaz Deputy
66.	Mr. Abd El Magid Mohd. Osman Hussein	Housing Committee, Governorate Council
67.	Mr. Ahmed Atta Allah	Darawo, Social Development Society
68.	Mr. Said Ahmed Shehab	Nasr City Markaz, Deputy Council
69.	Mr. Mahmoud Mohamed Ahmed Ishak	Kom Ombo, Social Development Society
70.	Mr. Mohamed Ali El Tayeb	Kom Ombo City, popular Council
71.	Mr. Bertil Vendel	Head, DANIDA, Aswan
72.	Mr. Moustafa Nouri	DANIDA

Chemonics Intl.

73.	Mr. Dewey Bryant	Chemonics
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76.	Mr. Ernest Rojas	Sec. Cities Project Officer, USAID
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81.	Mr. David Doran	Project Manager
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83.	Mr. Hassan Morsi	Design Manager
84.	Dr. Jonathan French	Environmental Assessment Director
85.	Dr. Hisham El Badri	Environmental Assessment Manager
86.	Dr. Tarek Selim	Session Moderator
87.	Mrs. Farida Morcos	Administrative Manager

APPENDIX C

Public NGO's Correspondence

APPENDIX C

Public NGO's Correspondence

No Correspondence has been received from any Non-Governmental Organization about the environment issues for this project.

APPENDIX D

Air Pollution and Noise Regulations

APPENDIX D

Table D-1: Maximal Limits of Outside Air Pollutants*.

Parameter	Maximum Limit (ceiling) (micrograms per cubic meter)	Period of Exposure
Sulphur Dioxide	350	1 hr
	150	24 hrs
	60	1 year
Carbon Monoxide	30 mgm/m^3	1 hr
	10 mgm/m^3	8 hrs
Nitrogen Dioxide	400	1 hr
	150	24 hrs
Ozone	200	1 hr
	120	8 hrs
Particles in suspension	150	24 hrs
(measured as black smoke)	60	1 yr
Total particles in suspension	230	24 hrs
	90	1 yr
Chest particles (PM 10)	70	24 hrs
Lead	1	1 yr

* Executive regulations of Law 4/1994 Annex 5.

Table D-2: Permissible Limits of Total Particles in Emissions

Kind of Activity	Maximum Limit (ceiling) of Emission (mgm/m³ of exhaust)
1- Carbon industry	50
2 - Coke industry	50
3 - Phosphates industry	50
4 - Ingots industry, and extraction of lead, zinc, copper, and other non-ferrous metallurgical industries	100
5 - Ferrous industries	200 Existing
	100 New
6 - Cement industry	500 Existing
	200 New
7 - Industrial timber and fibres	150
8 - Petroleum and oil refining industries	100
9 - The rest of industries	200

* Executive regulations of Law 4/1994 Annex 6.

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Table D-3: Maximum Limits (ceilings) of Gas and Fumes Emission From Industrial Installations

Pollutant	Maximum Limit (ceiling) of Emission Milligram/M^3 of Exhaust
Aldehydes (measures and formaldehydes)	20
Antimony	20
Carbon Monoxide	500 Existing
	250 New
Sulphur Dioxide Burning Coke and Petroleum	4000 Existing
	2500 New
Non-Ferrous Industries	3000
Sulphuric Acid Industry	1500
Sulphur Trioxide Plus Sulphuric Acid	150
Nitric Acid Industry	2000
Hydrochloric Acid (Hydrogen Chloride)	100
Hydrofluoric Acid (Hydrogen Fluoride)	15
Lead	20
Mercury	15
Arsenic	20
Heavy Elements (grand total)	25
Silicon Fluoride	10
Fluorine	20
Tar - Graphite Electrodes Industry	50
Cadmium	10
Hydrogen Sulphide	10
Chlorine	20
Carbon - Burning of Garbage	50
Carbon - Electrodes Industry	250
Organic Compounds - Burning organic liquid	50 0.04% of crude (Oil refining)
Copper	20
Nickel	20
Nitric acid Industry	3000 Existing
	400 New
Other Industries	300

* Executive regulations of Law 4/1994 Annex 6.

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Table D-4: Permissible Limits of Loudness Inside Places of Work and Indoors*.

Determination of the Type of the Place and Activity	Maximum Limit (ceiling) Permissible for Loudness of Valent Noise (decible A)
1- Places of work with shifts of up to 8 hours, with the aim of limiting noise hazards to hearing	90
2- Places of work which require hearing sound signals, and good hearing speech	80
3- Work rooms to follow up, measure and adjust operation, with high demands	65
4- Work rooms for computer or typing machines or like units	70
5- Work rooms for activities which require routine mental conncentration	60

* Executive regulations of Law 4/1994 Annex 7.

Maximum period permissible for exposure to noise in place of work (factories and workshops)

* The value given hereafter is indicated on the basis of non-affecting the sense of hearing.
- The loudness of the valent noise shall not exceed 90 decibles (A) during the daily work shift (8 hours).
- In case the level of valent noise loudness is higher than 90 decibles (A), the period of exposure shall be reduced according to the following table:

Level of Noise Loudness decible (A)	95	100	105	110	115
Period of Exposure (one hour)	4	2	1	½	1/4

- The level of momentary noise loudness during the work period shall not exceed 135 decibles.
- In case of exposure to different levels of noise loudness over 90 decibels.

  For intermittent periods during the work shift, the result shall not exceed

$$(\frac{A_1}{B_1} + \frac{A_2}{B_2} + ...) \quad \textit{of one whole}$$

Since: "A" is the period of exposure to a specific level of noise (hr) and

"B" is the permissible period of exposure at the same noise level (hr).

- (In case of exposure to intermittent noise issued from heavy hammers)

- It depends on the period of exposure (number of knocks during the daily shift) according to noise loudness, and the following table:

SOUND LOUDNESS DECIBLE	NUMBER PERMISSIBLE OF KNOCKS DURING THE DAILY PERIOD OF WORK
135	300
130	1000
125	3000
120	10000
115	30000

Noise issuing from heavy hammers shall be considered intermittent if the period between each knock and the next one is one second or more. If the period is less than that, the noise shall be considered continuous, in which case the foregoing four items shall apply thereto.

Table D-5: The Maximum Limit (Ceiling) Permissible for Noise Loudness in the Different Zones:

Type of Zone	Permissible Limit for Sound Loudness Decible (A)					
	Day/Time*		Evening**		Night***	
	From	To	From	To	From	To
Commercial, and administrative zones, and Mid Town	55	65	50	60	45	55
Residential zones including some woekshops or comercial business or on a public road	50	60	45	55	40	50
Residential suburbs with low background voise lend	40	50	35	45	30	40
Rural residential zones (hospitals and gardents)	35	45	30	40	25	35
Industrial zones (Heavy Industries)	60	70	55	65	50	60

* Day Time from 7 am to 6 pm

** Evening from 6 pm to 10 pm

*** Night from 10 pm to 7 am

APPENDIX E

Water Quality Standards and Guidelines

Part E1.	Ministry of Health Standards WHO Guidelines and USEPA Standards for Drinking Water
Part E2.	Regulations for Protection of the River Nile and Waterways
Part E3.	Regulations for Discharge of Liquid Wastes
Part E4.	Effluent Reuse and Disposal
Part E5.	Heavy Metal Criteria for the Application of Sewage in Agriculture

APPENDIX E1

Table E1-1 Water Quality Standards and Guidelines

Water Quality Parameter	Egyptian Standards	WHO Guidelines	USEPA Standards
Bacteriological Constituents			
cyptosporidium	*NR*	*NR*	TT (free)
e. coli (thermotolerant coliform)	*NR*	free	free
fecal coliform	free	*NR*	free
fecal floating bacteria	free	*NR*	*NR*
giardia lamblia	*NR*	*NR*	TT (free)
legionella	*NR*	*NR*	TT (free)
total coliform bacteria	3 cells/100 ml	free	present in no more than 5% of samples per month (goal = free)
total bacteria	< 50 cells/ml in 24 hrs at 37 oC < 50 cells/ml in 48 hrs at 22 oC	*NR* *NR*	HPC: TT (free)
turbidity	5 JTU for filtered water 10 JTU for groundwater	5 NTU	<1 NTU in 95% or more samples, never > 5 NTU, (goal = 0.2 NTU or less)
viruses	*NR*	*NR*	TT (free)
Inorganic Constituents (mg/l)			
aluminum	0.2	*NR*	*NR*
antimony	*NR*	0.005 *(PG)*	0.006
arsenic	0.05	0.01 *(PG)*	0.05
asbestos (fibers > 0.01 mm)	*NR*	*NR*	7 million fibers/L
barium	*NR*	0.7	2
beryllium	*NR*	*NR*	0.001
boron	*NR*	0.3	0.6 to 1 *(P)*
bromate		------ *see disinfection byproducts* ------	
cadmium	0.005	0.003	0.005
calcium	200	*NR*	*NR*
chromium	0.05	0.05 *(PG)*	0.1
copper	1	2 *(PG)*	TT (1.3)
cyanide	0.05	0.07	0.2
fluoride	0.8	1.5	4
lead	0.05	0.01	TT (0)
mercury (total)	0.001	0.001	0.002
molybdenum	*NR*	0.07	0.04 *(P)*
nickel	*NR*	0.02	0.1
nitrate	10 as N	50 as NO_3	10 as N
nitrite	0.005 as N	3 as NO_2 *(PG)*	1 as N
nitrate + nitrite	*NR*	(nitrate/50 + nitrite/3) < 1	10 as N
selenium	0.01	0.01	0.05
silver	*NR*	*NR*	*NR*
sulfate	400	250	500 *(P)*
tin	*NR*	*NR*	*NR*
thallium	*NR*	*NR*	0.002
zinc	5	3	2 *(P)*

Note: *NR* means not currently regulated or no recommended value. *(PG)* means provisional guideline value. TT means that a treatment technique is mandated in lieu of a parameter concentration limit (the value in parenthesis is a treatment goal). *(P)* means proposed for regulation.

Table E1-1 (continued)

Water Quality Parameter	Egyptian Standards	WHO Guidelines	USEPA Standards
Organic Constituents (ug/L)			
Chlorinated alkanes			
carbon tetrachloride	2	2	5
dichloromethane	20	20	5
1,1 - dichloroethane	*NR*	*NR*	*NR*
1,2 - dichloroethane	30	30	5
1,1,1 - trichloroethane	200	2000 *(PG)*	20
1,1,2 - trichloroethane	*NR*	*NR*	5
Chlorinated ethylenes			
vinyl chloride	5	5	2
1,1 - dichloroethylene	30	30	7
1,2 - dichloroethylene	50	50	70 cis/10 trans
trichloroethylene	70	70 *(PG)*	5
tetrachloroethylene	40	40	5
Aromatic hydrocarbons			
benzene	10	10	5
toluene	100	700	1000
xylenes	*NR*	500	10,000
ethybenzene	*NR*	300	700
styrene	*NR*	20	100
benzo(a)pyrene	0.7	0.7	0.2
Chlorinated benzene			
monochlorobenzene	300	300	100
1,2 - dichlorobenzene	1000	1000	75 para?
1,3 - dichlorobenzene	*NR*	*NR*	600 ortho?
1,4 - dichlorobenzene	300	300	*NR*
trichlorobenzenes (total)	20	20	70
Miscellaneous			
acrylamide	0.5	0.5	TT (0)
dialkyltins	*NR*	*NR*	*NR*
di (2-ethylhexyl) adipate	80	80	500
di(2-ethylhexyl) phthalate	8	8	6
edenic acid (EDTA)	200	200 *(PG)*	*NR*
epichlorohydrin	0.4	0.4 *(PG)*	TT (0)
glyphosphate	*NR*	*NR*	700
hexachlorobutadiene	0.6	0.6	1 *(P)*
hexachlorocyclopentadiene	*NR*	*NR*	50
oxamyl (vdate)	*NR*	*NR*	200
nitrilotriacetic acid	200	200	*NR*
picloram	*NR*	*NR*	500
tributyltin oxide	*NR*	2	*NR*

Note: *NR* means not currently regulated or no recommended value. *(PG)* means provisional guideline value. TT means that a treatment technique is mandated in lieu of a parameter concentration limit (the value in parenthesis is a treatment goal). *(P)* means proposed for regulation.

Table E1-1 (continued)

Water Quality Parameter	Egyptian Standards	WHO Guidelines	USEPA Standards
Pesticides & PCBs (ug/L)			
alachlor	20	20	2
aldicarb	10	10	3 *(P)*
aldicarb sulfone	*NR*	*NR*	2 *(P)*
aldicarb sulfoxide	*NR*	*NR*	4 *(P)*
aldrin/dieldrin	0.03	0.03	*NR*
atrazine	2	2	3
bentazone	30	30	*NR*
carbofuran	5	5	40
chlordane	0.2	0.2	2
chlorotoluron	30	30	*NR*
dalapon	*NR*	*NR*	200
DDT	2	2	*NR*
1,2-dibromo-3-chloropropane	1	1	0.2
2,4-D	30	30	70
1,2 - dichloropropane	20	20 *(PG)*	5
1,3 - dichloropropane	20	*NR*	*NR*
1,3 - dichloropropene	*NR*	20	0.6 *(P)*
dinoseb	*NR*	*NR*	7
diquat	*NR*	*NR*	20
endothal	*NR*	*NR*	100
endrin	*NR*	*NR*	2
ethylene dibromide (EDB)	*NR*	*NR*	0.05
heptachlor	*NR*	0.03	0.4
heptachlor epoxide	*NR*	0.03	0.2
hexachlorobenzene	1	1	1
isoproturon	9	9	*NR*
lindane	2	2	0.2
MCPA	2	2	*NR*
methoxychlor	20	20	40
metolachlor	10	10	100 *(P)*
molinate	6	6	*NR*
pendimethalin	20	20	*NR*
pentachlorophenol	9	9 *(PG)*	1
permethrin	20	20	*NR*
PCBs (as decachlorobiphenyl)	*NR*	*NR*	0.5
propanil	20	20	*NR*
pyridate	*NR*	100	*NR*
simazine	2	2	4
toxaphene	*NR*	*NR*	5.0E+00
2,3,7,8-TCDD (dioxin)	*NR*	*NR*	5.0E-05
2,4,5-TP (silvex)	*NR*	*NR*	50
trifluralin	20	20	5 *(P)*
chlorophenoxy herbicides other than 2,4-D and MCPA			
2,4-DB	90	90	*NR*
dichloroprop	100	100	*NR*
fenoprop	9	9	*NR*
MCPB	*NR*	*NR*	*NR*
mecoprop	10	10	*NR*
2,4,5-T	9	9	*NR*

Note: *NR* means not currently regulated or no recommended value. *(PG)* means provisional guideline value. TT means that a treatment technique is mandated in lieu of a parameter concentration limit (the value in parenthesis is a treatment goal). *(P)* means proposed for regulation.

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Table E1-1 (continued)

Water Quality Parameter	Egyptian Standards	WHO Guidelines	USEPA Standards
Disinfectants and Disinfection Byproducts (ug/L)			
monochloramine (mg/l)	3	3	4 *(P)*
di-and trichloramine (mg/l)	5	*NR*	*NR*
chlorine (mg/l)	*NR*	5	4 *(P)*
chlorine dioxide (mg/l)	*NR*	*NR*	0.8 *(P)*
chlorate (mg/l)	*NR*	*NR*	*NR*
chlorite (mg/l)	200	200 *(PG)*	1 *(P)*
iodine (mg/l)	*NR*	*NR*	*NR*
bromate (mg/l)	0.025	0.025 *(PG)*	0.010 *(P)*
chlorophenols	*NR*	*NR*	*NR*
2 - chlorophenol	*NR*	*NR*	*NR*
2,4 - dichlorophenol	*NR*	*NR*	*NR*
2,4,6 - trichlrophenol	200	200	*NR*
formaldehyde	*NR*	900	*NR*
MX	*NR*	*NR*	*NR*
trihalomethanes (1)	100	*see individual limits*	100 {80/40 *(P)*}
bromoform	*regulated as sum total*	100	*regulated as sum total*
dibromochloromethane	*regulated as sum total*	100	*regulated as sum total*
bromodichloromethane	*regulated as sum total*	60	*regulated as sum total*
chloroform	*regulated as sum total*	200	*regulated as sum total*
halogenated acetic acids	*see individual limits*	*see individual limits*	60/30 (P)
monochloroacetic acid	*NR*	*NR*	*regulated as sum total*
dichloroacetic acid	50	50 *(PG)*	*regulated as sum total*
trichloroacetic acid	100	100 *(PG)*	*regulated as sum total*
chloral hydrate	10	10 *(PG)*	TT (40) *(P)*
chloroacetone	*NR*	*NR*	*NR*
halogenated acetonitriles	*see individual limits*	*see individual limits*	*NR*
dichloroacetonitrile	90	90 *(PG)*	*NR*
dibromoacetonitrile	100	100 *(PG)*	*NR*
bromochloroacetonitrile	*NR*	*NR*	*NR*
trichloroacetonitrile	1	1 *(PG)*	*NR*
cyanogen chloride (as CN)	70	70	*NR*
chloropicrin	*NR*	*NR*	*NR*
Radioactive Constituents			
gross alpha activity	0.1 Micro Curie/Litre	0.1 Bq/L	15 pCi/L
gross beta activity	1 Micro Curie/Litre	1 Bq/L	4 mrem
radium-226 + radium-228	*NR*	*NR*	5 pCi/L
radium-226	*NR*	*NR*	20 pCi/L *(P)*
radium-228	*NR*	*NR*	20 pCi/L *(P)*
radon	*NR*	*NR*	300 pCi/L *(P)*
uranium	*NR*	*NR*	20 ug/L *(P)*

Note: *NR* means not currently regulated or no recommended value. *(PG)* means provisional guideline value. TT means that a treatment technique is mandated in lieu of a parameter concentration limit (the value in parenthesis is a treatment goal). *(P)* means proposed for regulation.

Table E1-1 (continued)

Water Quality Parameter	Egyptian Standards	WHO Guidelines	USEPA Standards
Aesthetic Standards			
color	<20-30 (Cobalt Platinum Scale)	15 TCU	15 CU
taste and odor	acceptable	acceptable	Odor: 3 threshold odor no.
temperature	*NR*	acceptable	*NR*
pH	6.5-9.2	*NR*	
Other Aesthetics (mg/l)			
aluminum	0.2	0.2	0.05 to 0.2
ammonia	*NR*	1.5	*NR*
chloride	500	250	250
hardness	500	*NR*	*NR*
hydrogen sulfide	*NR*	0.05	*NR*
iron	0.3 for filtered water	0.3	0.3
	1 for underground water	-	-
manganese	0.1 for filtered water	0.5 *(PG)*	0.2 *(P)*
	0.5 for groundwater	-	-
dissolved oxygen	*NR*	*NR*	*NR*
sodium	200	200	*NR*
sulfate		------------- *see inorganics above* -------------	
total dissolved solids	1200	1000	500
zinc		------------- *see inorganics above* -------------	

Note: *NR* means not currently regulated or no recommended value. *(PG)* means provisional guideline value. TT means that a treatment technique is mandated in lieu of a parameter concentration limit (the value in parenthesis is a treatment goal). *(P)* means proposed for regulation.

Appendix E2

According to Law 48/1982 and Decree 8/1983

Table (E2–1) Regarding Discharge and Into Surfaces of Potable Water.

Article (60):

Fresh (potable) waterways into which treated industrial fluid wastes are licensed to be discharged – must be within the following Standard Measures and Specifications:

Description	Standard Measures (Milligram)litre unless otherwise is mentioned
Color	Not more than 100 degree
Total solid materials	500
Temperature	5 degrees over the normal
Dissolved oxygen	Not less than 5
Hydrogen exponent	Not less than 7, and not mor than 8.5
Absorpent activated oxygen	Not more than 6
Consumed chemical oxygen	Not more than 10
Organic nitrogen	Not more than 1
Ammonia	Not more than 0.5
Greases and oils	Not more than 0.1
Total alkalinity	Not more than 150, and not less than 20
Sulfate	Not more than 200
Mercury compounds	Not more than 0.001
Iron	Not more than 1
Manganese	Not more than 0.5
Copper	Not more than 1
Zinc	Not more than 1
Industrial detergents	Not more than 0.5
Nitrate	Not more than 45
Fluorides	Not more than 0.5
Phenol	Not more than 0.02
Arsenic	Not more than 0.05
Cadmium	Not more than 0.01
Chromium	Not more than 0.05
Cyanide	Not more than 0.1
Lead	Not more than 0.05
Selenium	Not more than 0.01

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Article (61)

The standard measures for the license to discharge treated industrial fluid wastes into the potable water surfaces, and underground water reservoirs which were laid down by the Ministry of Health are:

Description	The River Nile from Egypt Southern Borders to Delta Barrages	The Nile Branch, Large Irrigation Canals, Canals, Side Channels, and underground water reservoirs
Temperture	35	35
Hydrogen Exponent	6–9	6–9
Color	Free of color	Free of color
Absorpent activated oxygen	30	20
COD (Dichromate)	40	30
COD (Permanganate)	15	10
Total dissolved solid materials	1200	800
Ashes of dissolved solid materials	1100	700
Suspended materials	30	30
Ashes of suspended materials	20	20
Sulfate (oil cake)	1	1
Oils, greases and resins	5	5
Phosphate (unorganic)	1	1
Nilrate (N 36)	30	30
Phenol	0.002	0.001
Fluorides	0.5	0.5
Total heavy metals,	1	1
Mercury	0.001	0.001
Lead	0.05	0.05
Cadium	0.01	0.01
Arsenic	0.05	0.05
Hexavalent Chrome	0.05	0.05
Copper	1	1
Nickel	0.1	0.1
Iron	1	1
Manganese	0.5	0.05
Zinc	1	1
Silver	0.05	0.05
Industrial delergents	0.05	0.05
Probable counting for the colon group in 100 cm 3	2500	2500

Article (62):

The Ministry of Water Resources and Public Works - without prejudice to the provisions of Article (60) of the present regulation - shall have the right to disregard some of the standard measures referred to in the previous Article; that shall be in the cases, in which the amount of treated industrial fluid wastes discharged into potable water surfaces shall be less than one hundred cubic meters per day, provided not exceeding the limits stated in the following schedule:

Description	The River Nile from the Egyptian Southern Borders to Delta Barrages	The Nile Branch large Irrigation Canals, Channels, side Channels, and Underground Water Reservoirs
Absorpent activated oxygen	40	30
Chemically consumed oxygen (Dichromate)	60	40
Chemically consumed oxygen (Permanganant)	20	15
Total solid materials	1500	1000
Ashes of solid materials	1000	900
Suspended materials	40	30
Oils, greases, and resins	10	10
Nitrate	40	30
Phenol	0.005	0.002

Article (63):

The treated industrial fluid wastes which are licensed to be discharged into potable water surfaces - must not be mixed with human or animal wastes (remains).

