PA-ABW-898

UNITED STATES GOVERNMENT

memorandum

DATE: 9 February 1987

REPLY TO ATTN OF: DR/PS, John C. Starnes, Mission Environmental Officer

SUBJECT: TALKHA COMBINED-CYCLE ADDITION (263-0196)
Environmental Assessment

TO: DR/ID, Azza I. El Abd

We have reviewed the Environmental Assessment Report of the Talkha Combined Cycle Power Plant Addition, prepared by Gilbert/Commonwealth International, dated December 1986. We concur that the proposed project offers substantial environmental advantages in comparison with other viable power generation alternatives.

The report indicates that the combined discharge of heated cooling water from the existing and proposed steam plants may result in moderate levels of environmental impact. We respectfully request that the following measures be taken to mitigate specific impacts:

1. A series of trash racks should be incorporated into the final design of the approach channel for the intake structure in order to reduce fish impingement.

2. Procedures should be developed to minimize the amount of chlorine used for biofouling control. Excessive chlorine residuals in the cooling water discharge may adversely affect aquatic life. The use of dechlorination chemicals and other alternatives to reducing the chlorine residual should be considered in the final design.

The Bureau Environmental Coordinator has delegated environmental clearance for this project to the Mission Environmental Officer. By this memorandum, I am advising that the environmental assessment has been reviewed and cleared.

cc: Dr. Stephen F. Lintner, ANE/PD/ENV

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ENVIRONMENTAL ASSESSMENT REPORT OF THE TALKHA COMBINED CYCLE POWER PLANT ADDITION

PREPARED ON BEHALF OF

EGYPTIAN ELECTRICITY AUTHORITY

FOR

USAID (GRANT NO. 263-0192)

BY:

GILBERT/COMMONWEALTH INTERNATIONAL, INC.

DECEMBER 1986

TABLE OF CONTENTS

Section	Title	Page
1.0	SUMMARY	1
2.0	PURPOSE	3
3.0	PROPOSED PROJECT AND ALTERNATIVES	3
3.1	Proposed Project and System Alternatives	4
3.1.1	General	4
3.1.2	Circulating Water System	5
3.1.3	Water & Wastewater Treatment Systems	6
3.2.	Power Generation Alternatives	8
3.3	No Action Alternative	8
4.0	AFFECTED ENVIRONMENT	8
4.1	General Site Environs	8
4.2	Damietta Branch, Nile River Shoreline Area	9
4.3	Damietta Branch, Nile River	9
4.3.1	Physical Characteristics and Hydrology	9
4.3.2	Water Quality Characteristics	10
4.3.3	Fisheries and Other Biota	11
5.0	ENVIRONMENTAL CONSEQUENCES	13
5.1	General	13
5.2	Effects on Water Quality	14
5.2.1	Circulating Water System	14
5.2.2	Low Volume Waste Streams	15
5.3	Effects on Aquatic Biota	16
5.3.1	Impingement	16
5.3.2	Entrainment	17
5.3.3	Thermal	18
5.3.4	Chemical	20
5.4	Other Effects	20
5.5	Unavoidable Adverse Effects	20
5.6	Commitment of Resources	20

6.0	BIBLIOGRAPHY	21
7.0	LIST OF PREPARERS	22
APPENDIX A.	ENVIRONMENTAL SCOPING REPORT	
APPENDIX B.	HANDOUT @ SCOPING MEETING	

LIST OF FIGURES

FIGURE NO.	TITLE
1	SITE LOCATION MAP
2	SITE PLOT PLAN
3	RIVER CROSS-SECTION AND HYDROLOGIC DATA.