Article (64):

In applying the provisions of the referred to Law No. (48) for 1982, the provisions of legislations organizing the standard measures regarding the radiations, and radiant substances shall be applicable, to make sure of their conformity with the industrial fluid wastes before authorizing their discharge into the potable water surfaces.

Table (E2-2): Regarding Discharge into Non-Potable Water Surfaces.

Article (66):

Sanitary drainage water, and the industrial fluid wastes which are licensed to be discharged into non-potable water surfaces, must fulfill the following standard measures and specifications:

Description	Sanitary Drainage Water	Industrial Fluid Wastes
Temperature	35° centigrades	35° centigrades
Hydrogen exponent pH	6–9	6–9
Absorpent activated oxygen	60	60
Consumed chemical oxygen (Mixhromate)	80	100
Consumed chemical oxygen (Permanganate)	40	50
Dissolved oxygen	Not less than 4	---
Oils and greases	10	10
Dissolved substances	2000	2000
Suspended substances	50	60
Coloured substances	Free of colored substances	Free of colored substnces
Sluphides	1	1
Cyanide	---	0.1
Phosphate	---	10
Nitrate	50	40
Fluorides	---	5.0
Phenol	---	0.005
Total of heavy metals	1	1
Insecticides with their different kinds	Nonexistent	Nonexistent
Probable counting in colon group in 100 cm3	5000	5000

Article (67):

In case of discharging sanitary drainage water, or industrial fluid wastes mixed with sanitary drainage water into non-potable water surface, according to the demand of the competent health body, the discharged water must be treated with chlorine for purifying it before its discharge, in such a manner that the remaining chlorine, twenty minutes after admixing it shall not be less than 0.50 milligram; and in as much as the the instruments and purification materials should be available and ready for work continously to perform such treatment on the reguest for carrying it out.

Article (68):

The non-potable water surfaces - into which the discharge of treated fluid wastes is licensed - must remain within the limits of the following standard measures and specifications:

Description	Standard Measures and Specifications
Temperature	Not more than (5) centigrades over the prevailing average
Dissolved oxygen	Not less than (4) milligram/litre at any time
Hydrogen (basis) exponent pH	Not less than (7), and not more than 8.5)
Industrial detergents	Not more than (0.5) milligram/litre
Phenol	Not more than (0.005) milligram/litre
Sediment	Not more than 50 unit
Dissolved solid substances	Not more than 650 milligram/litre
Probable counting for the colon group in 100 cm3	Not more than (5000)

Appendix E3

According to Law 93/1962 and Amendant No. 9/1989

Table E3-1: The criteria and specifications which should be fulfilled by liquid wastes which are authorized to be drained into public sewers:

Liquid wastes, which are drained from public-shops, commercial establishments or factories into the public sewers, should fulfill the following conditions and criteria:

- The degree of temperature should not be more than 40°C.
- The pH value should not be less than 6 and not more than 10.
- Soluble materials should not be more than 2000 milligrams/liter.
- Insoluble and precipitable materials hold not more than 500 milligrams/liter, provided that the precipitated materials should not be more than $5cm^3$ per liter per 10 minutes, and not more than 10cm3 per liter, per 30 minutes.
- B.O.D. should not be more than 400 parts per million.
- C.O.D. (Micrometeorite) should not be more than 700 parts per million.
- C.O.D. (Permanganate) should not be more than 350 parts per million.
- Sulphide should not be more than 10 parts per million estimated on the basis of sulphur.
- Cyanides should not be more than 0.1 part per million.
- Phosphate should not be more than 5 parts per million.
- Nitrate should not be more than 30 parts per million.
- Fluoridates should not be more than 1 part per million.
- Phenol should not be more than 0.005 part per million.
- Ammonia should not be more than 100 parts per million, estimated on the basis of nitrogen.
- Free chlorine should not be more than 10 parts per million one the basis of $CC1_3$ CHO.
- The percentage of sulpher dioxide should not be more than 1 part per million.
- Formaldehyde should not be more than 10 parts per million (HCHO).
- The percentage of lubricants, oils and resins should not be more than 100 parts per million.
- Silver, mercury, brass, nickel, zinc, chrome, cadmium, and solder should not separately or together be more than 10 parts per million if the volume of the liquid wastes drained does not exceed $50m^3$/day, not should they exceed 5 parts per million if the volume of liquid wastes drained into the sewers network exceeds $50m^3$/day
- Total silver and mercury should not be more than 1 particles per million.

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Liquid wastes should also be free from other petroleum, calcium carbide, organic dissolvents or any other material which the Sanitary Drainage Authority considers that its existence leads to endangering the workers undertaking the maintenance of the network, or causing damage to the sewer facilities, or to the treatment process or its existence leads to polluting the enviironment as a result of draining the surplus of the treatment processes of waste water. Industrial liquid wastes should also be free from any chemical insecticides or radioactive materials.

Table E3-2: Conditions and Criteria that should be Fulfilled by Liquid Wastes which are Drained by Surface Irrigation or by Irrigating Cultivable Land:

1. Dividing of Liquid Wastes into Three Categories:

The First Category

It includes liquid wastes of the public sewer operations which are directly subject to central or local government authorities, or general organizations owned by the government

The Second Category

It includes liquid wastes of the private sewers operations which are similar to those of the first category, but the sewers are not owned by central or local government authorities or genral organiation.

The Third Category

It includes industrial wastes.

The condition and criteria contained in Items (3) and (4) should be applied to the three categories.

2. Division of Land into Two Types

The First Type: Sandy

The Second Type: Clayey (Muddy/Silty)

3. General Conditions

- Sewage waste water may not be disposed of by the surface draining method, or by irrigating the land until after obtaining a permission from the concerned health authority, and in the case of the public sewers treatment stations relevant to the site chosen for surface draining before establishing such stations.
- Liquid wastes in public or private sewers and industrial wastes should conform to the criteria herein contained.
- The land where liquid wastes are drained should be situated at a distance of not less than 3 kilometers from the urban areas or the cordon of the city or village, whichever is further.
- The degree of treatment of the various types of liquid wastes should not be less primary treatment.
- The cultivation vegetables, fruits, or plants, which are eaten raw, should be probhibted in farms which are irrigated by the refuse carried off by sewers, and no animal or miching cattle may be breeded in such farms.
- Liquid wastes should leak in such a speed that will not give rise to aquatic pools.

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4. Prescribed Criteria

First: Concerning Sandy Land

- Precipitated materials per hour should not be more than 1 (one) cm^3 per liter per volume.
- Oils, lubricants and resins should not be more than 10 parts per million.
- Sulphides (estimated on the basis of sulphate) should not be more than one part per million.

Second: Concerning Clayey Land

- The pH value should not be less than 6, and not more than 9.
- BOD should not be more than 80 parts per million.
- COD should not be more than 50 parts per million.
- Insoluble materials should not be more than 80 parts per million.
- Sulphide (estimated on the basis of sulphur) should not be more than 0.1 part per million.
- Oils, lubricants and resins should not be more than 5 parts per million.
- Dissolved sodium chloride should not exceed 2000 parts per million.
- Cyanide should not exceed 0.1 parts per million.

Appendix E 4
Effluent Reuse and Disposal

While reuse of treated effluent is feasible and, in many instances, desirable with respect to conservation of resources, it must be recognized that implementation of an effluent reuse system on the scale required for Luxor requires extensive planning. Major institutional and technical issues that must be addressed include:

- Identification and characterization of potential demands for reclaimed water
- Treatment requirements for producing a safe and reliable reclaimed water that is suitable for its intended applications
- The need for storage facilities to balance seasonal fluctuations in supply with seasonal fluctuations in demand
- The need for supplemental facilities required to operate a water reuse system such as conveyance and distribution networks, operational storage facilities, and alternative disposal facilities
- The need for an institutional authority to monitor and manage the potential environmental and public health impacts of implementing water reclamation

The Ministry of Housing and Utilities has produced guidelines for the reuse of treated effluent. These guidelines include recommendations regarding allowable reuse applications, depending upon the level of wastewater treatment provided (fewer reuse restrictions apply for higher level of treatment). Primary, secondary, and tertiary levels of treatment are defined based on maximum limits for key water quality parameters, as summarized in the Ministerial Committee, Organized under Law No. 276 for the year 1994, report . An informal translation of this report is presented below.

Specifications and criteria for reuse of wastewater in irrigation:

A- Must perform Environmental Impact assessments for reuse of sewage water projects.

B- For safe use of sewage water in irrigation, this conditions have to be applied:

- Health precautions for farmers and end product users.
- Standards for reuse waters as mentioned in the attached tables (Tables E4-1 to E4-3).
- Type of plants as mentioned in the attached tables.
- Irrigation method as in the attached tables.

C- For reuse of sewage water in irrigation, this technical conditions have to be applied:

- Treatment of sewage water according to design criteria and tables attached.
- In the case, that the treatment plants did not meet its' design criteria, the responsible office has to take all precautions to safe the environment.
- Do periodic analysis of the sewage water.

- Putting caution signs at the water outlets, to show that this water is not safe to use and drink.

D- The owners of the agriculture areas are obliged to:

- Health and culutral awarnece for the farmers and workers.
- Make protective shoes and other medical and health facilities available.
- Insects and pest fighting.
- Plantation is restricted with what is mentioned in the attached tables, with informing officials with any strange change to the plantations.

E- For irrigating lands by sewage water, this conditions have to be applied:

- Method of irrigation has to agree with the level of treatment, (as indicated in the attached tables).
- No irrigation before harvesting by two weeks, and destroy any fruits that touches the ground.
- Take precautions to avoid workers from direct contact with water, where the drip and line irrigation methods is recomended.
- Periodical analysis of the root zone groundwater.
- Proper drainage for the soil.
- Use of mechanical equipments.
- For breeding lands three weeks difference between irrigating and breeding is a must.

F- Subject to provision prescribed in Law 48 for the year 1982 and its executive statutes.

While these guidelines are not legal water quality requirements, Luxor may use these guidelines to define the type of crops to be included in water reuse irrigation schemes. Assuming that compliance testing allows for correction of algae impacts, a well operated and maintained waste stabilization pond system will meet the guideline primary treatment standards under all operating conditions and meet the guideline secondary treatment standards on a consistent basis, thereby allowing pond effluent to be used for irrigation of a wide range of agricultural crops.

For the purposes of the proceeding with design activities, the immediate need is to define what, if any, physical facilities must be included to facilitate water reuse. The facilities to be provided may include:

- Effluent pump stations and force mains to convey treated effluent to remote water reuse sites
- Storage facilities to balance reclaimed water supply and demand
- Pipelines/distribution systems for or application of reclaimed water.

It is also essential that a sure means of effluent disposal be provided for each treatment facility so that seasonal variations in demand for reclaimed water do not impact treatment plant operations. The effluent disposal system should be sized for design year peak flows.

For the purposes of developing initial plant layouts to be presented in the basis of design reports, it will be assumed that reuse applications will be fed by gravity irrigation channels or the addition of pump stations and force mains to deliver reclaimed water to systems for distribution. The planning, design, and construction of the distribution systems is not within the scope of the Secondary Cities Project. This condition must be reviewed with USAID, NOPWASD, and the representatives of the secondary cities, based upon specific proposals and sites for effluent reuse application, to confirm the need for additional facilities and responsibilities for funding and execution.

Table E4-1: Reuse of sewage water in agriculture, level of treatment, type of plants and soils, and method of irrigation.

Group no.	Level of treatment	Permissible plantations	Health & Environmental precautions	Irrigation methods	Type of Soil
First	Sewage water	Wooden trees, Palm trees	- Fencing the irrigated lands. - Prohibiting direct contact with water. - Prohibiting entering the irrigated areas except for workers. - Prohibiting allowing cattle in the area. - take all health precaution for protection from infections.	Lines	light consistency
Second	Primary treatment	Cotton, linen, flowers	Same as for first group	Lines, Drip with filters	light consistency
Third	Secondary treatment	- Fodder and dry seeds - Grass areas. - Fruits that does not touch water - Cooked vegetables - Fruits that goes in food industry.	- Permissible to Grow cattle not for milk - Cooking food before eating	Lines, Drip	light, and medium consistency
Fourth	Tertiary treatment	- Raw vegetables and fruits - All kinds of crops and fruits.	No precautions	all irrigation methods except sprinkler	all types of soil

Table E4-2: Standards for sewage water reuse and level of treatment

No.	Description	Units	Group No. 1 Sewage water	Group No. 2 Primary	Group No. 3 Secondary	Group No. 4 Tertiary
1	BOD	ppm	*	300	40	20
2	COD	ppm	*	600	80	40
3	Suspended solids	ppm	*	350	40	20
4	Oil & grease	ppm	*	*	10	5
5	Intestinal nematodes	no./liter	*	5	1	1
6	Fecal coliform	per 100 mm	*	*	10000	1000
7	TDS	ppm	to 2500	to 2500	to 2500	to 2500
8	Sodium adsorption	%	*	25	20	20
9	Boron	ppm	*	to 5	to 5	to 5
10	Chlorides	ppm		to 350	350	350

* No standards

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Table E4-3: Advisory maximum concentrations for heavy metals

Metal	Units	Group No. 1 Sewage water	Group No. 2 Primary	Group No. 3 Secondary	Group No. 4 Tertiary
Cadmium	ppm	*	0.05	0.01	0.01
Lead	ppm	*	10	5	5
Copper	ppm	*	*	1	0.2
Nickel	ppm	*	0.5	0.5	0.2
Zinc	ppm	*	*	2	2
Cyanide	ppm	*	*	*	0.1
Chromium	ppm	*	*	*	0.1
Molybdenum	ppm	*	*	0.05	0.01
Manganese	ppm	*	0.2	0.2	0.2
Iron	ppm	*	*	5	5
Cobalt	ppm	*	*	0.05	0.05

* No limits

Notes

1- For Nickel, Not applying the standards for Alkaline and neutral soils.

2- High concentrations of lead is affecting the plants growth.

3- The above concentrations changes with the soil type, the plant sensitivity. In general, it decreases for light and medium soils and increase for heavy soils.

Appendix E 5

Heavy Metal Criteria for the Application of Sewage Sludge in Agriculture

Several countries have developed criteria limiting the rate at which heavy metals may be spread on agricultural land. The EA team are not aware that Egypt has yet (1996) published such criteria.

Meanwhile, USA and European Community criteria are briefly described below, extracted from the cited references.

USEPA Section 503 rule regarding the reuse of sewage sludge on agricultural lands (1). The wording of this rule expresses the philosophy that sewage sludge normally represents a valuable resource for agriculture, and that its use as a soil amendment for agricultural lands is to be encouraged, provided several environmental criteria are met. With respect to heavy metals, four tables are given, two of which are reproduced in Table E5-1 below. (The other two tables regulate pollutant loading rates to land, in terms of kg/ha and kg/ha/year.)

Briefly summarized, the rule states that sewage sludge shall not be applied to the land if the concentration of any pollutant in the sludge exceeds the pollutant concentration. Exceptions may be made if the rate of areal application (in terms of kg/ha and kg/ha/year) is sufficiently low; but in all cases no pollutant concentration may exceed the ceiling concentration.

European Community Council Directive of 1986 on the protection of the environment when sewage sludge is used in agriculture (2). In this Directive it is stated that sewage sludge can have valuable agronomic properties and its application in agriculture is to be encouraged provided that it is used correctly. Therefore, to this end, it is necessary to monitor the quality of sludges and of the soils on which they are used. Article 4 of the Directive provides values for concentrations of heavy metals in soil to which sludge is applied, concentrations of heavy metals in sludge, and the maximum annual quantities of such heavy metals which may be introduced into soil intended for agriculture. These limit values for the soil and the sludge are reproduced in Table E5-2.

Article 5 directs that Member States of the European Community shall prohibit the use of sludge where the concentration of one or more heavy metals in the soil exceeds the soil limit values shown above, and shall take the necessary steps to ensure that those limit values are not exceeded as a result of the use of sludge.

Each set of standards happens to consist of two values, which in effect provide a bracket to indicate what is considered a threshhold, below which there need be no concern, and above which there is concern.

1. U.S. code of Federal Regulations, Title 40, Chapter 1, Subchapter O, as amended by adding Part 503: STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE, Final Rule, November 25, 1992.

2. Official Journal of the European Communities: COUNCIL DIRECTIVE of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (86/278/EEC).

Table E5-1 Ceiling Concentrations and Pollutant Concentrations According to USEPA Sewage Sludge Standards (mg/kg, dry weight basis).

Parameter	Pollutant Concentration	Ceiling Concentration
Arsenic (As)	41	75
Cadmium (Cd)	39	85
Chromium (Cr)	1200	3000
Copper (Cu)	1500	4300
Lead (Pb)	300	840
Mercury (Hg)	17	57
Molybdenum (Mb)	18	75
Nickel (Ni)	420	420
Selenium (Se)	36	100
Zinc (Zn)	2800	7500

Table E5-2 Limit Values for Heavy Metals in Soil and Sludge, According to European Community Directive of 1986

Parameter	Limit value for the soil	Limit value for the Sludge
Cadmium (Cd)	1 to 3 mg/kg	20 to 40
Copper (Cu)	50 to 140	1000 to 1750
Nickel (Ni)	30 to 75	300 to 400
Lead (Pb)	50 to 300	750 to 1250
Zinc (Zn)	150 to 300	2500 to 4000
Mercury (Hg)	1 to 1.5	16 to 25
Chromium (Cr)	--	--

APPENDIX F

Proposed NOPWASD Water and Wastewater Quality Standards

Table F-1 NOPWASD Drinking Water Proposed Standards

Water Quality Parameter	NOPWASD Propsed Standards
Bacteriological Constituents	
Cryptosporidium	NR
E. Coli (thermotolerant coliform)	NR
Fecal Coliform	free
Fecal Floating bacteria	free
Giardia lamblia	NR
Legionella	NR
Total coliform bacteria	1 cell/100 ml per month 4 cells/100 ml when less than
Total bacteria	< 50 cells/ml in 24 hrs at 37 oC < 50 cells/ml in 48 hrs at 22 oC
Turbidity	1.0 NTU for filtered water on a monthly average 5 NTU for groundwater
viruses	NR
Inorganic Constituents (mg/l)	
aluminum	1.0
antimony	NR
arsenic	0.05
asbestos (fibers > 0.01 mm)	NR
barium	1.0
beryllium	NR
boron	NR
cadmium	0.005
calcium	NR
chromium	0.05
copper	1
cyanide	0.05
fluoride	See attached table
lead	0.05
mercury (total)	0.001
molybdenum	NR
nickel	NR
nitrate	45 as No 3
nitrite	NR
nitrate + nitrite	NR
selenium	0.01
silver	0.05
sulfate	NR
tin	NR
thallium	NR
zinc	NR

Note: *NR* means not currently regulated or no recommended value. (PG) means provisional guideline value. TT means that a treatment technique is mandated in lieu of a parameter concentration limit (the value in parenthesis is a treatment goal). (P) means proposed for regulation.

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Table F-1 Continued

Water Quality Parameter	NOPWASD Propsed Standards
Organic Constituents (ug/L)	
trichloroethylene	5.0
tetrachloroethylene	5.0
trichloroethylene	200
Pesticides & PCBs (ug/L)	
aldrin/dieldrin	0.03
chlordane	0.3
DDT	1
2,4-D	5.0
endrin	0.2
heptachlor	0.1
heptachlor epoxide	0.1
lindane	4
methoxychlor	100
2,4,5-TP (silvex)	10
toxaphene	5.0
Disinfectants and Disinfection Byproducts (ug/L)	
trihalomethanes (1)	100
bromoform	requlated as sum total
dibromochloromethane	requlated as sum total
bromodichloromethane	requlated as sum total
chloroform	requlated as sum total
Radioactive Constituents	
gross alpha activity	1.5 PCI/L
gross beta activity	50 PCI/L
radium-226 + radium-228	5 PCI/L
tritium	20000 pci/l
strontium-90	8 pci/l
radon	NR
uranium	20 PCI/L
Aesthetic Standards	
color	15 Units
taste and odor	3 units
temperature	NR
pH	6.5-9.2
Other Aesthetics (mg/l)	
aluminum	0.2
ammonia	NR
chloride	250
hardness	500
hydrogen sulfide	NR
iron	0.3 for filtered water
corrosivity	relatively low
manganese	0.1 for filtered water
specific conductance	900
dissolved oxygen	NR
sodium	200
sulfate	250
total dissolved solids	500
zinc	5.0
phenol	0.002 mg/L
foaming agent (MBAS)	0.5 mg/L

Note: *NR* means not currently regulated or no recommended value. (PG) means provisional guideline value. TT means that a treatment technique is mandated in lieu of a parameter concentration limit (the value in parenthesis is a treatment goal). (P) means proposed for regulation.

Table F-2 NOPWASD Wastewater Proposed Standards

1. Domestic Wastewater Discharge Standards to drainage canals with no direct reuse and no later mingling with fresh water supplies that are used either for irrigation, for domestic water supply, or for significant public contact sports:

Minimum Treatment	:	Primary Treatment
Disinfection	:	Not Required
Effluent parameters	:	
Settle able Solids	:	1.0 ml/liter/hour - sample 4 times/day

2. Domestic Wastewater Discharge Standards to Drainage Canals with irrigation reuse and/or later mingling with fresh water used for irrigation, for domestic water supply, and /or also for significant public contact sports:

Minimum Treatment	:	Secondary Treatment
Disinfection	:	Required
		Coliform level - 500 MPN/100 ml
		Sample 3
Effluent Parameters	:	
BOD	:	40 mg/L - sample daily
Suspended Solids	:	40 mg/L - sample daily
Dissolved Oxygen	:	2.0 mg/L - sample daily
Chlorine Residual	:	Yes - no limit specified

3. Domestic Wastewater Discharge Standards to the River Nile and its associated branches, side canals, etc., including the discharge from moving boats:

Minimum Treatment	:	Secondary Treatment
Disinfection	:	Required
		Coliform level - 200 MPN/100 ml
		Sample 3 times/week
Effluent Parameters	:	
BOD	:	30 mg/1 - sample daily*
Suspended Solids	:	30 mg/1 - sample daily*
Dissolved Oxygen	:	2.0 mg/1 - sample 3 times/week*
Chlorine Residual	:	1.0 mg/1 - sample 4 times/day
PH	:	6.5 - 9.0 - sample daily
Oil and Grease	:	0.1 mg/1 - sample daily*

* For moving boats sample only once weekly.

4. Domestic Wastewater Discharge Standards to estuary waters (brackish) used for recreation and fishing:

Minimum Treatment	:	Secondary Treatment
Disinfection	:	Required
		Coliform level - 500 MPN/100 ml
Effluent Parameters	:	
BOD	:	40 mg/1 - sample daily
Suspended Solids	:	40 mg/1 - sample daily
Dissolved Oxygen	:	2.0 mg/1 - sample 3 times/week
Chlorine Residual	:	1.0 mg/1 - sample 4 times/day
Oil and Grease	:	0.1 mg/1 - sample daily

F. INDUSTRIAL WASTE DISCHARGE STANDARDS TO WATERWAYS

Such discharges should meet the same requirements as the domestic waste (sewage) discharge standards covered in previous sections, in terms of: BOD, suspended solids, settled mater, oil and grease. The pH of the discharged wastewater should be kept within a rang varying from 6.5 to 8.5.

Such waste discharges should not contain either human or animal wastes. Therefore, no disinfection nor coliform bacteria monitoring is needed.

LAND DISPOSAL AND RECLAMATION STANDARDS/USING DOMESTIC SEWAGE EFFLUENTS

NOPWASD should develop a highly organized and controlled wastewater reclamation program for all of Egypt.

a. Primary Treated Effluents

Primary treated effluents are safe and suitable for a variety of irrigation purposes, such as:

- The surface irrigation of fodder crops for animals being raised for meat production. Such animals can also graze on the fodder growing areas.
- The surface irrigation of grain (or seed crops, with the exception of rice.
- The surface irrigation of cotton (fiber) crops.
- The surface irrigation of all types of trees, including fruit trees,

provided no crops are harvested off the ground surface.

- The surface irrigation of vineyards (grapes).

Note:surface irrigation means flooding of the land. Spray irrigation with primary effluents is not acceptable because of plugging problems of sprinkler heads and the danger of pathogen travel because of aerial drifts, mists and sprays. This mist problem can be overcome by providing a buffer area around the perimeter of the irrigation area.

A primary sewage effluent used for the above outlined purposes, is an effluent that contains no more than 0.5 ml/L/hour of settled matter. This effluent quality test should be conducted daily.

b. Secondary Treated Effluents

Secondary treated effluents are safe and suitable for a variety of irrigation purpose, such as:

- All crops described under the previous discussion of primary treated effluents.
- The surface and spray irrigation of fodder crops used for the grazing of milking animals.
- The surface and spray irrigation of processed food crops.
- The surface and spray irrigation of golf courses. *
- The surface and spray irrigation of public parks*, athletic fields*, median strips*, green belt areas*, nurseries*, and cemeteries.*

Note:* Irrigation should be performed only during night-time hours.

An effluent used for the above-outlined purposes is an effluent in which the organic matter has been stabilized, is non-putrescible and contains dissolved oxygen. Furthermore, the wastewater must be disinfected, which means that most of the pathogens have been deactivated by the use of chlorine.

Minimum Treatment	:	Secondary
Disinfection	:	Required
		Coliform level
		- 100 MPN/100 ml (Unplanned reclamation)
		- 200 MPN/100 ml (Unplanned reclamation)
		Sample 3 times/week
Effluent Parameters	:	
BOD	:	30 mg/1 - sample daily

Suspended Solids	:	30 mg/1 - ample daily
Dissolved Oxygen	:	2.0 mg/1 - sample 3 times/week
pH	:	6.5 - 9.0 - sample daily

Note: The above-specified level of disinfection should not be considered absolutely safe, but is a substantial improvement compared to current reclamation reuse practices.

APPENDIX G

Archaeology Report by Kent R. Weeks, Ph.D.

A Report on the Archaeological Contents of
Areas in Luxor, Kom Ombo, Medamud and Daraw
Likely to be Affected by
the WWWP

Kent R. Weeks, Ph.D.
The Theban Mapping Project

1 The City of Luxor

1.1 Modern Luxor, ancient Thebes, is one of the richest archaeological zones on earth. Surrounding the temples of Karnak and Luxor, its best-known East Bank structures and two of the largest religious structures ever constructed by man, an entire city thrived here for several thousand years The ancient city may have had a population of nearly 50,000 persons, not too different from Luxor's population in the 1960s AD. Yet, except for a very few test excavations or notes on artifacts found in the course of new construction, nothing is known of this ancient townsite. Only within the enclosure walls of the Karnak and Luxor temple has any extensive work been done and, even there, work has been minimal and unsystematic.

1.2 Defining the extent of Luxor's ancient archaeological zone is simple: just draw a line around Luxor's modern limits and declare the entire town an ancient site. This, unfortunately, does not allow us to answer properly the question of how to update Luxor's deteriorating infrastructure in a way that avoids causing serious archaeological damage. To do that, one must examine early maps, aerial photographs, excavation reports, even 19th and early 20th century tourist postcards, conduct extensive on-the-ground surveys, and hope for the best. It must be taken as given that *any* digging within the Luxor city limits will uncover archaeological remains. The best that one can do is to try and minimize the damage that will be done to the monuments lying below the surface.

1.3 There is a general rule that can be followed to locate ancient remains at Luxor or, for that matter, anywhere else in the Nile floodplain: it is almost certain that any collection of houses that existed prior to about 1960 AD--whether hamlet, village, town, or city-- will have archaeological remains lying beneath it.

1.3.1 Two factors account for this. First, prior to the 1960s, when the Aswan High Dam brought to an end the annual inundation of the Nile Valley floodplain, local inhabitants built their houses on small mounds of silts that rose above the level of surrounding agricultural fields and, consequently, above the level of the annual inundation. These "islands" (called "kôms" or "tells") were created over 10-15,000 years ago as a natural result of the regular flooding. Since the first appearance of agricultural society in Egypt (about 5-6,000 BCE), man has built atop these tells, thereby protecting his homes from flood damage. These tells were the building sites of choice until the inundation stopped in the 1960s, and homes built in the early 1900s lie atop the remains of homes built in the 18th century; these lie atop homes built in the 15th century; and so on. The stratigraphy of some tells shows over sixty centuries of building activity. Many of the tells originally lay only a few centimetres above the floodplain; as generation after generation built on them, they grew deeper, and today their surface can sometimes lie several metres above the surrounding fields.

1.3.2 Second, as the population of Egypt increased and agricultural land became scarcer and more valuable, economic pressures prevented local inhabitants from converting irrigable fields into occupation sites. It was better to live in densely-packed villages atop these agriculturally useless tells (useless because gravity could not bring Nile flood waters to them) than to waste cultivable land.

1.3.3 Thus, if one plots the location of pre-1960 villages in the Luxor area, one is at the same time plotting the location of ancient occupation sites. Homes constructed since the 1960s have not followed this plan. Increasing population and economic factors have outweighed the desire to protect agricultural land, and a very substantial number of modern buildings lie (illegally) within the agricultural zone. No ancient structures are likely to lie beneath them.

2.1 The accompanying map of the northern half of Luxor identifies five categories of archaeologically important zones. They are ranked in order of their archaeological importance (an arbitrary and subjective designation, to be sure), and in order of the protection they receive from the Egyptian Government. The Karnak and Luxor temple complexes, declared protected archaeological zones by the Egyptian Supreme Council of Antiquities, are marked in red. These two areas can be considered Category 1 sites. They are reserves in which no new construction is allowed.

2.2 Areas usually adjacent to the red zones, in which archaeological excavations and/or pre-1960 maps and aerial photographs have indicated the *certain* presence of *significant* archaeological materials, are marked in green. These form Category 2 sites. For example, excavations across the Luxor-Airport road to the south of the Temple of Mut have revealed a very large ancient village contemporaneous with the Karnak Temple complex. Between Karnak and Luxor Temples, adjacent to the Avenue of Sphinxes which connects them, test excavations have also indicated extensive dynastic and Graeco-Roman remains. Behind (that is, east of) Karnak Temple, there lie remains of a sizeable temple constructed in the New Kingdom by the Pharaoh Akhenaton. Between the Karnak-Mut Temple processional avenue and the River Nile there lies another avenue of sphinxes, so far revealed only in a small test pit.

2.3 Areas in which archaeological materials are less well attested, but nonetheless certain to exist, are marked by green stripes. This is Category 3. For example, to the east of the Karnak complex, excavations conducted several years ago have revealed at least one other temple and numerous mud-brick structures. North of the Karnak compound, it is likely that the modern village lies above another ancient townsite.

2.4 Areas in which archaeological materials are certain to exist, but which seem likely to be less important than the first three categories, are marked by blue stripes. This is Category 4. The extent of the areas so marked on this map should be considered to be the absolute minimum size of this archaeological zone. It is entirely possible that Category 4 should include virtually all of the area within Luxor's pre-1960 boundary. I have excluded areas to the east of the railroad tracks and areas north of the Karnak complex, for example, only because it was impossible to obtain adequate maps or photographs of these sectors. Nor has the area to the southwest of Luxor Temple been included, although modern excavations of building foundations to the east of Sharia Television have revealed ancient walls and stone statuary (none of them plotted or published).

2.5 Areas not color-coded on the map either lie outside the scope of the WWWP or seem less likely than the first four categories to contain significant archaeological materials. These comprise Category 5. There is no guarantee, however, that they are archaeologically sterile; indeed, that would be highly unlikely.

3.1. Given the wide distribution of archaeological materials in Luxor, how is one to design a WWWP that does the least possible damage to ancient materials and yet fills the needs of the modern inhabitants?

3.1.1 First, Category 1 red zones must be completely avoided. That's Egyptian antiquities law.

3.1.2 Second, great care must be taken when trenching in green (or green-striped) areas (Categories 2 and 3). Test borings made for the WWWP indicate the presence of red brick and/or limestone here (and in other areas, too), and this suggests the presence of archaeological remains. The nature of the boring data (and, admittedly, the reports are extremely vague) suggests that most of this material lies more than 1.5 metres below surface. If this proves to be generally correct, then it would be best to dig only shallow trenches for water and waste water pipes, or at least dig the trenches no deeper than the minimum requirements of a gravity-flow system will allow.

3.1.3 If one wants to be conservative and cautious, blue-striped (Category 4) areas should be treated as those in 3.1.2. Here, however, the constraints on depth can perhaps be less rigorously observed.

4.1 An important recommendation: about fifty years ago, a canal was dug around the perimeter of the Karnak complex. The canal, some five metres wide and four metres deep, was intended to divert ground water away from the Temple itself. This did not work, and the canal has since been partially filled in (but is still easily recognizable). The canal is marked on the acompanying plan as a purple line on the eastern and southern sides of the Karnak complex. Any trenching within this canal will disturb only modern fill, and one can thus be assurred that it will do no harm to the monuments; the canal itself already has done all the damage there is to do. Therefore, one could use this canal as the location of principal water and waste water pipes. Shallower trenches could then be dug for secondary pipelines running into neighboring villages in the green (Categories 2 and 3) and blue (Category 4) areas.

4.2 The plans provided to me indicate that a pumping station is to be built immediately south of the Luxor-airport road, some 100 metres south of the Karnak-Mut Temple complex. I would recommend that this be changed. This site lies directly atop an ancient townsite, immediately adjacent to the excavated area of that townsite, and only twenty metres from the Antiquities Department storeroom and office. It would be potentially dangerous for the monuments (and politically inappropriate) to build a pumping station here.

5. The City of Kom Ombo

5.1 There are three archaeological zones in this area.

5.1.1 The Temple of Kom Ombo, on the banks of the Nile, is defined by an enclosure wall built by the Antiquities Department. It constitutes a Category 1 red zone and must be completely avoided.

5.1.2 Surrounding the Temple, there is extensive evidence of the ancient townsite that, especially in the Graeco-Roman period, was one of Upper Egypt's principal cities. A panoramic view of the remains of this city and an ancient cemetery lying the east of the Temple is attached, and the *approximate* extent of its remains is identified on the attached map as a green (Category 2) archaeological zone. The same care should be taken here as in the Category 2 zone in Luxor, although here, there is evidence of archaeological materials *from the surface* to a depth of perhaps three metres. One will have to accept the fact that any trenching in this green area will expose and cut through archaeological materials. Because there are no surveys of the ancient townsite, I cannot offer precise recommendations as to where trenching might do the least harm, except to note that, in general, the closer one gets to modern agricultural land, the farther one goes from the Temple, the shallower and less significant the archaeological stratum should (in theory) become.

5.1.3 Along the desert edge in the Kom Ombo area (not the modern edge, but the edge as it appears on pre-1960 maps), and extending eastward in wadis for about 1 kilometre, lie a series of Palaeolithic work stations. Many of these were recorded around the turn of this century; many others have already been destroyed by the eastward expansion of cultivation. There is a slight potential for damage to this archaeological material if trenches are dug here, but I give the area a Category 5 ranking.

6. Daraw

6.1 There is no published evidence of archaeological material in the areas of Daraw included in the WWWP proposal. However, it would be unlikely that the areas are archaeologically sterile. I have not examined the results of any borings here. In the absence of such information, I can make only two (unsubstantiated) observations. First: areas near the Nile, as indicated on the accompanying map, would seem to me the most likely areas in the floodplain to contain archaeological material. Second: there *may* be Palaeolithic material along the pre-1960 desert edge east of the modern camel market. I give both these areas a ranking of Category 5.

7. Medamud

6.1 Medamud is a problem. Archaeological work there has concentrated almost exclusively on the Middle Kingdom temple area, although it is known that other monuments, particularly of the Graeco-Roman Period, lie throughout the entire *kom* and probably beyond it. In the absence of any more detailed maps of the area (and noting that

I did not have access to a plan showing the proposed location of WWWP work), I can only suggest that one stay as far away from the *kom* as possible and that excavation be shallow. The attached plan of the site, made in 1925, shows the liimits of the *kom* and the location of some of its contents.

APPENDIX H

Existing Water Quality Data

Part H1.	Kom Ombo Kassel Canal Water Analysis
Part H2.	Darawo Canal Water Analysis
Part H3.	Nile Water Analysis at Darawo - Kom Ombo Region
Part H4.	Kom Ombo Wastewater Analysis

Appendix H1

Table H1-1: Kassel Canal Water Analysis (Kom Ombo Water Treatment Plant Daily Report)

Date	Site	Color	Taste	Turbidity NTU	Temperature C	pH	Alkalinity ppm	Alkalinity (CO3)ppm	Chlorides ppm	Balance	Conductivity uS/cm
23/1/93	WTP intake			24	16.3	5.81	120.0	zero	17	120	230.0
25/1/93	WTP intake			6.2	16.4	6.02	130	zero	17	110	250
28/1/93	WTP intake			8.6		7.26	128	zero	26.6	114	260
30/1/93	WTP intake			9	16.7	6.08	140	zero	13	100	240
2/2/93	WTP intake			19	15.8	6.42	130	zero	14	120	230
3/2/93	WTP intake			3.4	15.6	6.62	126	zero	13	110	230
4/2/93	WTP intake			2.4	14.9	6.86	120	zero	11.5	100	230
7/2/93	WTP intake			2.4	14.7	6.75	120	zero	13	112	220
9/2/93	WTP intake			2.9	15.8	6.53	132	zero	12	110	200
10/2/93	WTP intake			2.8	15.6	6.72	122	zero	12	106	220
14/2/93	WTP intake			3.1	15.7	6.84	128	zero	13	100	230
17/2/93	WTP intake			2.8	16.3	6.71	120	zero	13	110	230
21/2/93	WTP intake			3	16.5	6.74	130	zero	14	110	250
23/2/93	WTP intake			4.5	16.7	6.41		zero	14		240
27/2/93	WTP intake			3.9	18.3	6.48	130	zero	13	110	250
4/3/93	WTP intake			5.2	18.4	6.58	122	zero	13.5	110	220
7/3/93	WTP intake			2.3	20.8	6.38	120	zero	15	114	250
10/3/93	WTP intake			1.9	20	6.27	120	zero	16	104	250
14/3/93	WTP intake			3.7	17.5	6.89	140	zero	15	104	250
16/3/93	WTP intake			2.1	18.4	6.67	140	zero	14	100	250
20/3/93	WTP intake			3	17.2	6.53	120	zero	19	70	220
22/3/93	WTP intake			2.3	17.4	6.16	130	zero	16	72	230
28/3/93	WTP intake			4.8	18.5	6.41	130	12	16	70	270
30/3/93	WTP intake			5.2	18.4	6.28	120	8	18		270
31/3/93	WTP intake			4.5	18.3	6.17	130	zero	15	116	250
1/4/93	WTP intake			3.7	18.6	6.28	138	zero	19	114	240
3/4/93	WTP intake			5.3	19.9	6.33	130	8	15	116	220
5/4/93	WTP intake			4.4	19.6	6.23	126	zero	18	110	260
6/4/93	WTP intake			3.6	18.9	6.17	130	zero	17	116	250
7/4/93	WTP intake			2.9	20.4	6.51	124	zero	14	110	260
11/4/93	WTP intake			3.1	20.4	6.21	120.0	8.0	12	110	260.0

Table H1-1: (Continued)

Date	Site	Color	Taste	Turbidity	Temperature	pH	Alkalinity	Alkalinity	Chlorides	Balance	Conductivity
				NTU	C		ppm	(CO3)ppm	ppm		uS/cm
12/4/93	WTP intake			2.9	20.2	6.46	118	12	14	104	250
13/4/93	WTP intake			4.2	21	6.32	124	zero	15	110	250
14/4/93	WTP intake			2.8	20.7	6.51	122	zero	12.5	116	260
18/4/93	WTP intake			2.6	22.2	6.32	120	8	17	110	260
20/4/93	WTP intake			3.5	27.1	6.31	120	zero	16	120	280
21/4/93	WTP intake			3	25.8	6.19	130	zero	16	116	270
22/4/93	WTP intake			3.3	25	6.25	126	zero	16	104	270
27/4/93	WTP intake			3.7	22	6.3	126	8	10	114	260
5/5/93	WTP intake			3.3	21.4	7	134	zero	12	110	250
6/5/93	WTP intake			3.6	23.7	6.21	124	zero	16	120	260
11/5/93	WTP intake			2.5	22.8	5.93	130	zero	12.5	118	250
24/5/93	WTP intake			2.7	25.3	6.83	114	zero	17.5	106	250
26/5/93	WTP intake			2.6	20	6.49	130	8		106	260
29/5/93	WTP intake			1.7	20	6.3	120	8		108	260
5/6/93	WTP intake			2	20	6.21	116	8		106	240
10/6/93	WTP intake			2.2	20	6.33	116	zero		106	240
14/6/93	WTP intake			3	20.6	6.43	120	zero	9	102	250
22/6/93	WTP intake			2.6	20	6.48	126	zero		104	250
24/6/93	WTP intake			5.8	20	6.33	130	8		104	260
14/8/93	WTP intake			3.8	28	6.35	118	zero	16	110	260
16/8/93	WTP intake			2.5	27	6.27	122	zero	10	98	260
19/8/93	WTP intake			2.6	29	6.25	120	zero	14	100	260
21/8/93	WTP intake			2.2	28	6.13	120	8	16	98	260
4/9/93	WTP intake			2	27	6.41	120	8	16	102	250
9/9/93	WTP intake			1.8	27	6.23	120	8		102	260
11/9/93	WTP intake			1.9	25.3	6.54	120	zero	14.5	100	250
13/9/93	WTP intake			1.7	27	6.24	120	8		104	260
16/9/93	WTP intake			2	28	6.34	124	8		106	270
20/9/93	WTP intake			2	28	6.3	122	8	15	110	250
23/9/93	WTP intake			2	28	6.29	130	8	15	106	280
25/9/93	WTP intake			1.7	27	6.28	134	16	17	98	270