LIST OF TABLES

TABLE NO.	TITLE
1	ESTIMATED COST SUMMARY FOR COOLING WATER ALTERNATIVES
2	WATER QUALITY DATA FOR DAMIETTA BRANCH
3	FISHES POTENTIALLY OCCURRING IN DAMIETTA BRANCH
4	TEMPERATURE SUMMARY FOR DAMIETTA BRANCH AND COOLING WATER DISCHARGES
5	WATER QUALITY STANDARDS FOR EGYPT
6	U.S. EPA NEW SOURCE PERFORMANCE STANDARDS FOR STEAM ELECTRIC PLANTS
7	RESEARCH DATA ON TEMPERATURE TOLERANCE OF SELECTED WARM WATER FISHES

SECTION 1.0

SUMMARY

In accordance with environmental procedures of the United States Agency for International Development (USAID), as set forth in 22 CFR 216, this Environmental Assessment addresses the potential environmental effects of the Egyptian Electricity Authority's (EEA) proposed Talkha Combined Cycle addition.

The project consists of upgrading the eight existing combustion turbine generators (8X24MW) at the existing Talkha Power Station complex, located on the west bank of the Damietta Branch, River Nile, and converting these units to combined cycle operation through the addition of heat recovery steam generators (HRSG's) and steam turbines. The upgrade and conversion would result in the utilization of waste heat from the existing turbines to produce an additional 110 MW (approx.) of generating capacity. No additional fuel consumption is required for the converted units. As such, the project is essentially an energy conservation effort with substantial savings in foreign exchange equivalent. The overall merits of the project have been previously reviewed by USAID (1986), and both EEA and USAID have given the project top priority.

The implementation of this project would result in no additional air pollution, and the proposed facilities are, for the most part, located on land presently dedicated to power generation (192 MW combustion turbine, 127,5 MW steam) therefore, previous environmental reviews of the project, particularly that conducted by Ebasco (1985), concluded that the major potential adverse environmental effect of the project is associated with the discharge of heated condenser cooling water to the Damietta Branch of the river Nile.

An Environmental Scoping Meeting attended by appropriate parties on December 13, 1986, addressed this and other environmental issues associated with the proposed project. The result of these foregoing activities provided the focus and scope of this assessment.

The major findings of this assessment are as follows:

- While the specific environmental effects of other currently viable power generation alternatives oil/gas fired steam plant, diesel units combustion turbine units cannot be assessed, the present project offers substantial environmental advantages of potential air pollution and fuel conservation.

- The use of a closed-cycle cooling system (cooling towers) as an alternative to the proposed once-through cooling system has been studied. Although natural draft towers were estimated to be the least cost option, their use was rejected on the basis of operational and maintenance considerations. The results of the present assessment indicates that substantial additional

protection of Nile River Biota would likely result from the use of a closed-cycle system. However, the present analysis suggests that detrimental effects resulting from the thermal discharge as proposed considered in conjunction with the thermal outfall from the existing steam units, would not be severe.

- The analysis of the combined thermal outfalls from average conditions, the river ambient temperature, would be increased by no more than 5 C, in accordance with applicable water quality standards for Egypt. Under occasional low flow conditions, which occur in winter, the 5 C limit may be exceeded.

- The combined thermal discharges are not likely to result in severe effects on Nile River fishes or other biota. However, more subtle detrimental effects may be evident, particularly as a result of elevated river temperature associated with low river flows in winter.

- The specific operational requirement for chlorination to control biofouling of the condenser and other cooling water system components, has not been established. However, the proposed system is capable of chlorine dosages potentially detrimental to organism near the outfall, particularly fishes resident in the plume in cooler months of the year.

In summary, the combined discharge of heated cooling water from the existing and proposed steam plants may result in moderate levels of environmental impact, as a result of the low flow conditions that occur during the winter months.

The following suggestions for further study and impact mitigation are made as a result of this assessment:

- Consideration should be given to conducting a review of existing river discharge data and other pertinent information prior to final design to more accurately determine the behavior of the thermal discharge plume under low river flow conditions, especially as related to recirculation potential.

- It appears advisable to conduct the necessary studies during early stages of operation to reduce to as low as practicable, concentrations of residual chlorine in the circulating water system in order to minimize potential ill effects and fishes and other aquatic organisms.