Table H1-1: (Continued)

Date	Site	Color	Taste	Turbidity	Temperature	pH	Alkalinity	Alkalinity	Chlorides	Balance	Conductivity
				NTU	C		ppm	(CO3)ppm	ppm		uS/cm
9/10/93	WTP intake			3.2	26.5	6.89	134	12	16	104	280
19/10/93	WTP intake			3	28.5	7.36	128	8	13.5	94	280
30/10/93	WTP intake			2.7	28	7.28	126	12	18	88	280
15/11/93	WTP intake			1.8	22.5	6.3	128	12		100	260
16/11/93	WTP intake			1.9	22	6.24	124	12		110	260
20/11/93	WTP intake			2.2	22.5	6.4	126	12		110	280
22/11/93	WTP intake			2.4	23.5	6.5	126	8	15	110	290
27/11/93	WTP intake			2.2	22.5	6.68	128	12	15	110	270
28/11/93	WTP intake			2.3	22	6.37	124	zero	15	106	270
30/11/93	WTP intake			2.3	23	6.27	124	8	18	112	280
2/12/93	WTP intake			2.4	23.5	6.3	128	8		112	270
5/12/93	WTP intake			2.5	22	6.41	124	zero	18	108	270
13/12/93	WTP intake			2.3	20	6.74	128	8	17	110	260
15/12/93	WTP intake			2.2	19.5	6.54	130	zero	17	110	260
21/12/93	WTP intake			2.1	21	7.66	128	zero	18	108	270
23/12/93	WTP intake			1.9	20		124	zero	17	110	260
28/12/93	WTP intake			2	21	7.39	126	zero		112	270
30/12/93	WTP intake			2.2	21		126	zero		110	260
1/1/94	WTP intake			2.7	23		130	zero		120	280
3/1/94	WTP intake			2.4			130	zero	15	120	250
5/1/94	WTP intake			3.2	19		130	zero	18	120	270
8/1/93	WTP intake			2.6	19			zero	16	120	260
15/1/94	WTP intake			2.6	19			zero	19	130	260
22/1/94	WTP intake			2.5			130			116	260
18/6/94	WTP intake			2.6			118	12	18	110	260
19/6/94	WTP intake			2.1			114	zero		102	250
20/6/94	WTP intake			2.5			120	12	12	110	260
21/6/94	WTP intake			1.9			120	zero	12	106	260
22/6/94	WTP intake			2.1			116	8	13	106	240
27/6/94	WTP intake			2.1			116	zero	13	104	260

Table H1-1: (Continued)

Date	Site	Color	Taste	Turbidity NTU	Temperature C	pH	Alkalinity ppm	Alkalinity (CO3)ppm	Chlorides ppm	Balance	Conductivity uS/cm
28/6/94	WTP intake			1.9			114	zero	12	106	260
29/6/94	WTP intake			2			114	zero	14	104	250
30/6/94	WTP intake			2.9			112		14	104	250
19/7/94	WTP intake						114	zero	15	106	
3/8/94	WTP intake			2.3					12	104	90
16/8/94	WTP intake			2.4				zero	13	104	90
24/8/94	WTP intake			1.6						102	90
30/8/94	WTP intake			1.5					13	102	90
3/9/94	WTP intake			1.3					14.5	104	90
6/9/94	WTP intake			2.2						102	270
11/9/94	WTP intake			1.8			118	12	13	104	280
15/9/94	WTP intake			1.8			120	4	13	110	270
17/9/94	WTP intake			1.7			118	zero	15	102	290
25/9/94	WTP intake			1.8			140	zero	17	112	270
29/9/94	WTP intake			1.7			128	zero	17	108	290
2/10/94	WTP intake			1.9			122	zero		106	290
8/10/94	WTP intake			2			120	zero	16	106	290
12/10/94	WTP intake			2.5			124	zero		106	280
17/10/94	WTP intake			2			124	zero		108	290
24/10/94	WTP intake			1.7			118	8		104	300
26/10/94	WTP intake			1.7			122	8	16	106	290
1/11/94	WTP intake			2.4			130	zero	14	120	290
22/11/94	WTP intake			2.3			130	zero		110	280
1/12/94	WTP intake			2.5			130	zero		114	260
6/12/94	WTP intake			2.2			130	zero	14.5	118	260

Appendix H2

Table H2-1: Darawo Canal Water Analysis (Water Treatment Plant Report)

Date	Site	Turbidity NTU	Conductivity uS/cm	TDS ppm	Chlorides ppm	Alkalinity (CO3)ppm	Total Hardness ppm	Sulphates ppm	Calcium ppm	Magnesium ppm	Manganese ppm	Iron ppm	NH3 ppm
5/7/95	WTP intake	2.8	268	159.88	19.5	130	116		80	36		0.5	zero
20/6/95	WTP intake		250	165	14.5	124	116	23.44	7.2	32	zero	zero	zero
17/7/95	WTP intake	3.8	261		15	80	110		80	30		zero	0.1
7/8/95	WTP intake	3.5			16.5	128	122		66	56		zero	zero
14/10/95	WTP intake	2.4	275	181.5	12	120	114		70	44		zero	zero

Table H2-2: Darawo Groundwater Analysis (Water Treatment Plant Report)

Date	Site	Turbidity NTU	Conductivity uS/cm	TDS ppm	Chlorides ppm	Alkalinity (CO3)ppm	Total Hardness ppm	Sulphates ppm	Calcium ppm	Magnesium ppm	Manganese ppm	Iron ppm	NH3 ppm
20/6/95	Groundwater		540	400	64	358	326	50.96	33.12	75.2	zero	zero	0.6

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Appendix H3

Table H3-1: Nile Water Analysis at the Start of Kassel Canal (performed by the Ministry of Health Laboratories)

Date	pH	Conductivity uS/cm	DO ppm	TDS ppm	NH3 ppm	NO2 ppm	NO3 ppm	Alkalinity ppm	Hardness ppm	CL ppm	Ca ppm	BOD ppm	COD ppm	Mn ppm	Fe ppm	SiO2 ppm	SO4 ppm	Mg ppm
Jan-94	7.4	230	4.1	190	1.8			166	142	16	36	8.4	20			0.18		12.24
Feb-94	7.5	250	6.6	7.8	0.83			148	150	22	36.2	2.5	12			0.15		14.28
Mar-94	7.5	260	7.5	126	0.26			154	138	8	36.9	0.7	18			0.2		11.08
Oct-94	7.5	260			0.8			142	138	18	34					0.25		12.7
Nov-94	7.7	270						152	14.25	18	35.2							13

Table H3-2: Nile Water Analysis at the End of Kassel Canal (performed by the Ministry of Health Laboratories)

Date	pH	Conductivity uS/cm	DO ppm	TDS ppm	NH3 ppm	NO2 ppm	NO3 ppm	Alkalinity ppm	Hardness ppm	CL ppm	Ca ppm	BOD ppm	COD ppm	Mn ppm	Fe ppm	SiO2 ppm	SO4 ppm	Mg ppm
Jan-94	7.4	260	6.4	190	2.3			146	142	18	36	3.8	28					13
Feb-94	7.7	280	5.8	178	0.38			150	152	20	36.8	4.5	24			0.19		12.4
Mar-94	7.7	270	7.4	184	0.66			156	144	20	36.3	1.5	16			0.17		14.46
Oct-94	7.7	270			0.1			156	142	18	35.7					0.13		14.88
Nov-94	7.8	275						152	144	20	36.2					0.13		12.6

Appendix H4

Table H4-1: Egyptian Sugar and Distillation Effluent Wastewater Analysis (performed by the Kom Ombo water treatment plant Laboratory)

Date	Location	pH	Conductivity	CO3	HCO3	Ca	Mg	Hardness	Cl	Fe	Mn	Cu	SO4	S	PO4	NH4	NO2	NO3	COD	TDS	S.S
			uS/cm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
18/2/90	Sewer # 1	7.6	2.9	0	220	44.8	19.7	194	13	1	0	0	22.5	0	0.67	0.76	0	0	320	370	1813
18/2/90	Sewer # 2	7.3	250	0	300	64	30	288	18	0.6	0	0	19	0	0.56	0.49	0	0	160	520	1087
18/2/90	Mixture	7.6	260	0	284	46	24	216	30	0.4	0	0	14	0	0.57	0.49	0	0	160	350	800

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APPENDIX I

Positive Threshold Decision

UNITED STATES AGENCY for INTERNATIONAL DEVELOPMENT

CAIRO EGYPT

ACTION MEMORANDUM

TO: Gilbert Jackson
Near East Bureau Environmental Coordinator

FROM: Anne Patterson
USAID/Cairo Mission Environmental Officer

SUBJECT: Positive Threshold Decision for proposed Secondary Cities Project (263-0256)

DATE: June 22, 1994

BACKGROUND:

USAID/Cairo is currently designing a $321 million, 8 year LOP, water and wastewater project which will provide water and/or wastewater treatment facilities to the cities of Mansoura, Nuweiba, Sharm el Sheikh, Luxor, Isna, and the Aswan Group (the cities of Durawo, Nasr City, and Kom Ombo which are located in a single locality). The project outputs are expected to be improved water and wastewater services, improved operation and maintenance, increased wastewater treatment and water supply coverage, and increased revenue collection in each of the participating cities.

DISCUSSION:

The activities proposed in the Secondary Cities Project will include large-scale potable water and sewerage projects and, as such, can be classified as "actions normally having a significant effect on the environment" (22 CFR 216.2(d)(xi)). Accordingly, the Mission has determined that a positive threshold decision is needed and that Environmental Analyses of proposed project activities will be required. Although it is the opinion of the Mission that the impact of the project's activities on the environment will be beneficial overall, there are many environmental issues which can not be addressed adequately based on existing studies or within the context of the Project Paper. Since project activities will vary greatly by geographical location, climate and terrain, population density, and proximity to sensitive ecological habitats, it is proposed that site-specific scoping statements and environmental assessments be prepared for each site or locality.

ACTION:

That by signing below, the Environmental Coordinator, Bureau for Asia and the Near East approve the Mission's finding of a positive threshold decision for the Secondary Cities Project (263-0236). Furthermore, approval is needed for the Mission's proposal to proceed with separate scoping sessions and environmental assessments for Mansoura, Nuweiba, Sharm el Sheikh, Luxor, Isna, and the Aswan Group.

Decision of Environmental Coordinator, Bureau for Asia and the Near East

JBE 7/11/94 Approved: Herbert S. Jacks

Date: 7/11/94

Clearances:

RRhoda, Acting AD/PDS	RcR	Date:
PSullivan, LEG	PWS	Date: 6/23/94
MRaslan for ANewman, DR/UAD	draft	Date: 6/23/94

APPENDIX J

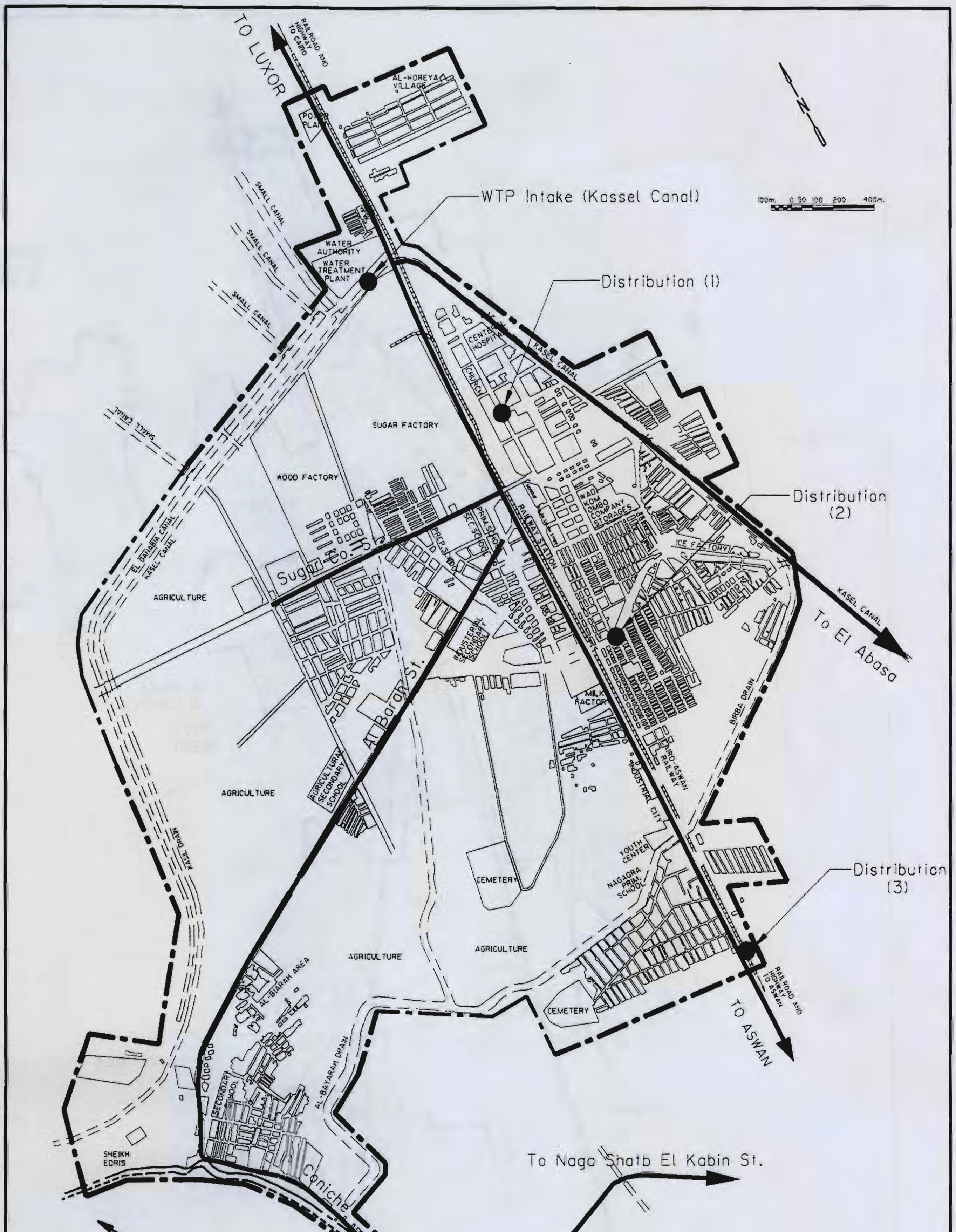
WATER SAMPLING PROGRAM RESULTS

Part J1. Aswan Sampling Program

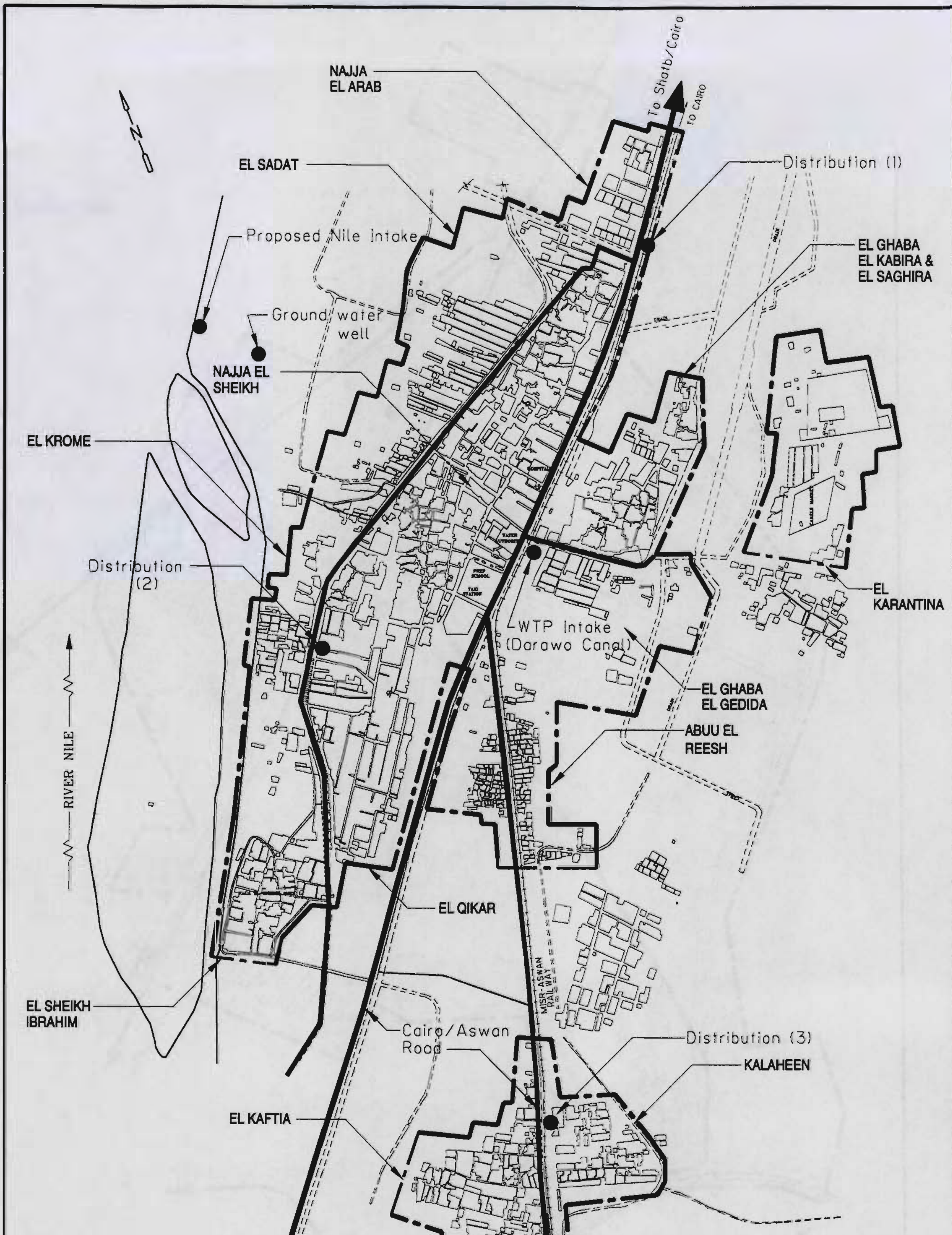
Part J2. GOG Laboratory Results

Part J3. Summary of Water Quality Results

Part J4. Heavy Metals in Sediments



CDM International Inc. with Dr. Ahmed Abdel-Warith Consulting Engineers	ENVIRONMENTAL ASSESSMENT KOM OMBO WATER QUALITY SAMPLING LOCATIONS	PROJECT NO. 3055-007 FILE: ENAR\CTRPL002 FIGURE NUMBER J - 1



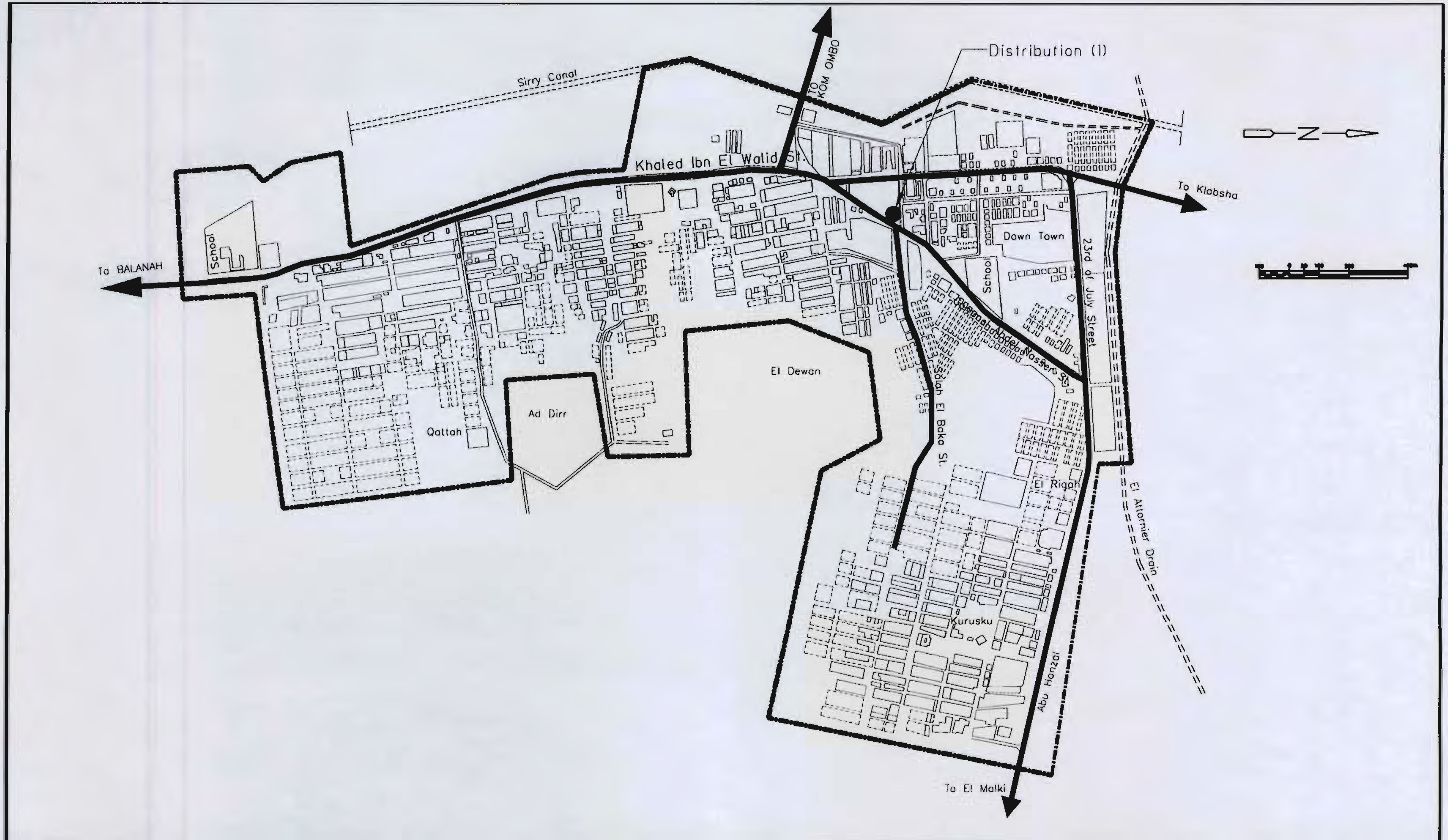
CDM International Inc.
A Subsidiary of Camp Dresser & McKee Inc.

with
Dr. Ahmed Abdel-Warith
Consulting Engineers

ENVIRONMENTAL ASSESSMENT
DARAWO
WATER QUALITY SAMPLING LOCATIONS

PROJECT NO. 3055-008
FILE: ENAR\CTRPL002

FIGURE NUMBER
J-2



CDM International Inc. A Subsidiary of Camp Dresser & McKee Inc. environmental services offices worldwide with Dr. Ahmed Abdel-Warith Consulting Engineers	ARAB REPUBLIC OF EGYPT — جمهورية مصر العربية National Organization for Potable Water and Sanitary Drainage (NOPWASD) — الهيئة القومية لمياه الشرب والصرف الصحي SECONDARY CITIES ED/CM PROJECT USAID GRANT No. 263-0236	ENVIRONMENTAL ASSESSMENT NASR CITY WATER QUALITY SAMPLING LOCATION	PROJECT NO. 3055-009 FILE: ENAR\CTRPL002 FIGURE NUMBER J-3

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APPENDIX J1

Table J1-1: Aswan Sampling Program

First Round

PART 1. SAMPLING PLAN

LOCATION	Sanitary	Heavy Metals	Other Metals	Volatile Organics	Other Organics	THMs	Microbiological	Radioactive
Kom Ombo WTP In	Water	Sediment	Water		Water		Water	
Kom Ombo Nile	Water	Sediment	Water		Water	1	Water	
Kom Ombo new WTP	Water	Sediment	Water		Water	1	Water	
Kom Ombo FW	Water		Water			1	Water	
Sugar Factory Effluent	Water		Water				Water	
Darawo WTP Intake	Water	Sediment	Water		Water		Water	
Darawo GW	Water		Water	Water			Water	Water
Darawo Nile intake	Water	Sediment	Water		Water	1	Water	
Darawo FW	Water		Water			1	Water	
Kom Ombo Distribution						3		
Darawo Distribution						3		
Nasr City Distribution	Water		Water			1	Water	

PART 2. SPECIFIC PARAMETERS

Category	Parameter	CDM Laboratory Tests No.	GOG Laboratory Tests No.
Sanitary Parameters:			
	Alkalinity	0	10
	pH	0	10
	Total Hardness	0	10
	Specific conductance	0	10
	Turbidity	0	10
	Color, apparent & true	0	10
	Odor Screen*	0	10
	Corrosivity	0	10
	Total Dissolved Solids	0	10
	Total Suspended Solids	0	10
	Total Organic Carbon	0	10
	Anions:(chloride,nitrate,nitrite Sulfate, phosphate & fluoride)	0	10
	Surfactants (MBAS)	0	0
	Total Cyanide	0	10
	Ammonia	0	10
	BOD	0	10
	COD	0	10
	Oil and Grease	0	10
	Phenols	0	10
	Fecal Coliform	0	10
	Total Coliform	0	10
	Total count of Bacteria	0	10
	Algae count	0	10
	Temperature	0	10
Heavy Metals			
	Antimony	0	5
	Arsenic	0	5
	Barium	0	5
	Beryllium	0	5
	Cadmium	0	5
	Chromium	0	5
	Lead	0	5
	Mercury	0	5
	Nickel	0	5
	Silver	0	5
	Selenium	0	5
	Thallium	0	5
Other Metals			
	Sodium	0	10
	Potassium	0	10
	Magnesium	0	10
	Manganese	0	10
	Copper	0	10
	Iron	0	10
	Zinc	0	10
	Aluminum	0	10
	Calcium	0	10
Organics			
	Volatile Organics (524.2)	0	1
	Semi-Volatile Organics	0	1
	EDB & DBCP (504)	0	5
	Pesticides.PCBs (505)	0	5
	Herbicides (515.1)	0	5
	Herbicides (531.1)	0	5
	Herbicides (525.2)	0	5
	Herbicides (508)	0	5
	Herbicides (507 or 525.1)	0	5
	Carbamate Pesticides	0	5
Disinfection By Products (DBP)			
	THM	0	12
	Haloacetic acid (SM6233)	0	0
	Bromate chlorite(Method 300B)	0	0
Microbiology			
	Cryptosporidium		0
	Giardia		0
	Viruses		0
Radioactive			
	Beta-particles	0	1
	Alpha emitters	0	1
	Radon	0	0
	Radium-226,-228	0	0

Table J1-2: Aswan Sampling Program
Second and Third Rounds

PART 1. SAMPLING PLAN

LOCATION	Sanitary
Kom Ombo WTP in	Water
Kom Ombo Nile	Water
Darawo WTP intake	Water
Darawo Nile intake	Water

PART 2. SPECIFIC PARAMETERS

Category	Parameter	CDM Laboratory Tests No.	GOG Laboratory Tests No.
Sanitary Parameters:			
	Alkalinity	0	4
	pH	0	4
	Total Hardness	0	4
	Specific conductance	0	4
	Turbidity	0	4
	Color, apparent & true	0	4
	Odor Screen*	0	4
	Corrosivity	0	4
	Total Dissolved Solids	0	4
	Total Suspended Solids	0	4
	Total Organic Carbon	0	4
	Anions:(chloride,nitrate,nitrite Sulfate, phosphate & fluoride)	0	4
	Surfactants (MBAS)	0	0
	Total Cyanide	0	4
	Ammonia	0	4
	BOD	0	4
	COD	0	4
	Oil and Grease	0	4
	Phenols	0	4
	Fecal Coliform	0	4
	Total Coliform	0	4
	Total count of Bacteria	0	4
	Algae count	0	4
	Temperature	0	4

EL FUSTAT CENTRAL WATER QUALITY LAB.

INORGANIC & RADIOMETRY LAB.

Sanitary Parameters'Analysis (Aswan) " 1 "

CLIENT : CDM International Project

Sampling Date : 12 & 13 / 03 / 96

Date Reported : 19 / 03 / 96

Parameter	Unit (Sample Source)	Kom Ombo WTP Intake	Kom Ombo Nile	Kom Ombo new WTP	Kom Ombo FW	Darawo WTP Intake
Temperature	0c	20	19	21	20	21
Residual Chlorine	ppm	....	....	....	0.95	....
pH		7.84	8.01	7.4	7.82	8.35
Specific Conductance	uS/cm	256	246	232	260	237
Turbidity	NTU	2	1.5	1.1	0.85	2.8
Apparent Color	Hazen Unit	<5	<5	<5	<5	<5
True Color	Hazen Unit	<5	<5	<5	<5	<5
Odor	Threshold odor no.	odorless	odorless	odorless	odorless	odorless
Corrosivity	Saturation index	0	0	-0.1	0	0.1
Alkalinity	ppm as Ca CO3	112	120	110	112	106
Total Hardness	ppm as Ca CO3	102	106	104	100	82
Total Dissolved Solids	ppm	172	174	152	182	142
Total Solids	ppm	194	332	152	186	148
Total Suspended Solids	ppm	22	158	Nil	4	6
Chloride	ppm	14	13	11	14	10
Fluoride	ppm	0.38	0.36	0.34	0.33	0.38
Ammonia / N	ppm	0.033	0.1	0.256	Nil	Nil
Nitrite / N	ppm	Nil	Nil	Nil	0.012	Nil
Nitrate / N	ppm	0.597	0.61	0.78	0.405	0.548
Sulfate	ppm	10	10	9	12	9
Phosphate	ppm	Nil	Nil	Nil	Nil	Nil
Total Cyanide	ppm	Nil	Nil	Nil	Nil	Nil
Oil & Grease	ppm	Nil	Nil	Nil	Nil	Nil
BOD5	ppm	....	....	....	....	...
COD	ppm	....	....	....	....	....

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CHEMIST	CHIEF	DIRECTOR
Sayed. A. El Maksoud		Gehad
S.ABD EL-MAKSOUD	S.ABD EL-RAHMAN	G.HASSAN

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EL-FUSTAT CENTRAL WATER QUALITY LAB.

INORGANIC & RADIOMETRY LAB.

Sanitary Parameters'Analysis (Aswan) " 2 "

CLIENT : CDM International Project

Sampling Date : 12 & 13 / 03 / 96

Date Reported : 19 / 03 / 96

Parameter	Unit \ Sample Source	Darawo GW	Darawo Nile Intake	Darawo FW	Sugar Cane Factory	Nasr EL Noba
Temperature	0c	24.0	20.0	19.5	35.5	20.4
Residual Chlorine	ppm	....	....	1.00	....	0.90
pH		6.70	8.02	7.58	6.74	7.50
Specific Conductance	uS/cm	708.0	216.0	238.0	272.0	238.0
Turbidity	NTU	0.50	0.94	1.25	9.50	0.90
Apparent Color	Hazen Unit	<5	<5	<5	60	<5
True Color	Hazen Unit	<5	<5	<5	8	<5
Odor	Threshold odor no.	odorless	odorless	odorless	odorless	odorless
Corrosivity	Saturation Index	0.0	0.0	0.0	-1.1	-0.1
Alkalinity	ppm as Ca CO3	350	114	106	108	110
Total Hardness	ppm as Ca CO3	320	100	96	116	102
Total Dissolved Solids	ppm	490	148	142	254	136
Total Solids	ppm	490	250	148	272	148
Total Suspended Solids	ppm	Nil	102	6	18	12
Chloride	ppm	65.0	10.0	11.0	14.0	12.0
Fluoride	ppm	0.330	0.320	0.380	0.300	0.420
Ammonia / N	ppm	0.324	0.448	Nil	0.443	0.030
Nitrite / N	ppm	0.132	Nil	Nil	Nil	Nil
Nitrate / N	ppm	0.550	0.570	0.289	0.460	0.558
Sulfate	ppm	45.0	9.0	10.0	14.5	10.0
Phosphate	ppm	0.224	Nil	Nil	Nil	Nil
Total Cyanide	ppm	Nil	Nil	Nil	Nil	Nil
Oil & Grease	ppm	Nil	Nil	Nil	480.0	Nil
BOD5	ppm	....	....	....	....	...
COD	ppm	....	....	....	245.5	....

CHEMIST	CHIEF	DIRECTOR
Sayed A. El MAKSOUD		Gehad
S.ABD EL-MAKSOUD	S.ABD EL-RAHMAN	G.HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LAB
ORGANIC LAB

CLIENT : CDM INTERNATIONAL
SAMPLING DATE:MARCH 13,1996
DATE REPORTED:MARCH 20,1996

TOTAL ORGANIC CARBON ANALYSIS
ASWAN

NO	LOCATION	CONCENTRATION (mg/l)	NOTES
1	KOMOMBO-WTP-IN	2.299	
2	KOMOMBO-NILE	2.136	
3	KOMOMBO-NEW-WTP	2.269	
4	KOMOMBO-FW	2.518	
5	DARAWO-WTP-IN	2.336	
6	DARAWO-GW	0.382	
7	DARAWO-NILE-IN	2.284	
8	DARAWO-FW	2.312	
9	SUGARCANE FACTORY	49.915	
10	NASR EL-NUBA	2.447	

CHEMISTS
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CHIEF OF ORGANIC
Safaa El Saddik

DIRECTOR
GEHAD HASSAN

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GENERAL ORGANISATION FOR GREATER CAIRO WATER SUPPLY
FUSTAT CENTRAL WATER QUALITY LABORATORY
MICROBIOLOGY LABORATORY

CLIENT : CDM INTERNATIONAL
SAMPLING DATE : MARCH 13,1996
DATE REPORTED: MARCH 16,1996

BIOLOGICAL & MICROBIOLOGICAL ANALYSIS
ASWAN

SAMPLE	BACTERIA			ALGAE COUNT	NEMATODES
	TOTAL COLIFORM	FECAL COLIFORM	TOTAL COUNT	UNIT/ML	UNIT/L
	CFU/100 ML	CFU/100 ML	CFU/1 ML		
Kom Ombo WTP in.	14000	6400	950	340	....
Kom Ombo nile	3000	1800	2470	385	....
Kom Ombo new WTP	26000	4400	1490	218	....
Kom Ombo FW	<1	<1	10	25	....
Daraw WTP intake	4000	1320	300	560	....
Daraw GW	<1	<1	15	1	....
Daraw nile intake	11025	2700	8320	550	....
Daraw FW	<1	<1	10	35	....
Sugar cane factory	4*10^9	3.5*10^9	10.9*10^7	335	....
Nasr el Noba	<1	<1	15	20	....

MICROBIOLOGIST — M.MOUSSA , A. ISMAIL

CHIEF MICROBIOLOGY — N. GAYED

DIRECTOR — GEHAD HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LAB
ORGANIG LAB

CLIENT:CDM INTERNATIONAL
SAMPLING DATE:MARCH 13,1996
DATE REPORTED:MARCH 19,1996

PHENOLS ANALYSIS METHOD # 604
ASWAN

NO.	COMPOUNDS	LOCATION									
		Kom OMBO WTP intake	Kom Ombo Nile	Kom Ombo New WTP	Kom Ombo FW	Darawo WTPintake	Darawo GW	Darawo Nile intake	Darawo FW	Sugarcane Fact.-waste	Nasr El Nuba
		CONCENTRATION(ug/l)									
1	2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2	Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3	2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4	2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5	2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6	4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7	2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8	2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9	4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10	2-Methyl-4,6-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11	Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	10.865	ND

**Not Detected at or above the method reporting limit (ND)*

CHEMISTS
T.ROSHDY & A.RADWAN
Tarik Ali Radwan

CHIEF OF ORGANIC
SAFAA EL- SADDIK
Safaa

DIRECTOR
GEHAD HASSAN
Gehad

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

EL FUSTAT CENTRAL WATER QUALITY LAB.

INORGANIC & RADIOMETRY LAB.

Other Metals'Analysis (Aswan) " 2 "

CLIENT : CDM International Project

Sampling Date : 12 & 13 / 03 / 96

Date Reported : 19 / 03 / 96

Parameter (Sample Source →)	Unit	Darawo GW	Darawo Nile Intake	Darawo FW	Sugar Cane Factory	Nasr EL Noba
Sodium	mg/l	63.5	15.6	15.9	21.5	17.6
Potassium	mg/l	5.1	4.9	4.9	8.1	5.1
Calcium	mg/l	56	24	24	28	24.8
Magnesium	mg/l	43.2	9.6	8.64	11.04	9.6
Iron	mg/l	0.1	0.1	0.1	0.1	0.1
Manganese	mg/l	0.75	UDL	UDL	0.07	UDL
Copper	ug/l	UDL	UDL	UDL	38	1.14
Zinc	mg/l	0.05	0.04	0.03	0.06	0.11
Aluminium	mg/l	0.1	0.1	0.2	0.5	0.1

UDL = Under Detection Limit

CHEMIST — M.EL HALOTY

CHIEF — S.ABD EL-RAHMAN

DIRECTOR — G.HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

EL FUSTAT CENTRAL WATER QUALITY LAB.

INORGANIC & RADIOMETRY LAB.

Other Metals'Analysis (Aswan) " 1 "

CLIENT : CDM International Project

Sampling Date : 12 & 13 / 03 / 96

Date Reported : 19 / 03 / 96

Parameter	Sample Source / Unit	Kom Ombo WTP Intake	Kom Ombo Nile	Kom Ombo new WTP	Kom Ombo FW	Darawo WTP Intake
Sodium	mg/l	18.7	20.6	19.1	10.9	16
Potassium	mg/l	5.1	4.9	5	5.1	4.9
Calcium	mg/l	24.8	26.4	25.0	24	20
Magnesium	mg/l	9.6	9.6	9.6	9.6	12
Iron	mg/l	0.3	0.1	0.1	0.1	0.5
Manganese	mg/l	UDL	UDL	UDL	UDL	0.06
Copper	ug/l	1.52	UDL	UDL	2.47	UDL
Zinc	mg/l	0.03	0.04	0.04	0.10	0.08
Aluminium	mg/l	0.4	0.1	0.1	0.3	0.4

UDL = Under Detection Limit

CHEMIST	CHIEF	DIRECTOR
M.EL HALOTY	S.ABD EL-RAHMAN	G.HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

EL FUSTAT CENTRAL WATER QUALITY LAB.

INORGANIC & RADIOMETRY LAB.

Heavy Metals'Analysis (Aswan)

CLIENT : CDM International Project

Sampling Date : 12 & 13 / 03 / 96

Date Reported : 19 / 03 / 96

Parameter	Unit	Kom Ombo WTP intake (Sediment)	Kom Ombo Nile (Sediment)	Kom Ombo new WTP (Sediment)	Darawo WTP (Sediment)	Darawo Nile intake (Sediment)
Antimony	ug/g	0.39	0.29	0.45	0.58	0.37
Arsenic	ug/g	0.63	1.14	0.32	1.38	0.71
Barium	ug/g	0.27	0.45	0.27	0.53	0.41
Beryllium	ug/g	1.05	1.2	UDL	0.8	0.4
Cadmium	ug/g	0.105	0.103	UDL	0.08	0.035
Chromium	ug/g	44	41	UDL	0.35	0.14
Lead	ug/g	7.5	6.5	1.0	10.3	7.3
Nickel	ug/g	36.12	64.1	0.332	32.6	31
Silver	ug/g	0.19	0.04	UDL	0.05	UDL

CHEMIST

M.EL HALOTY

CHIEF

S.ABD EL-RAHMAN

DIRECTOR

G.HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

EL FUSTAT CENTRAL WATER QUALITY LAB.

INORGANIC & RADIOMETRY LAB.

Heavy Metals'Analysis (Aswan)

CLIENT : CDM International Project

Sampling Date : 12 & 13 / 03 / 96

Date Reported : 19 / 05/ 96

Parameter	Unit / Sample Source	Kom Ombo WTP Intake (Sediment)	Kom Ombo Nile (Sediment)	Kom Ombo new WTP (Sediment)	Darawo WTP (Sediment)	Darawo Nile Intake (Sediment)
Mercury	ug/g	0.08	0.02	0.05	0.05	0.05
Selenium	ug/g	0.27	0.34	0.3	0.47	0.29
Thallium	ug/g	20	10	UDL	20	10

CHEMIST — M.EL HALOTY

CHIEF — S.ABD EL-RAHMAN

DIRECTOR — G.HASSAN

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LABORATORY
ORGANIC LABORATORY

CLIENT : CDM INTERNATIONAL
SAMPLING DATE : MARCH 13 , 1996
DATE REPORTED : MARCH 19 , 1996

VOLATILES ANALYSIS METHOD #524.2

ASWAN

DARAWO GW

NO	COMPOUND	CONC.(ug / l)	NO	COMPOUND	CONC. (ug / l)
1	1,2-Dichloropropane	ND	13	Benzene	ND
2	1,3-Dchloropropane	ND	14	Chlorobenzene	ND
3	Carbon tetrachloride	ND	15	1,2-Dichlorobenzene	ND
4	Dichloromethane	ND	16	1,4-Dichlorobenzene	ND
5	1,2-Dichloroethane	ND	17	Hexachlorobutadiene	ND
6	1,1,1-Trichloroethane	ND	18	1,2,3-Trchlorobenzene	ND
7	Vinyl chloride	ND	19	1,2,4-Trichlorobenzene	ND
8	1,1-Dichloroethene	ND	20	1,2-Dibromo-3-chloropropane	ND
9	Cis-1,2- Dichloroethene	ND	21	Chloroform	ND
10	Trans 1,2- Dichloroethene	ND	22	Bromodichloromethane	ND
11	Trichloroethene	ND	23	Dibromochloromethane	ND
12	Tetrachloroethene	ND	24	Bromoform	ND

* ND = Not Detected at or above method reporting limit

CHEMIST	CHIEF OF ORGANIC	DIRECTOR
Ahmed Saad Ali	Safaa EL Saddik	Gehad Hassan

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LABORATORY
ORGANIC LABORATORY

CLIENT : CDM INTERNATIONAL
SAMPLING DATE : MARCH 13 , 1996
DATE REPORTED : MARCH 28 , 1996

SEMI - VOLATILES ANALYSIS METHOD # 625

DARAWO -GW

NO.	COMPOUND	CONC.(mg / l)	NO.	COMPOUND	CONC. (mg / l)
1	N-nitrosodimethyl amine	ND	33	acenaphthylene	ND
2	aniline	ND	34	dimethyl phthalate	ND
3	phenol	ND	35	2,6-dinitrotoluene	ND
4	2-chlorophenol	ND	36	acenaphthene	ND
5	1,3-dichlorobenzene	ND	37	nitroaniline	ND
6	1,4-dichlorobenzene	ND	38	2,4-dinitrophenol	ND
7	1,2-dichlorobenzene	ND	39	dibenzofurane	ND
8	benzyl alcohol	ND	40	4-nitrophenol	ND
9	bis(2-chloroisopropyl) ether	ND	41	2,4-dinitrotoluene	ND
10	hexachloroethane	ND	42	fluorene	ND
11	4-methyl phenol	ND	43	4-chlorophenyl phenyl ether	ND
12	N-nitroso-di-N-propylamine	ND	44	diethyl phthalate	ND
13	nitrobenzene	ND	45	4,6-dinitro-2-methyl phenol	ND
14	isophorone	ND	46	N-nitrosodiphenylamine	ND
15	2-nitrophenol	ND	47	azobenzene	ND
16	2,4-dimethyl phenol	ND	48	4-bromophenyl phenyl ether	ND
17	Bis(2-chloroethoxy)methane	ND	49	hexachlorobenzene	ND
18	2,4-dichlorophenol	ND	50	pentachlorophenol	ND
19	1,2,4-trichlorobenzene	ND	51	phenanthrene	ND
20	naphthalene	ND	52	anthracene	ND
21	benzoic acid	ND	53	carbazol	ND
22	4-chloroaniline	ND	54	dibutyl phthalate	ND
23	hexachlorobutadiene	ND	55	flouranthene	ND
24	4-chloro-3-methyl phenol	ND	56	pyrene	ND
25	2-methylnaphthalene	ND	57	butyl benzyl phthalate	ND
26	hexachlorocyclopentadiene	ND	58	chrysene	ND
27	2,4,6-trichlorophenol	ND	59	benzo(a)anthracene	ND
28	2,4,5-trichlorophenol	ND	60	3,3-dichlorobenzidine	ND
29	2-chloronaphthalene	ND	61	Bis(2-ethyl hexyl phthalate)	ND
30	2-nitroaniline	ND	62	di-n-octylphthalate	ND
31	benzo(k)fluoranthene	ND	63	benzo(a)pyrene	ND
32	indeno(1,2,3-c-d)pyrene	ND	64	benzo(j,h,i)anthracene	ND

** ND = Not Detected at or above method reporting limit*
***UDL =Under Detection limt of method*

CHEMIST	CHIEF OF ORGANIC	DIRECTOR
Ahmed Saad Ali	*Safaa EL Saddik*	*Gehad Hassan*

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY CENTRAL LAB.
ORGANIC LAB.