- In the absence of good reasons to the contrary, cultivated areas adjacent to the Nile River that would be disturbed from installation of the intake and discharge structures and associated piping should be restored to their pre-construction condition.

SECTION 2.0

PURPOSE

This Environmental Assessment is intended to address the potential environmental effects of the proposed Talkha Combined Cycle Plant addition in accordance with the U.S. Agency for International Development (USAID) procedures (22CFR216). The scope of this document was determined on the basic of previous environmental reviews and a formal Scoping Meeting held at Egyptian Electricity Authority (EEA) offices in Talkha on December 13, 1986 (see Appendix A).

Results of these foregoing activities, most notably an environmental review by Ebasco (1985), indicated that the only significant potential for adverse impact was related the thermal discharge to the Nile River. The plant facilities will be situated on land presently dedicated to power generation. Moreover, the project involves the recovery of exhaust heat from existing combustion gas turbines generators to produce electricity, and no additional fuel would be burned. Potentially significant adverse effects on resources other than the Nile are thus considered minimal, and they are not considered in detail in this assessment.

The need for the proposed project is well established, as outlined by USAID (1986). In brief, the project will provide approximately 110 mw of additional badly needed electrical generating capacity to Egypt, and also will help conserve domestic energy supplies, both of which are considered key elements to Egypt's economic growth and stability. The addition of equipment at the Talkha gas turbine plant to permit operation as a combined cycle plant, as represented by the proposed project, would provide an additional 830,000 MWH of electrical energy per year with no additional fuel consumption. Viewed as a substitute for alternative oil - fired generation, the combined cycle addition represents fuel savings of 1.8 million barrels per year with a foreign exchange equivalent of $27 million per year (assuming a price per barrel of $15). The Talkha project is considered a top priority project, both for the Government of Egypt and USAID (USAID, 1986)

SECTION 3.0

PROPOSED PROJECT AND ALTERNATIVES

The following subsection describes the proposed Talkha Combined Cycle Plant Addition, and two major alternatives:

1. Development of alternative means of generation.

2. The no action alternative.

Alternatives to the cooling water system type and design are also discussed, since potential adverse environmental impacts related to the thermal discharged have been identified as the issue of greatest concern.

3.1 PROPOSED PROJECT AND SYSTEM ALTERNATIVES

3.1.1 GENERAL

The proposed project consists of technical modifications to upgrade existing General Electric Frame 5 combustion turbine generators (8X24MW) at EEA's Talkha Power Station, and to convert these units to combined cycle operation by addition of an exhaust heat recovery system and a steam cycle representing an additional 100-110MW of electrical generating capacity. The Talkha Power Station complex is located on the west bank of the Damietta Branch, River Nile, about 1 km from Talkha; the city of El-Mansura lies opposite the station (Figure 1)

The technical modifications to upgrade the existing units will improve their efficiency, with no potential for adverse environmental impacts. The improved efficiency of the units resulting from this upgrade is thus viewed as a net positive impact both directly in terms of improved air quality, and indirectly as a result of net fuel savings. As such, this aspect of the project is not treated further in this Environmental Assessment.

The steam cycle addition proposed for Talkha involves the installation of eight heat recovery steam generators (HRSG's), one for each of the existing combustion turbines, to extract presently wasted heat from the turbine exhaust gases to produce steam. The steam output from the HRSG's will be combined in a header and directed to two (2) dedicated steam turbines generators, each rated at approximately 50MW. The completed combined cycle addition, to be operated as a base-load plant, will thus consist of two units (four HRSG's per unit), each rated at approximately 150 MW (100 MW gas turbine, 50 MW steam). The addition of the 100MW steam cycle involves no additional fuel consumption, since only waste heat from the existing units is utilized.