CLIENT : CDM INTERNATIONAL
SAMPLING DATE:MARCH13,1996
DATE REPORTED:MARCH 18,1995

TRIAZINE PESTICIDE ANALYSIS METHOD#619

ASWAN

NO	LOCATION	COMPOUND (ug/l)						
		SIMAZINE	ATRAZINE	PROMETON	PROPAZINE	AMETRYN	PROMETRYN	TERBUTRYN
1	KOMOMBO-WTP-IN	ND	ND	ND	ND	ND	ND	ND
2	KOMOMBO-NILE	ND	ND	ND	ND	ND	ND	ND
3	KOMOMBO-NEW-WTP	ND	ND	ND	ND	ND	ND	ND
4	DARAWO-WTP-IN	ND	ND	ND	ND	ND	ND	ND
5	DARAWO-NILE-IN	ND	ND	ND	ND	ND	ND	ND

(ND):NOT DETECTED AT OR ABOVE THE METHOD REPORTING LIMIT.

CHEMISTS
T.ROSHDY & A.RADWAN

CHIEF OF ORGANIC
SAFAA EL SADDIK

DIRECTOR
GEHAD HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LABORATORY
ORGANIC LABORATORY

CLIENT : CDM INTERNATIONAL
SAMPLING DATE : MARCH 13 , 1996
DATE REPORTED : MARCH 28 , 1996

SEMI - VOLATILES ANALYSIS METHOD # 625

DARAWO -GW

NO.	COMPOUND	CONC.(mg / l)	NO.	COMPOUND	CONC. (mg / l)
1	N-nitrosodimethyl amine	ND	33	acenaphthylene	ND
2	aniline	ND	34	dimethyl phthalate	ND
3	phenol	ND	35	2,6-dinitrotoluene	ND
4	2-chlorophenol	ND	36	acenaphthene	ND
5	1,3-dichlorobenzene	ND	37	nitroaniline	ND
6	1,4-dichlorobenzene	ND	38	2,4-dinitrophenol	ND
7	1,2-dichlorobenzene	ND	39	dibenzofurane	ND
8	benzyl alcohol	ND	40	4-nitrophenol	ND
9	bis(2-chloroisopropyl) ether	ND	41	2,4-dinitrotoluene	ND
10	hexachloroethane	ND	42	fluorene	ND
11	4-methyl phenol	ND	43	4-chlorophenyl phenyl ether	ND
12	N-nitroso-di-N-propylamine	ND	44	diethyl phthalate	ND
13	nitrobenzene	ND	45	4,6-dinitro-2-methyl phenol	ND
14	isophorone	ND	46	N-nitrosodiphenylamine	ND
15	2-nitrophenol	ND	47	azobenzene	ND
16	2,4-dimethyl phenol	ND	48	4-bromophenyl phenyl ether	ND
17	Bis(2-chloroethoxy)methane	ND	49	hexachlorobenzene	ND
18	2,4-dichlorophenol	ND	50	pentachlorophenol	ND
19	1,2,4-trichlorobenzene	ND	51	phenanthrene	ND
20	naphthalene	ND	52	anthracene	ND
21	benzoic acid	ND	53	carbazol	ND
22	4-chloroaniline	ND	54	dibutyl phthalate	ND
23	hexachlorobutadiene	ND	55	flouranthene	ND
24	4-chloro-3-methyl phenol	ND	56	pyrene	ND
25	2-methylnaphthalene	ND	57	butyl benzyl phthalate	ND
26	hexachlorocyclopentadiene	ND	58	chrysene	ND
27	2,4,6-trichlorophenol	ND	59	benzo(a)anthracene	ND
28	2,4,5-trichlorophenol	ND	60	3,3-dichlorobenzidine	ND
29	2-chloronaphthalene	ND	61	Bis(2-ethyl hexyl phthalate)	ND
30	2-nitroaniline	ND	62	di-n-octylphthalate	ND
31	benzo(k)fluoranthene	ND	63	benzo(a)pyrene	ND
32	indeno(1,2,3-c-d)pyrene	ND	64	benzo(j,h,i)anthracene	ND

* *ND = Not Detected at or above method reporting limit*
***UDL =Under Detection limt of method*

CHEMIST	CHIEF OF ORGANIC	DIRECTOR
Ahmed Saad Ali	*Safaa EL Saddik*	*Gehad Hassan*
AHSA	Safaa	Gehad

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY CENTRAL LAB.
ORGANIC LAB.

CLIENT : CDM INTERNATIONAL
SAMPLING DATE:MARCH13,1996
DATE REPORTED:MARCH 18,1995

TRIAZINE PESTICIDE ANALYSIS METHOD#619

ASWAN

NO	LOCATION	COMPOUND (ug/l)						
		SIMAZINE	ATRAZINE	PROMETON	PROPAZINE	AMETRYN	PROMETRYN	TERBUTRYN
1	KOMOMBO-WTP-IN	ND	ND	ND	ND	ND	ND	ND
2	KOMOMBO-NILE	ND	ND	ND	ND	ND	ND	ND
3	KOMOMBO-NEW-WTP	ND	ND	ND	ND	ND	ND	ND
4	DARAWO-WTP-IN	ND	ND	ND	ND	ND	ND	ND
5	DARAWO-NILE-IN	ND	ND	ND	ND	ND	ND	ND

(ND):NOT DETECTED AT OR ABOVE THE METHOD REPORTING LIMIT.

CHEMISTS
T.ROSHDY & A.RADWAN

CHIEF OF ORGANIC
SAFAA EL SADDIK

DIRECTOR
GEHAD HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LABORATORY
ORGANIC LABORATORY

CLIENT :CDM INTERNATIONAL
SAMPLING DATE:MARCH 13,1996
DATE REPORTED:MARCH 20,1996

EDB/DBCP ANALYSIS METHOD # 504

ASWAN

NO	COMPOUND (ug/l)	LOCATION				
		Kom Ombo WTP intake	Kom Ombo Nile	Kom Ombo new WTP	Darawo WTP intake	Darawo Nile intake
1	1,2-Dibromoethane	ND	ND	ND	ND	ND
2	1,2-Dibromo-3-chloropropane	ND	ND	ND	ND	ND

(ND):NOT DETECTED AT OR ABOVE THE METHOD REPORTING LIMIT.

CHEMIST
HAZEM NAWAR

CHIEF OF ORGANIC
SAFAA EL-SADDIK

DIRECTOR
GEHAD HASSAN

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LAB.
ORGANIC LAB.

CLIENT : CDM INTERNATIONAL
SAMPLING DATE: MARCH 13,1996
DATE REPORTED: MARCH 19,1995

POLYCHLORINATED BIPHENYL ANALYSIS METHOD# 608

ASWAN

NO	LOCATION	COMPOUND (ug/l)						
		PCB-1221	PCB-1016	PCB-1232	PCB-1242	PCB-1254	PCB-1248	PCB-1260
1	KOM OMBO WTP INTAKE	ND	ND	ND	ND	ND	ND	ND
2	KOM OMBO NILE	ND	ND	ND	ND	ND	ND	ND
3	KOM OMBO NEW WTP	ND	ND	ND	ND	ND	ND	ND
4	DARAWO WTP INTAKE	ND	ND	ND	ND	ND	ND	ND
5	DARAWO INTAKE	ND	ND	ND	ND	ND	ND	ND

**ND=Not Detected at or above method reporting limit*

CHEMISTS
T.ROSHDY & A.RADWAN
Ali Radwan

CHIEF OF ORGANIC
SAFAA EL SADDIK
Safaa

DIRECTOR
GEHAD HASSAN
Gehad

BEST AVAILABLE COPY

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY CENTRAL LAB.
ORGANIC LAB.

CLIENT: CDM INTERNATIONAL

CHLORINATED PHENOXY ACID HERBICIDEDS
ANALYSIS METHOD # 6640B
ASWAN

SAMPLING DATE:MARCH 13,1996
DATE REPORTED:MARCH 19,1996

NO	COMPOUNDS	CONCENTRATION (ug/l)				
		SAMPLE SOURCE				
		KOMOMBO WTP IN	KOMOMBO NILE	KOMOMBO NEW WTP	DARAWO WTP INTAKE	DARAWO NILE INTAKE
1	2,4 - D	ND	ND	ND	ND	ND
2	2,4,5 - TP (SILVEX)	ND	ND	ND	ND	ND
3	2,4,5 - T	ND	ND	ND	ND	ND
4	TOTAL					

(ND): NOT DETECTED AT OR ABOVE THE METHOD REPORTING LIMIT.

CHEMISTS	CHIEF OF ORGANIC	DIRECTOR
T.ROSHDY & A.RADWAN	SAFAA EL SADDIK	GEHAD HASSAN
Ali Radwan	Safaa	

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LABORATORY
ORGANIC LABORATORY.

CLIENT: CDM INTERNATIONAL
SAMPLING DATE: MARCH 13, 1996
DATE REPORTED: MARCH 28, 1996

PESTICIDE ANALYSIS METHOD # 608

ASWAN

NO	COMPOUNDS	CONCENTRATION (ug/l) SAMPLE SOURCE					NOTES
		KOMOMBO WTP IN	KOMOMBO NILE	KOMOMBO NEW WTP	DARAWO WTP INTAKE	DARAWO NILE INTAKE	
1	ALPHA BHC	ND	ND	ND	ND	ND	[redacted]
2	BETA BHC	ND	ND	ND	ND	ND	[redacted]
3	GAMA BHC	ND	ND	ND	ND	ND	[redacted]
4	DELTA BHC	ND	ND	ND	ND	ND	[redacted]
5	HEPTACHLOR	ND	ND	ND	ND	ND	[redacted]
6	ALDRIN	ND	ND	ND	ND	ND	[redacted]
7	HEPTACHLOREPOXIDE	ND	ND	ND	ND	ND	[redacted]
8	ENDOSULFAN - 1	ND	ND	ND	ND	ND	[redacted]
9	DDE	ND	ND	ND	ND	ND	[redacted]
10	DIELDRIN	ND	ND	ND	ND	ND	[redacted]
11	ENDRIN	ND	ND	ND	ND	ND	[redacted]
12	ENDOSULFAN - 2	ND	ND	ND	ND	ND	[redacted]
13	DDD	ND	ND	ND	ND	ND	[redacted]
14	ENDRINALDEHYDE	ND	ND	ND	ND	ND	[redacted]
15	ENDOSULFANSULFATE	ND	ND	ND	ND	ND	[redacted]
16	DDT	ND	ND	ND	ND	ND	[redacted]
17	METHOXYCHLOR	ND	ND	ND	ND	ND	[redacted]
18	ENDRINKETON	ND	ND	ND	ND	ND	[redacted]
19	TOXAPHENE	ND	ND	ND	ND	ND	[redacted]
20	CHLORDANE	ND	ND	ND	ND	ND	[redacted]

(ND): NOT DETECTED AT OR ABOVE THE METHOD REPORTING LIMIT.
(UDL): UNDER DETECTION LIMIT.

CHEMISTS
T.ROSHDY&A.RADWAN
Ali Radwan

CHIEF OF ORGANIC
SAFAA EL-SADDIK
Safaa

DIRECTOR
GEHAD HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LAB
ORGANIC LAB

CLIENT:CDM INTERNATIONAL
SAMPLING DATE:MARCH 13,1996
DATE REPORTED:MARCH 20,1996

Carbamates analysis method # 431.1

ASWAN

NO.	COMPOUNDS	LOCATION				
		Kom ombo WTP intake	Kom ombo Nile	Kom ombo New WTP	Darawo WTP intake	Darawo Nile intake
		CONCENTRATION (ug / l)				
1	Aldicarbsulfoxide	ND	ND	ND	ND	ND
2	Aldicarbsulfone	ND	ND	ND	ND	ND
3	Oxamyl	ND	ND	ND	ND	ND
4	Methomyl	ND	ND	ND	0.522	ND
5	3-Hydroxycarbofuran	ND	ND	ND	ND	ND
6	Aldicarb	ND	ND	ND	ND	ND
7	Propoxur	ND	ND	ND	ND	ND
8	Carbofuran	ND	ND	ND	ND	ND
9	Carbaryl	ND	ND	ND	ND	ND
10	Methiocarb	ND	UDL	ND	ND	ND

Not Detected at or above the method reporting limit (ND)
Under Detection Limit (UDL)

Chemists
Hazem Nawar & Faiza Afifi

Chief of Organic
Safaa ELSaddik

Director
Gehad Hassan

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LABORATORY

ORGANIC LABORATORY

CLIENT : CDM INTERNATIONAL

SAMPLING DATE: MARCH 13, 1996

DATE REPORTED : MARCH 20,1996

TRIHALOMETHANES ANALYSIS METHOD # 501.2

ASWAN

NO	COMPOUND (ug/l)	LOCATION											
		Kom Ombo Nile	Kom Ombo new WTP	Kom Ombo FW	Darawo WTP intake	Darawo FW	Kom Ombo DS.1	Kom Ombo DS.2	Kom Ombo DS.3	Darawo DS.1	Darawo DS.2	Darawo DS.3	Nasr EL-Nuba
1	CHLOROFORM	ND	ND	20.591	ND	21.399	22.951	23.105	22.616	22.238	38.014	25.545	24.679
2	DICHLOROBROMOMETH.	ND	ND	11.019	ND	11.441	12.58	12.334	12.181	11.633	17.284	13.479	12.265
3	DIBROMOCHLOROMETH.	ND	ND	4.231	ND	4.541	5.169	4.831	4.864	4.494	5.839	5.035	4.414
4	BROMOFORM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5	TOTAL			35.841		37.381	40.7	40.27	39.661	38.365	61.137	44.059	41.358

(ND):NOT DETECTED AT OR ABOVE THE METHOD REPORTING LIMIT.

(UDL):UNDER DETECTION LIMIT.

CHEMIST
HAZEM NAWAR

CHIEF OF ORGANIC
SAFAA EL-SADDIK

DIRECTOR
GEHAD HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY
EL FUSTAT CENTRAL WATER QUALITY LAB.
INORGANIC & RADIOMETRY LAB.

Radioactivity's Analysis(Aswan)

CLIENT : CDM International Project

Sampling Date : 12 &13 / 03 /96

Date Reported : 26/03/96

Parameter	Unit	Sample Source: Darawo GW
Gross Alpha	PCi /L	0.35685±0.09976
Gross Beta	PCi /L	UDL

CHEMIST — Sayed. A. El MAKSOUD — S.ABD EL-MAKSOUD

CHIEF — Saber — S.ABD EL-RAHMAN

DIRECTOR — G.Hassan — G.HASSAN

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

EL FUSTAT CENTRAL WATER QUALITY LAB.

INORGANIC & RADIOMETRY LAB.

Sanitary Parameters'Analysis (Aswan) (Second round)

CLIENT : CDM International Project

Sampling Date : 6 / 08 / 96

Date Reported : 12 / 08/ 96

Parameter	Unit / Sample Source	Kom Ombo WTP intake	Darawo Nile intake	Darawo WTP intake	Kom Ombo Nile intake
Temperature	0c	14.7	15.1	15.4	15.4
pH		7.74	7.31	7.75	7.72
Specific Conductance	uS/cm	254	201	220	256
Turbidity	NTU	0.15	0.18	0.21	0.38
Apparent Color	Hazen Unit	<5	<5	<5	<5
True Color	Hazen Unit	<5	<5	<5	<5
Odor	Threshold odor no.	odorless	odorless	odorless	odorless
Corrosivity	Saturation index	0	0	0	0
Alkalinity	ppm as Ca CO3	118	114	116	128
Total Hardness	ppm as Ca CO3	100	96	102	110
Total Dissolved Solids	ppm	168	124	140	172
Total Solids	ppm	174	132	148	184
Total Suspended Solids	ppm	6	8	8	12
Chloride	ppm	9	10	15	18
Fluoride	ppm	0.21	0.22	0.23	0.24
Ammonia / N	ppm	0.152	0.188	0.2	0.165
Nitrite / N	ppm	0.0155	0.0141	0.02	0.0179
Nitrate / N	ppm	Nil	Nil	Nil	Nil
Sulfate	ppm	10	9	9.5	12.5
Phosphate	ppm	0.0043	0.0034	0.0163	0.0134
Total Cyanide	ppm	Nil	Nil	Nil	Nil
BOD5	ppm	....	....	....	...
COD	ppm	....	....	....	....

CHEMIST — S.ABD EL-MAKSOUD

CHIEF — S.ABD EL-RAHMAN

DIRECTOR — HASSAN

GENERAL ORGANISATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LABORATORY LABORATORY

MICROBIOLOGY LABORATORY

CLIENT : CDM INTERNATIONAL

SAMPLING DATE :6/08/1996

DATE REPORTED: 9/08/1996

BIOLOGICAL & MICROBIOLOGICAL ANALYSIS
ASWAN (Second round)

SAMPLE	BACTERIA			ALGAE COUNT UNIT/ML	NEMATODES UNIT/L
	TOTAL COLIFORM CFU/100 ML	FECAL COLIFORM CFU/100 ML	TOTAL COUNT CFU/1 ML		
Kom Ombo WTP in.	200	100	2840	225	....
Daraw nile intake	1300	500	6600	270	....
Daraw WTP intake	1400	460	6200	900	....
Kom Ombo nile intake	1000	400	9040	360	....

MICROBIOLOGIST
M. Moussa
M.MOUSSA , A. ISMAIL

CHIEF MICROBIOLOGY
Nagy
N. GAYED

DIRECTOR
Gehad
GEHAD HASSAN

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LAB
ORGANIG LAB

CLIENT:CDM INTERNATIONAL
SAMPLING DATE:AUGUST 5,96
DATE REPORTED:AUGUST 12,96

Phenols analysis method # 604
ASWAN

NO.	COMPOUNDS	LOCATION			
		KOM OMBO WTP INTAKE	KOM OMBO NILE INTAKE	DARAWO WTP INTAKE	DARAWO NILE INTAKE
		CONCENTRATION ug/L			
1	2-Chlorophenol	ND	ND	ND	ND
2	Phenol	ND	ND	ND	ND
3	2-Nitrophenol	ND	ND	ND	ND
4	2,4-Dimethylphenol	ND	ND	ND	ND
5	2,4-Dichlorophenol	ND	ND	ND	ND
6	4-Chloro-3-methylphenol	ND	ND	ND	ND
7	2,4,6-Trichlorophenol	ND	ND	ND	ND
8	2,4-Dinitrophenol	ND	ND	ND	ND
9	4-Nitrophenol	5.81	ND	ND	ND
10	2-Methyl-4,6-Dinitrophenol	ND	ND	ND	ND
11	Pentachlorophenol	8.199	ND	ND	ND

*Not Detected at or above the method reporting limit (ND)

CHEMISTS
T.ROSHDY & A.RADWAN
Ali Radwan

CHIEF OF ORGANIC
SAFAA EL- SADDIK
Safaa

DIRECTOR
GEHAD HASSAN
Gehad

<u>GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY</u>

FUSTAT CENTRAL WATER QUALITY LAB
ORGANIC LAB

CLIENT : CDM INTERNATIONAL
SAMPLING DATE:AUG. 5,1996
DATE REPORTED:AUG. 7,1996

TOTAL ORGANIC CARBON ANALYSIS

ASWAN

NO	LOCATION	CONCENTRATION (mg/l)	NOTES
1	KOMOMBO-WTP-IN	1.459	
2	KOMOMBO-NILE-IN	1.579	
3	DARAWO-WTP-IN	1.408	
4	DARAWO-NILE-IN	1.430	

CHEMISTS	CHIEF OF ORGANIC	DIRECTOR
T.ROSHDY&A.SAAD	SAFAA EL SADDIK	GEHAD HASSAN

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

EL FUSTAT CENTRAL WATER QUALITY LABORATORY
ORGANIC LABORATORY

SAMPLING DATE : 5/8/1996
DATE REPORTED: 30/8/1996

HYDROCARBON ANALYSIS BY FTIR METHOD #413.2\418.1

ASWAN

No.	Sample Identification	TOG mg/l	Comments
1	Kom Ombo Nile	ND	
2	Kom Ombo WTP In.	ND	
3	Darawo Nile In.	0.20	
4	Darawo WTP In.	0.60	

TOG : Total Oil and Grease.
ND : Not Detected

Chemist	Chemist	Chief of Organic	Director
H.Nawar	Kh.Fahmy	Safa El Saddik	Gehad Hassan

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GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

EL FUSTAT CENTRAL WATER QUALITY LAB.

INORGANIC & RADIOMETRY LAB.

Sanitary Parameters'Analysis (Aswan)
(3-rd round)

CLIENT : CDM international Project

Sampling Date : 10 / 09 / 96

Date Reported : 17 / 09/ 96

Parameter	Sample Source Unit	Kom Ombo Nile intake	Kom Ombo WTP intake	Darawo Nile intake	Darawo WTP intake
Temperature	0c	15.4	14.7	15.1	15.4
pH		8.16	8.14	8.08	7.99
Specific Conductance	uS/cm	340	308	256	256
Turbidity	NTU	2.6	1.6	0.8	2.8
Apparent Color	Hazen Unit	<5	<5	<5	<5
True Color	Hazen Unit	<5	<5	<5	<5
Odor	Threshold odor no.	odorless	odorless	odorless	odorless
Corrosivity	Saturation index	0	0	0	0
Alkalinity	ppm as Ca CO3	130	118	112	112
Total Hardness	ppm as Ca CO3	106	102	96	96
Total Dissolved Solids	ppm	221	200.2	166.4	166.4
Total Solids	ppm	225	202.2	168.4	168.4
Total Suspended Solids	ppm	4	2	2	2
Chloride	ppm	14	13	8	9
Fluoride	ppm	0.3	0.25	0.38	0.36
Ammonia / N	ppm	0.251	0.253	0.112	0.097
Nitrite / N	ppm	0.009	0.010	0.015	0.016
Nitrate / N	ppm	0.456	0.292	0.082	0.107
Sulfate	ppm	12	10	9	9.5
Phosphate	ppm	0.016	0.020	0.006	0.009
Total Cyanide	ppm	Nil	Nil	Nil	Nil
BOD5	ppm	...	....	....	....
COD	ppm	....	....	....	....

CHEMIST — S.ABD EL-MAKSOUD

CHIEF — S.ABD EL-RAHMAN

DIRECTOR — G.A.HASSAN

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GENERAL ORGANISATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LABORATORY

MICROBIOLOGY LABORATORY

CLIENT : CDM INTERNATIONAL

SAMPLING DATE :10/09/1996

DATE REPORTED: 15/09/1996

BIOLOGICAL & MICROBIOLOGICAL ANALYSIS
ASWAN (Third round)

SAMPLE	BACTERIA			ALGAE COUNT UNIT/ML
	TOTAL COLIFORM CFU/100 ML	FECAL COLIFORM CFU/100 ML	TOTAL COUNT CFU/1 ML	
Kom Ombo WTP in.	1000	200	4920	50
Daraw nile intake	1800	450	1600	30
Daraw WTP intake	2600	1100	2000	50
Kom Ombo nile intake	2400	1150	1200	60

MICROBIOLOGIST

M.MOUSSA & A. ISMAIL

CHIEF MICROBIOLOGY

N. GAYED

DIRECTOR

GEHAD HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LAB
ORGANIC LAB

CLIENT : CDM INTERNATIONAL
SAMPLING DATE: SEP.10,1996
DATE REPORTED: SEP.14,1996

TOTAL ORGANIC CARBON ANALYSIS

ASWAN

NO	LOCATION	CONCENTRATION (mg/l)	NOTES
1	KOMOMBO-WTP-IN	2.593	
2	KOMOMBO-NILE-IN	2.715	
3	DARAWO-WTP-IN	2.549	
4	DARAWO-NILE-IN	2.680	

CHEMISTS
T.ROSHDY&A.SAAD

CHIEF OF ORGANIC
SAFAA EL SADDIK

DIRECTOR
GEHAD HASSAN

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

FUSTAT CENTRAL WATER QUALITY LAB
ORGANIG LAB

CLIENT:CDM INTERNATIONAL
SAMPLING DATE:SEP. 10,96
DATE REPORTED SEP. 24,96

Phenols analysis method # 604
ASWAN

NO.	COMPOUNDS	LOCATION			
		KOM OMBO WTP INTAKE	KOM OMBO NILE INTAKE	DARAWO WTP INTAKE	DARAWO NILE INTAKE
		CONCENTRATION ug/L			
1	2-Chlorophenol	ND	ND	ND	ND
2	Phenol	ND	1.69	ND	ND
3	2-Nitrophenol	ND	ND	ND	ND
4	2,4-Dimethylphenol	ND	1.5	ND	ND
5	2,4-Dichlorophenol	ND	ND	ND	ND
6	4-Chloro-3-methylphenol	ND	ND	ND	ND
7	2,4,6-Trichlorophenol	ND	ND	ND	ND
8	2,4-Dinitrophenol	ND	ND	ND	ND
9	4-Nitrophenol	ND	2.72	ND	ND
10	2-Methyl-4,6-Dinitrophenol	ND	ND	ND	ND
11	Pentachlorophenol	ND	ND	ND	ND

*Not Detected at or above the method reporting limit (ND)

CHEMISTS
T.ROSHDY & A.RADWAN

CHIEF OF ORGANIC
SAFAA EL- SADDIK
Safaa

DIRECTOR
GEHAD HASSAN
Gehad

GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY

EL FUSTAT CENTRAL WATER QUALITY LABORATORY
ORGANIC LABORATORY

SAMPLING DATE : 09/11/96
DATE REPORTED: 03/10/96

HYDROCARBON ANALYSIS BY FTIR METHOD #413.2\418.1

ASWAN

No.	Sample Identification	TOG mg/l	Comments
1	Kom Ombo Nile	ND	
2	Kom Ombo WTP In.	0.50	
3	Darawo Nile In.	0.20	
4	Darawo WTP In.	0.67	

TOG : Total Oil and Grease.
ND : Not Detected at or above the method reporting limit

Chemist	Chemist	Chief of Organic	Director
		Safaa	Gehad
H.Nawar	Kh.Fahmy	Safaa El Saddik	Gehad Hassan

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Appendix J3

Table J3-1a: Kom Ombo Sanitary Parameters (Drinking Water)

First Round

Parameter	units	Kom Ombo WTP Intake	Kom Ombo Nile Intake	Kom Ombo New WTP Intake	Kom Ombo Finished Water	Standards		
						EPA	WHO	EGYPT
Alkalinity	ppm as $CaCO_3$	112	120	110	112			
pH		7.84	8.01	7.4	7.82	...	NR	6.5-9.2
Temperature	C	20	19	21	20	NR	acceptable	NR
Residual Chlorine	ppm				0.95			
Total Hardness	ppm as $CaCO_3$	102	106	104	100	NR	NR	500
Specific conductance	uS/cm	256	246	232	260			
Turbidity	NTU	2	1.5	1.1	0.85	<1	5	5
Color apparent	Hazen unit	<5	<5	<5	<5	15	15	<20-30
Color true	Hazen unit	<5	<5	<5	<5			
Odor Screen	Threshold odor No.	odorless	odorless	odorless	odorless	odor 3	acceptable	acceptable
Corrosivity	Saturation index	0	0	-0.1	0			
Total Dissolved Solids	ppm	172	174	152	182	500	1000	1200
Total Suspended Solids	ppm	22	158	nil	4			
Total solids	ppm	194	332	152	186			
Total Organic Carbon	mg/l	2.299	2.136	2.269	2.518			
Chloride	ppm	14	13	11	14	250	250	500
Fluoride	ppm	0.38	0.36	0.34	0.33	4	1.5	0.8
Ammonia /N	ppm	0.033	0.1	0.256	nil	NR	1.5	NR
Nitrite /N	ppm	nil	nil	nil	0.012	1	3 as NO_2	0.005
Nitrate /N	ppm	0.597	0.61	0.78	0.405	10	50 as NO_3	10
Sulfate	ppm	10	10	9	12	500	250	400
Phosphate	ppm	nil	nil	nil	nil			
Surfactants (MBAS)								
Total Cyanide	ppm	nil	nil	nil	nil	0.2	0.07	0.05
BOD5	ppm							
COD	ppm							
Oil and Grease	ppm	nil	nil	nil	nil			
Phenols								
2-chlorophenol	ug/l	ND	ND	ND	ND	NR	NR	NR
phenol	ug/l	ND	ND	ND	ND			2
2-nitophenol	ug/l	ND	ND	ND	ND			
2,4-dimethylphenol	ug/l	ND	ND	ND	ND			
2,4-dichlorophenol	ug/l	ND	ND	ND	ND	NR	NR	NR
4-chloro-3-methylphenol	ug/l	ND	ND	ND	ND			
2,4,6-trichlorophenol	ug/l	ND	ND	ND	ND	200	200	NR
2,4-dinitrophenol	ug/l	ND	ND	ND	ND			
4-nitrophenol	ug/l	ND	ND	ND	ND			
2-metyl-4,6-dinitrophenol	ug/l	ND	ND	ND	ND			
pentachlorophenol	ug/l	ND	ND	ND	ND			
Fecal Coliform	CFU/1ML	6400	1800	4400	<1	free	NR	free
Total Coliform	CFU/1ML	14000	3000	26000	<1	see note 1	free	3/100 ml
Total count of Bacteria	CFU/1ML	950	2470	1490	10	HPC (free)	NR	<50 in 48 hr
Algae count	unit/ML	340	385	218	25			

Note ND = Not Detected

Table J3-1b: Darawo Sanitary Parameters (Drinking Water)

First Round

Parameter	units	Darawo WTP Intake	Darawo GW	Darawo Nile Intake	Darawo Finished Water	Standards		
						EPA	WHO	EGYPT
Alkalinity	ppm as $CaCO_3$	106	350	114	106			
pH		8.35	6.7	8.02	7.58	...	NR	6.5-9.2
Temperature	C	21	24	20	19.5	NR	acceptable	NR
Residual Chlorine	ppm				1			
Total Hardness	ppm as $CaCO_3$	106	320	100	96	NR	NR	500
Specific conductance	uS/cm	237	708	216	238			
Turbidity	NTU	2	0.5	0.94	1.25	<1	5	5
Color apparent	Hazen unit	<5	<5	<5	<5	15	15	<20-30
Color true	Hazen unit	<5	<5	<5	<5			
Odor Screen	Threshold odor No.	odorless	odorless	odorless	odorless	odor 3	acceptable	acceptable
Corrosivity	Saturation index	0.1	0	0	0			
Total Dissolved Solids	ppm	142	490	148	142	500	1000	1200
Total Suspended Solids	ppm	6	nil	102	6			
Total solids	ppm	148	490	250	148			
Total Organic Carbon	mg/l	2.336	0.382	2.284	2.312			
Chloride	ppm	10	65	10	11	250	250	500
Fluoride	ppm	0.38	0.33	0.32	0.38	4	1.5	0.8
Ammonia /N	ppm	nil	0.324	0.448	nil	NR	1.5	NR
Nitrite /N	ppm	nil	0.132	nil	nil	1	3 as NO_2	0.005
Nitrate /N	ppm	0.548	0.55	0.57	0.289	10	50 as NO_3	10
Sulfate	ppm	9	45	9	10	500	250	400
Phosphate	ppm	nil	0.224	nil	nil			
Surfactants (MBAS)								
Total Cyanide	ppm	nil	nil	nil	nil	0.2	0.07	0.05
BOD5	ppm							
COD	ppm							
Oil and Grease	ppm	nil	nil	nil	nil			
Phenols								
2-chlorophenol	ug/l	ND	ND	ND	ND	NR	NR	NR
phenol	ug/l	ND	ND	ND	ND			2
2-nitophenol	ug/l	ND	ND	ND	ND			
2,4-dimethylphenol	ug/l	ND	ND	ND	ND			
2,4-dichlorophenol	ug/l	ND	ND	ND	ND	NR	NR	NR
4-chloro-3-methylphenol	ug/l	ND	ND	ND	ND			
2,4,6-trichlorophenol	ug/l	ND	ND	ND	ND	200	200	NR
2,4-dinitrophenol	ug/l	ND	ND	ND	ND			
4-nitrophenol	ug/l	ND	ND	ND	ND			
2-metyl-4,6-dinitrophenol	ug/l	ND	ND	ND	ND			
pentachlorophenol	ug/l	ND	ND	ND	ND			
Fecal Coliform	CFU/1ML	1320	<1	2700	<1	free	NR	free
Total Coliform	CFU/1ML	4000	<1	11025	<1	see note 1	free	3/100 ml
Total count of Bacteria	CFU/1ML	300	15	8320	10	HPC (free)	NR	<50 in 48 hr
Algae count	unit/ML	550	1	550	35			

Note ND = Not Detected

Table J3-1c: Kom Ombo and Darawo Sanitary Parameters (Drinking Water)

Second Round

Parameter	units	Kom Ombo Nile Intake	Kom Ombo WTP Intake	Darawo Nile Intake	Darawo WTP Intake	Standards		
						EPA	WHO	EGYPT
Alkalinity	ppm as $CaCO_3$	128	118	114	116			
pH		7.72	7.74	7.31	7.75	...	NR	6.5-9.2
Temperature	C	15.4	14.7	15.1	15.4	NR	acceptable	NR
Residual Chlorine	ppm				0.95			
Total Hardness	ppm as $CaCO_3$	110	100	96	102	NR	NR	500
Specific conductance	uS/cm	256	254	201	220			
Turbidity	NTU	0.38	0.15	0.18	0.21	<1	5	5
Color apparent	Hazen unit	<5	<5	<5	<5	15	15	<20-30
Color true	Hazen unit	<5	<5	<5	<5			
Odor Screen	Threshold odor No.	odorless	odorless	odorless	odorless	odor 3	acceptable	acceptable
Corrosivity	Saturation index	0	0	0	0			
Total Dissolved Solids	ppm	172	168	124	140	500	1000	1200
Total Suspended Solids	ppm	12	6	8	8			
Total solids	ppm	184	174	132	148			
Total Organic Carbon	mg/l	1.579	1.459	1.43	1.408			
Chloride	ppm	18	9	10	15	250	250	500
Fluoride	ppm	0.24	0.21	0.22	0.23	4	1.5	0.8
Ammonia /N	ppm	0.165	0.152	0.188	0.2	NR	1.5	NR
Nitrite /N	ppm	0.0179	0.0155	0.0141	0.02	1	3 as NO_2	0.005
Nitrate /N	ppm	nil	nil	nil	nil	10	50 as NO_3	10
Sulfate	ppm	12.5	10	9	9.5	500	250	400
Phosphate	ppm	0.0134	0.0034	0.0163	0.0134			
Total Cyanide	ppm	nil	nil	nil	nil	0.2	0.07	0.05
BOD5	ppm							
COD	ppm							
Oil and Grease	ppm	ND	ND	0.2	0.6			
Phenols								
2-chlorophenol	ug/l	ND	ND	ND	ND	NR	NR	NR
phenol	ug/l	ND	ND	ND	ND			2
2-nitophenol	ug/l	ND	ND	ND	ND			
2,4-dimethylphenol	ug/l	ND	ND	ND	ND			
2,4-dichlorophenol	ug/l	ND	ND	ND	ND	NR	NR	NR
4-chloro-3-methylphenol	ug/l	ND	ND	ND	ND			
2,4,6-trichlorophenol	ug/l	ND	ND	ND	ND	200	200	NR
2,4-dinitrophenol	ug/l	ND	ND	ND	ND			
4-nitrophenol	ug/l	ND	5.81	ND	ND			
2-metyl-4,6-dinitrophenol	ug/l	ND	ND	ND	ND			
pentachlorophenol	ug/l	ND	8.199	ND	ND			
Fecal Coliform	CFU/1ML	400	100	500	460	free	NR	free
Total Coliform	CFU/1ML	1000	200	1300	1400	see note 1	free	3/100 ml
Total count of Bacteria	CFU/1ML	9040	2840	6600	6200	HPC (free)	NR	<50 in 48 hr
Algae count	unit/ML	360	225	270	900			

Note ND = Not Detected

Table J3-1d: Kom Ombo and Darawo Sanitary Parameters (Drinking Water) Third Round

Parameter	units	Kom Ombo Nile Intake	Kom Ombo WTP Intake	Darawo Nile Intake	Darawo WTP Intake	Standards EPA	WHO	EGYPT
Alkalinity	ppm as $CaCO_3$	130	118	112	112			
pH		8.16	8.14	8.08	7.99	...	NR	6.5-9.2
Temperature	C	15.4	14.7	15.1	15.4	NR	acceptable	NR
Residual Chlorine	ppm							
Total Hardness	ppm as $CaCO_3$	106	102	96	96	NR	NR	500
Specific conductance	uS/cm	340	308	256	256			
Turbidity	NTU	2.6	1.6	0.8	2.8	<1	5	5
Color apparent	Hazen unit	<5	<5	<5	<5	15	15	<20-30
Color true	Hazen unit	<5	<5	<5	<5			
Odor Screen	Threshold odor No.	odorless	odorless	odorless	odorless	odor 3	acceptable	acceptable
Corrosivity	Saturation index	0	0	0	0			
Total Dissolved Solids	ppm	221	200.2	166.4	166.4	500	1000	1200
Total Suspended Solids	ppm	4	2	2	2			
Total solids	ppm	225	202.2	168.4	168.4			
Total Organic Carbon	mg/l	2.715	2.593	2.68	2.549			
Chloride	ppm	14	13	8	9	250	250	500
Fluoride	ppm	0.3	0.25	0.38	0.36	4	1.5	0.8
Ammonia /N	ppm	0.251	0.253	0.112	0.097	NR	1.5	NR
Nitrite /N	ppm	0.009	0.1	0.15	0.16	1	3 as NO_2	0.005
Nitrate /N	ppm	0.456	0.292	0.082	0.107	10	50 as NO_3	10
Sulfate	ppm	12	10	9	9.5	500	250	400
Phosphate	ppm	0.016	0.02	0.006	0.009			
Total Cyanide	ppm	nil	nil	nil	nil	0.2	0.07	0.05
BOD5	ppm							
COD	ppm							
Oil and Grease	ppm	ND	0.5	0.2	0.67			
Phenols								
2-chlorophenol	ug/l	ND	ND	ND	ND	NR	NR	NR
phenol	ug/l	1.69	ND	ND	ND			2
2-nitophenol	ug/l	ND	ND	ND	ND			
2,4-dimethylphenol	ug/l	1.5	ND	ND	ND			
2,4-dichlorophenol	ug/l	ND	ND	ND	ND	NR	NR	NR
4-chloro-3-methylphenol	ug/l	ND	ND	ND	ND			
2,4,6-trichlorophenol	ug/l	ND	ND	ND	ND	200	200	NR
2,4-dinitrophenol	ug/l	ND	ND	ND	ND			
4-nitrophenol	ug/l	2.72	ND	ND	ND			
2-metyl-4,6-dinitrophenol	ug/l	ND	ND	ND	ND			
pentachlorophenol	ug/l	ND	ND	ND	ND			
Fecal Coliform	CFU/1ML	1150	200	450	1100	free	NR	free
Total Coliform	CFU/1ML	2400	1000	1800	2600	see note 1	free	3/100 ml
Total count of Bacteria	CFU/1ML	1200	4920	1600	2000	HPC (free)	NR	<50 in 48 hr
Algae count	unit/ML	60	50	30	50			

Note ND = Not Detected

Table J3-1e: Nasr City Sanitary Parameters (Drinking Water) First Round

Parameter	units	Nasr City Water	Standards		
			EPA	WHO	EGYPT
Alkalinity	ppm as $CaCO_3$	110			
pH		7.5	...	NR	6.5-9.2
Temperature	C	20.4	NR	acceptable	NR
Residual Chlorine	ppm	0.9			
Total Hardness	ppm as $CaCO_3$	102	NR	NR	500
Specific conductance	uS/cm	238			
Turbidity	NTU	0.9	<1	5	5
Color apparent	Hazen unit	<5	15	15	<20-30
Color true	Hazen unit	<5			
Odor Screen	Threshold odor No.	odorless	odor 3	acceptable	acceptable
Corrosivity	Saturation index	-0.1			
Total Dissolved Solids	ppm	136	500	1000	1200
Total Suspended Solids	ppm	12			
Total solids	ppm	148			
Total Organic Carbon	mg/l	2.447			
Chloride	ppm	12	250	250	500
Fluoride	ppm	0.42	4	1.5	0.8
Ammonia /N	ppm	0.03	NR	1.5	NR
Nitrite /N	ppm	nil	1	3 as NO_2	0.005
Nitrate /N	ppm	0.558	10	50 as NO_3	10
Sulfate	ppm	10	500	250	400
Phosphate	ppm	nil			
Surfactants (MBAS)					
Total Cyanide	ppm	nil	0.2	0.07	0.05
BOD5	ppm				
COD	ppm				
Oil and Grease	ppm	nil			
Phenols					
2-chlorophenol	ug/l	ND	NR	NR	NR
phenol	ug/l	ND			2
2-nitophenol	ug/l	ND			
2,4-dimethylphenol	ug/l	ND			
2,4-dichlorophenol	ug/l	ND	NR	NR	NR
4-chloro-3-methylphenol	ug/l	ND			
2,4,6-trichlorophenol	ug/l	ND	200	200	NR
2,4-dinitrophenol	ug/l	ND			
4-nitrophenol	ug/l	ND			
2-metyl-4,6-dinitrophenol	ug/l	ND			
pentachlorophenol	ug/l	ND			
Fecal Coliform	CFU/1ML	<1	free	NR	free
Total Coliform	CFU/1ML	<1	see note 1	free	3/100 ml
Total count of Bacteria	CFU/1ML	15	HPC (free)	NR	<50 in 48 hr
Algae count	unit/ML	20			