The conceptual arrangement of proposed facilities on the site is depicted on Figure 2. The major facilities associated with the project include the eight HRSG's placed adjacent to the existing combustion turbine units, a building to house the two steam turbine generators and appurtenances, water treatment facilities, and addition to the existing switchyard, and a water intake pumphouse and discharge structure located at the Nile River shoreline.

The proposed project facilities, except for water intake and discharge facilities, will occupy land already dedicated to power generation. In addition, no additional fuel will be consumed. Therefore, the major

direct interfaces of the proposed project with the environment are associated with the plant's circulating water system (condenser cooling system) and water /wastewater treatment systems.

3.1.2 CIRCULATING WATER SYSTEM

The proposed combined cycle addition features an open cycle (once-through) cooling water system wherein water is withdrawn from the Nile, passed through each of the combined cycle unit's main condensers, and discharged back to the river. Design circulating water flow is approximately 45,000 gpm, or 90,000 gpm (5.7 cu.m/s or 0.49 million cu.m/day) for both units combined. Upon passage through the condensers, the temperature of this circulating water will be increased by a maximum of 10 C.

As presently conceptualized, the intake water pumphouse is located on the Nile River shoreline, approximately 100m upstream from the intake channel serving the existing steam units at the power station (Figure 2). This location represents optimization for the standpoint of being located well upstream of the discharge structure (to avoid recirculation of heated water) and by minimizing the pipe run (about 600m) through the existing power plant complex. Main features of the intake structure include:

- Three (3) vertical travelling screens capable of automatic or manual operation and constructed of 3/8 inch (1.0 cm) mesh stainless steel cloth.
- A screen wash and debris handling system.
- Trash racks in front of the screens.
- Maximum approach velocity in the intake channel of 0.3 m/s (1 fps).
- Maximum through-screen velocity of 0.6 m/s (2fps).

Present plans call for placement of the circulating water discharge structure at or a short distance upstream from the discharge channel of the present steam generating units (Figure 2). The discharge structure has not yet been designed, but a concrete seal well - overflow type structure is planned.

Provisions for boiling control in the condenser and circulating water system include an Amertap system and a chlorination system. The chlorination system specified involves injection of gaseous chlorine into the circulating water system at the pumphouse. The system will be minimally capable of injecting chlorine for 30 minutes every eight hours

to achieve a minimum chlorine residual of 0.5 ppm at condenser outlet sampling points.

The proposed open-cycle circulating water system, as described above, was selected on the basis of an analysis of cooling water alternatives conducted by Sabbour Associates (1982). The study considered several open cycle cooling systems which involved upgrading cooling water tunnels being used for the existing steam plants at the site. All of these alternatives were rejected early in the study on the basis of technical difficulties of the upgrade itself and on the necessity to disrupt operations of the existing plant. Four other open-cycle alternatives were subjected to a more detailed technical and economic analysis (Cases I - IV, Table 1). The alternatives were distinguished on the basis of pipe routing (630m vs. 1250m) and discharge either to the nearby irrigation canal (El Sahel Canal) versus the Nile River. The proposed alternative (Table 1, Case III) reportedly was favored over other once-through schemes in view of its relatively low cost, and an apparent inability to obtain clearance from the Ministry of Irrigation to discharge into the canal.

A closed cycle cooling system involving the use of cooling towers was also considered by Sabbour (1982) for the Talkha combined cycle plant (Table 1). Reduction of the thermal loading on waterways and potential ill-effects on fish and other aquatic biota through the use of cooling towers was recognized as an advantage of using cooling towers. Natural draft towers were apparently the least cost cooling water option (Table 1). However, use of towers in place of the chosen once-through option was rejected on the basis of potential difficulties associated with necessary period maintenance and cleaning, the necessity for additional water treatment systems, and potential problems (eg protection of outdoor switchgear) associated with increased humidity caused by the towers (Sabbour Associates, 1982).