Note ND = Not Detected

Table J3-2: Sanitary Parameters (Egyptian Sugar and Distillation wastewater effluent)

Parameter	units	Egyptian Sugar and Distilation Effluent	Standards	
			Potable Water Ways	Non-potable Water Ways
Sanitary Parameter				
Alkalinity	ppm as $CaCO_3$	108		
pH		6.74	"6-9	"6-9
Temperature	C	35.5	35	35
Residual Chlorine	ppm			
Total Hardness	ppm as $CaCO_3$	116		
Specific conductance	uS/cm	272		
Turbidity	NTU	9.5		
Color apparent	Hazen unit	60	free	free
Color true	Hazen unit	8	free	free
Odor Screen	Threshold odor No.	oderless		
Corrosivity	Saturation index	-1.1		
Total Dissolved Solids	ppm	254	800	2000
Total Suspended Solids	ppm	18	30	50
Total solids	ppm	272		
Total Organic Carbon	mg/l	49.915		
Chloride	ppm	14		
Fluoride	ppm	0.3	0.5	...
Ammonia /N	ppm	0.443		
Nitrite /N	ppm	nil		
Nitrate /N	ppm	0.46	30	50
Sulfate	ppm	14.5	1	1
Phosphate	ppm	nil	1	...
Surfactants (MBAS)				
Total Cyanide	ppm	nil		...
BOD5	ppm		20	60
COD	ppm	245.5	30	80
Oil and Grease	ppm	480	5	10
Phenols				
2-chlorophenol	ug/l	ND		
phenol	ug/l	ND	0.001	....
2-nitophenol	ug/l	ND		
2,4-dimethylphenol	ug/l	ND		
2,4-dichlorophenol	ug/l	ND		
4-chloro-3-methylphenol	ug/l	ND		
2,4,6-trichlorophenol	ug/l	ND		
2,4-dinitrophenol	ug/l	ND		
4-nitrophenol	ug/l	ND		
2-metyl-4,6-dinitrophenol	ug/l	ND		
pentachlorophenol	ug/l	ND		
Fecal Coliform	CFU/100ML	$3.5 * 10^9$		
Total Coliform	CFU/100ML	$4 * 10^9$		
Total count of Bacteria	CFU/100ML	$10.9 * 10^7$	2500 MPN	5000 MPN
Algae count	unit/ML	335		
Nematodes	unit/L		NON	

Note ND = Not Detected

Table J3-3a: Kom Ombo Organic Parameters (Drinking water)

Parameter	units	Kom Ombo	Kom Ombo	Kom Ombo	Standard		
		WTP intake	Nile Intake	New WTP Intake	EPA	WHO	EGYPT
EDB/DBCP (method 504)							
1,2-Dibromoethane	ug/l	ND	ND	ND			
1,2-Dibromo-3-chloropropane	ug/l	ND	ND	ND	0.2	1	1
1,2,3-Trichloropropane	ug/l						
Pesticides (method 608)							
Alpha BHC	ug/l	ND	ND	ND			
Beta BHC	ug/l	ND	ND	ND			
Gama BHC	ug/l	ND	ND	ND			
Delta BHC	ug/l	ND	ND	ND			
Heptachlor	ug/l	ND	ND	ND	0.4	0.03	NR
Aldrin	ug/l	ND	ND	ND	NR	0.03	0.03
Heptachlorepoxide	ug/l	ND	ND	ND	0.2	0.03	NR
Endosulfan-1	ug/l	ND	ND	ND			
DDE	ug/l	ND	ND	ND			
Dieldrin	ug/l	ND	ND	ND	NR	0.03	0.03
Endrin	ug/l	ND	ND	ND	2	NR	NR
Endosulfan -2	ug/l	ND	ND	ND			
DDD	ug/l	ND	ND	ND			
Endrinaldehyde	ug/l	ND	ND	ND			
Endosulfansulfate	ug/l	ND	ND	ND			
DDT	ug/l	ND	ND	ND	NR	2	2
Methoxychlor	ug/l	ND	ND	ND	40	20	20
Endrinketon	ug/l	ND	ND	ND			
Toxaphene	ug/l	ND	ND	ND	5	NR	NR
Chlordane	ug/l	ND	ND	ND	2	0.2	0.2
Hexachlorobenzene	ug/l						
Hexachlorocyclopentadiene	ug/l				50	NR	NR
Aroclor 1221							
Aroclor 1232							
Aroclor 1242/1016							
Aroclor 1248							
Aroclor 1254							
Aroclor 1260							
Herbicides (method 6640 B)							
2,4 - D	ug/l	ND	ND	ND	70	30	30
2,4,5 - TP (Silvex)	ug/l	ND	ND	ND	50	NR	NR
2,4,5 -T	ug/l	ND	ND	ND	NR	9	9
Total	ug/l						
Triazine Pesticide (method 619)		ND	ND	ND			
Simazine	ug/l	ND	ND	ND	4	2	2
Atrazine	ug/l	ND	ND	ND	3	2	2
Prometon	ug/l	ND	ND	ND			
Propazine	ug/l	ND	ND	ND			
Ametryn	ug/l	ND	ND	ND			
Prometryn	ug/l	ND	ND	ND			
Terbutryn	ug/l	ND	ND	ND			

Note ND = Not Detected NR = Not Required

Table J3-3a: Kom Ombo Organic Parameters (Drinking water) (continued)

Parameter	units	Kom Ombo WTP Intake	Kom Ombo Nile Intake	Kom Ombo New WTP Intake	Standard EPA	WHO	EGYPT
Pesticides.PCBs (method 505)					0.5	NR	NR
PCB - 1221	ug/l	ND	ND	ND			
PCB - 1016	ug/l	ND	ND	ND			
PCB - 1232	ug/l	ND	ND	ND			
PCB - 1242	ug/l	ND	ND	ND			
PCB - 1254	ug/l	ND	ND	ND			
PCB - 1248	ug/l	ND	ND	ND			
PCB - 1260	ug/l	ND	ND	ND			
Carbamates pesticides							
Aldicarbsulfoxide	ug/l	ND	ND	ND	4	NR	NR
Aldicarbsulfone	ug/l	ND	ND	ND	2	NR	NR
Oxamyl	ug/l	ND	ND	ND	NR	NR	200
Methomyl	ug/l	ND	ND	ND			
3-Hydroxycarbofuran	ug/l	ND	ND	ND			
Aldicarb	ug/l	ND	ND	ND	3	10	10
Propoxur	ug/l	ND	ND	ND			
Carbofuran	ug/l	ND	ND	ND	40	5	5
Carbaryl	ug/l	ND	ND	ND			
Methiocarb	ug/l	ND	ND	ND			
Herbicides (method 515.1)							
Bentazon					NR	30	30
Dalapon					200	NR	NR
2,4-DB					NR	90	90
Dichloroprop					NR	100	100
Dinoseb					7	NR	NR
MCPA					NR	2	2
Mecoprop (MCPP)					NR	10	10
Herbicides (method 525.2)							
Alachlor (Lasso)					2	20	20
Metolachlor					100	10	10
Molinate					NR	6	6
Pendimethalin					NR	20	20
cis- Permethrin					NR	20	20
trans- Permethrin					NR	20	20
Propanil					NR	20	20
Trifluralin					5	20	20
Pesticides (method 547)							
Glyphosate					700	NR	NR
Pesticides (method 548.1)							
Endothall					100	NR	NR
Pesticides (method 549.1)							
Diquat					20	NR	NR

Note ND = Not Detected NR = Not Required

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Table J3-3b: Darawo Organic Parameters (Drinking water)

Parameter	units	Darawo	Darawo	Standard			
		WTP Intake	Nile Intake	EPA	WHO	EGYPT	EGYPT
EDB/DBCP (method 504)							
1,2-Dibromoethane	ug/l	ND	ND				
1,2-Dibromo-3-chloropropane	ug/l	ND	ND	0.2	1	1	1
1,2,3-Trichloropropane	ug/l						
Pesticides (method 608)							
Alpha BHC	ug/l	ND	ND				
Beta BHC	ug/l	ND	ND				
Gama BHC	ug/l	ND	ND				
Delta BHC	ug/l	ND	ND				
Heptachlor	ug/l	ND	ND	0.4	0.03	NR	NR
Aldrin	ug/l	ND	ND	NR	0.03	0.03	0.03
Heptachlorepoxide	ug/l	ND	ND	0.2	0.03	NR	NR
Endosulfan-1	ug/l	ND	ND				
DDE	ug/l	ND	ND				
Dieldrin	ug/l	ND	ND	NR	0.03	0.03	0.03
Endrin	ug/l	ND	ND	2	NR	NR	NR
Endosulfan -2	ug/l	ND	ND				
DDD	ug/l	ND	ND				
Endrinaldehyde	ug/l	ND	ND				
Endosulfansulfate	ug/l	ND	ND				
DDT	ug/l	ND	ND	NR	2	2	2
Methoxychlor	ug/l	ND	ND	40	20	20	20
Endrinketon	ug/l	ND	ND				
Toxaphene	ug/l	ND	ND	5	NR	NR	NR
Chlordane	ug/l	ND	ND	2	0.2	0.2	0.2
Hexachlorobenzene	ug/l						
Hexachlorocyclopentadiene	ug/l			50	NR	NR	NR
Aroclor 1221							
Aroclor 1232							
Aroclor 1242/1016							
Aroclor 1248							
Aroclor 1254							
Aroclor 1260							
Herbicides (method 6640 B)							
2,4 - D	ug/l	ND	ND	70	30	30	30
2,4,5 - TP (Silvex)	ug/l	ND	ND	50	NR	NR	NR
2,4,5 -T	ug/l	ND	ND	NR	9	9	9
Total	ug/l						
Triazine Pesticide (method 619)							
Simazine	ug/l	ND	ND	4	2	2	2
Atrazine	ug/l	ND	ND	3	2	2	2
Prometon	ug/l	ND	ND				
Propazine	ug/l	ND	ND				
Ametryn	ug/l	ND	ND				
Prometryn	ug/l	ND	ND				
Terbutryn	ug/l	ND	ND				

Note ND = Not Detected

Table J3-3b: Darawo Organic Parameters (Drinking water) (continued)

Parameter	units	Darawo WTP Intake	Darawo Nile Intake	Standard			
				EPA	WHO	EGYPT	EGYPT
Pesticides.PCBs (method 505)				0.5	NR	NR	NR
PCB - 1221	ug/l	ND	ND				
PCB - 1016	ug/l	ND	ND				
PCB - 1232	ug/l	ND	ND				
PCB - 1242	ug/l	ND	ND				
PCB - 1254	ug/l	ND	ND				
PCB - 1248	ug/l	ND	ND				
PCB - 1260	ug/l	ND	ND				
Carbamates pesticides							
Aldicarbsulfoxide	ug/l	ND	ND	4	NR	NR	NR
Aldicarbsulfone	ug/l	ND	ND	2	NR	NR	NR
Oxamyl	ug/l	ND	ND	NR	NR	200	200
Methomyl	ug/l	0.522	ND				
3-Hydroxycarbofuran	ug/l	ND	ND				
Aldicarb	ug/l	ND	ND	3	10	10	10
Propoxur	ug/l	ND	ND				
Carbofuran	ug/l	ND	ND	40	5	5	5
Carbaryl	ug/l	ND	ND				
Methiocarb	ug/l	ND	ND				
Herbicides (method 515.1)							
Bentazon				NR	30	30	30
Dalapon				200	NR	NR	NR
2,4-DB				NR	90	90	90
Dichloroprop				NR	100	100	100
Dinoseb				7	NR	NR	NR
MCPA				NR	2	2	2
Mecoprop (MCPP)				NR	10	10	10
Herbicides (method 525.2)							
Alachlor (Lasso)				2	20	20	20
Metolachlor				100	10	10	10
Molinate				NR	6	6	6
Pendimethalin				NR	20	20	20
cis- Permethrin				NR	20	20	20
trans- Permethrin				NR	20	20	20
Propanil				NR	20	20	20
Trifluralin				5	20	20	20
Pesticides (method 547)							
Glyphosate				700	NR	NR	NR
Pesticides (method 548.1)							
Endothall				100	NR	NR	NR
Pesticides (method 549.1)							
Diquat				20	NR	NR	NR

Note ND = Not Detected NR = Not Required

Table J3-4: Disinfection Byproducts

Parameter	units	Kom Ombo				Standards		
		Finished Water	Distribution 1	Distribution 2	Distribution 3	EPA	WHO	EGYPT
Chloroform	ug/l	20.591	22.951	23.105	22.616		200	
Dichlorobromomethane	ug/l	11.019	12.58	12.334	12.181		60	
Dibromochloromethane	ug/l	4.231	5.169	4.831	4.864		100	
Bromoform	ug/l	ND	ND	ND	ND		100	
THM Total	ug/l	35.841	40.7	40.27	39.661	100		100

Parameter	units	Darawo				Standards		
		Finished Water	Distribution 1	Distribution 2	Distribution 3	EPA	WHO	EGYPT
Chloroform	ug/l	21.399	22.238	38.014	25.545		200	
Dichlorobromomethane	ug/l	11.441	11.633	17.284	13.479		60	
Dibromochloromethane	ug/l	4.541	4.494	5.839	5.035		100	
Bromoform	ug/l	ND	ND	ND	ND		100	
THM Total	ug/l	37.381	38.365	61.137	44.059	100		100

Parameter	units	Nasr City	Standards		
		Distribution 1	EPA	WHO	EGYPT
Chloroform	ug/l	24.679		200	
Dichlorobromomethane	ug/l	12.265		60	
Dibromochloromethane	ug/l	4.414		100	
Bromoform	ug/l	ND		100	
THM Total	ug/l	41.358	100		100

Table J3-5: Other Metals (Drinking Water)

Parameter	units	Kom Ombo WTP Intake	Kom Ombo Nile Intake	Kom Ombo New WTP Intake	Kom Ombo Finished Water	Standards		
						EPA	WHO	EGYPT
Sodium	mg/l	18.7	20.6	19.1	18.9	NR	200	200
Potassium	mg/l	5.1	4.9	5	5.1	NR	NR	NR
Magnesium	mg/l	9.6	9.6	9.6	9.6	NR	NR	NR
Manganese	mg/l	ND	ND	ND	ND	0.2	0.5	0.1
Copper	mg/l	0.00152	ND	ND	0.00247	1.3	2	1
Iron	mg/l	0.3	0.1	0.1	0.1	0.3	0.3	0.3
Zinc	mg/l	0.03	0.04	0.04	0.19	2	3	5
Aluminum	mg/l	0.4	0.1	0.1	0.3	0.05-0.2	0.2	0.2
Calcium	mg/l	24.8	26.4	25.6	24	NR	NR	200

Note ND = Not Detected Note NR = Not Recommended

Parameter	units	Darawo Nile Intake	Darawo WTP Intake	Darawo GW	Darawo Finished Water	Standards		
						EPA	WHO	EGYPT
Sodium	mg/l	15.6	16	63.5	15.9	NR	200	200
Potassium	mg/l	4.9	4.9	5.1	4.9	NR	NR	NR
Magnesium	mg/l	9.6	12	43.2	8.64	NR	NR	NR
Manganese	mg/l	ND	0.06	0.75	ND	0.2	0.5	0.1
Copper	mg/l	ND	ND	ND	ND	1.3	2	1
Iron	mg/l	0.1	0.5	0.1	0.1	0.3	0.3	0.3
Zinc	mg/l	0.04	0.08	0.05	0.03	2	3	5
Aluminum	mg/l	0.1	0.4	0.1	0.2	0.05-0.2	0.2	0.2
Calcium	mg/l	24	20	56	24	NR	NR	200

Note ND = Not Detected Note NR = Not Recommended

Parameter	units	Nasr City Water	Standards		
			EPA	WHO	EGYPT
Sodium	mg/l	17.6	NR	200	200
Potassium	mg/l	5.1	NR	NR	NR
Magnesium	mg/l	9.6	NR	NR	NR
Manganese	mg/l	ND	0.2	0.5	0.1
Copper	mg/l	0.00114	1.3	2	1
Iron	mg/l	0.1	0.3	0.3	0.3
Zinc	mg/l	0.11	2	3	5
Aluminum	mg/l	0.1	0.05-0.2	0.2	0.2
Calcium	mg/l	24.8	NR	NR	200

Note ND = Not Detected
Note NR = Not Recommended

Table J3-6: Other Metals (Egyptian Sugar and Distillation wastewater effluent)

Parameter	units	Egyptian Sugar and Distilation Effluent	Standards	
			Potable Water Ways	Non-potable Water Ways
Sodium	mg/l	21.5		
Potassium	mg/l	8.1		
Magnesium	mg/l	11.04		
Manganese	mg/l	0.07	0.05	
Copper	mg/l	0.038	1	
Iron	mg/l	0.1	1	
Zinc	mg/l	0.06	1	
Aluminum	mg/l	0.5		
Calcium	mg/l	28		

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Table J3-7: Radiactive Parameters

Parameter	units	Groundwater Darawo	Standards		
			EPA	WHO	EGYPT
Gross Alpha	PCi/L	0.357+/-0.0998	15 PCi/L	0.1 Bq/L	0.1 uCurie/L
Gross Beta	PCi/L	UDL	4 mrem	1 Bq/L	1 uCurie/L

Appendix J4

Based on the discussion in Section 2.4.4 concerning the methodology to relate the heavy metals concentrations in sediment to water quality parameters, the following approach was suggested. This approach will be illustrated by taking the Antimony results as an example (see Table J4-1):

- Assume that each 0.39 ug of Antimony (Kom Ombo water treatment plant intake) is adhered to each gram of suspended solids in the water column, where the concentrations of the suspended solids is 25 mg/l.
- Multiplying 0.39 ug/g by 0.025 gm/l of suspended solids gives 0.00975 ug/l of Antimony in the water column.
- Comparing 0.00975 ug/l with WHO standards of 5 ug/l or USEPA of 6 ug/l shows very low concentrations of Antimony in the water column.

Table J4-1a: Heavy Metals in Kom Ombo WTP Intake Sediments

Parameter	WTP Intake Sediment ug/g	Nile Intake Sediment ug/g	New WTP Intake Sediment ug/g	Sediment Standards		WTP Intake mg/l	Nile Intake mg/l	New WTP Intake mg/l	Drinking Water Standards		
				NOAA Soil	EC Soil				EGYPT	WHO	USEPA
Suspended solids						22	158	50			
Antimony	0.39	0.29	0.45	NA		0.00858	0.04582	0.0225	NR	5	6
Arsenic	0.63	1.14	0.32	33-85		0.01386	0.18012	0.016	50	10	50
Barium	0.27	0.45	0.27	NA		0.00594	0.0711	0.0135	NR	700	2000
Beryllium	1.95	1.2	ND	NA		0.0429	0.1896	0	NR	NR	1
Cadmium	0.105	0.103	ND	5-9	1-3	0.00231	0.016274	0	5	3	5
Chromium	44	41	ND	80-145	NA	0.968	6.478	0	50	50	100
Lead	7.5	6.5	1.9	35-110	50-300	0.165	1.027	0.095	50	10	0
Mercury	*0.08*	*0.02*	*0.05*	*0.15-1.3*	*1-1.5*	*0.00176*	*0.00316*	*0.0025*	*1*	*1*	2
Nickel	36.12	64.1	0.332	30-50	30-75	0.79464	10.1278	0.0166	NR	20	100
Silver	0.19	0.04	ND			0.00418	0.00632	0	NR	NR	NR
Selenium	0.27	0.34	0.3	NA		0.00594	0.05372	0.015	10	10	50
Thallium	20	10	ND			0.44	1.58	0	NR	NR	2

Note ND = Not Detected NR = Not Required

Table J4-1b: Heavy Metals in Darawo WTP Intake Sediments

Parameter	WTP Intake Sediment ug/g	Nile Intake Sediment ug/g	Sediment Standards		WTP Intake mg/l	Nile Intake mg/l	Drinking Water Standards			
			NOAA Soil	EC Soil			EGYPT	WHO	USEPA	USEPA
Suspended solids					6	102				
Antimony	0.58	0.37	NA		0.01276	0.05846	NR	5	6	6
Arsenic	1.38	0.71	33-85		0.03036	0.11218	50	10	50	50
Barium	0.53	0.41	NA		0.01166	0.06478	NR	700	2000	2000
Beryllium	0.8	0.4	NA		0.0176	0.0632	NR	NR	1	1
Cadmium	0.03	0.035	5-9	1-3	0.00066	0.00553	5	3	5	5
Chromium	0.35	0.14	80-145	NA	0.0077	0.02212	50	50	100	100
Lead	10.3	7.3	35-110	50-300	0.2266	1.1534	50	10	0	0
Mercury	0.05	0.05	0.15-1.3	1-1.5	0.0011	0.0079	1	1	2	2
Nickel	32.6	31	30-50	30-75	0.7172	4.898	NR	20	100	100
Silver	0.05	ND			0.0011	0	NR	NR	NR	NR
Selenium	0.47	0.29	NA		0.01034	0.04582	10	10	50	50
Thallium	20	10			0.44	1.58	NR	NR	2	2

Note ND = Not Detected NR = Not Required