3.1.3 Water and Wastewater Treatment Systems

Facilities and equipment necessary to collect, treat, and dispose of all wastewater generated by the proposed plant are provided for in plant specifications. Pertinent aspects of the major systems involved are as follows:

Sewage Treatment System

- The sewage treatment plant specified for the Talkha plant consists of 3000 gallon (11.4 cubic meter) per day capacity extended aeration, actuated sludge facility designed to serve the combined cycle installation as well as the existing combined cycle service building. Sewage effluent will be of a quality that meets or exceeds applicable local standards.

Raw Water Treatment System

This system will produce coagulated and filtered water for the demineralizer plant, potable water supply, and other plant uses. Waste streams will be segregated and treated to minimize any adverse effect on the environment. As a minimum, clarifier blowdown will be discharged to a settling basin or tank prior to discharge, and chemical drains will be neutralized prior to discharge. Potentially hazardous chemical leaks or spills will be contained and isolated from water supplies and other plant discharge streams.

Demineralizer Plant

The demineralizer plant produces demineralized water, primarily for boiler feedwater. The demineralizer resins will be periodically regenerated using HCI and NaOH. The regenerante waste streams thus produced will be neutralized prior to discharge. Although the resultant waste stream contains relatively high dissolved solids content, the constituents are primarily those originating in the original raw water from the Nile.

process & equipment drainage

Process and equipment drainage provisions will include a drainable oil/water separator sufficient to treat potential oily waste streams from the lube oil storage area, equipment drains or floor drains. Oil thus recovered will be collected in drums for ultimate disposition.

chemical metal cleaning wastes

Chemical cleaning (eg, acid, alkaline washes) are periodically required for HRSG;s and other system components. Provisions will be made for storage, treatment and safe disposal of all waste streams generated in this process. It is currently proposed to use portable units for this activity.

Equipment and facilities provided on the site to treat such low volume waste streams as makeup pretreatment clarifier blowdown and filter backwash, demineralizer regenerante wastes, HRSG blowdown, and oily wastes will be designed to treat these wastes to levels consistent with U.S.EPA Standards.

3.2 POWER GENERATION ALTERNATIVES

A wide range of alternatives to the Talkha Combined Cycle addition to produce the needed power have been considered, and reviewed by USAID (1986).

To summarize, the only viable means of producing generating capacity equivalent to the Talkha Combined Cycle project, within a reasonable time period are a gas or oil-fired steam plant, gas turbine units, or diesel units. Relative to the proposed project, capital costs for these alternative would be higher for diesel units, comparable for a gas/oil fired units, and lower for gas turbine units. However, all would consume substantial quantities of fuel resulting in much higher total costs than the proposed plant. In addition, development of an gas/oil fired steam unit would require an additional 12 months beyond the 24 months required to implement the proposed project.

While environmental costs of these alternatives cannot be quantified, all would have adverse effects on air quality and accelerated depletion of natural resources (fuel). The steam plant alternative would also pose the potential for adverse effects on aquatic systems from the cooling water system.

3.3 NO ACTION ALTERNATIVE

Failure to provide additional generating capacity, as represented by this project, will exacerbate present shortfalls in available energy supply relative to current and projected demands in the Arab Republic of Egypt. Potential consequences of not implementing the project have been adequately discussed by USAID (1986).

SECTION 4.0

AFFECTED ENVIRONMENT

4.1 GENERAL SITE ENVIRONS

The immediate area surrounding the proposed combined cycle generating units, consists of the Talkha Power Station complex (Figure 2). The eight combustion turbine units (8X24 MW) situated near the west side of the complex, were installed in 1979. The existing steam electric units on the Talkha site consist of three 12.5 MW units placed in service in 1955-56 and three 30.0 MW units placed in service in 1966-67. A total of 319.5 MW of generating capacity is thus present on the site (192 MW gas turbine, 127.5 MW steam). EEA is currently considering the possibility of constructing a new gas/oil fired steam plant (2X210 MW) at the Talkha site, in addition to the proposed 100 MW combined cycle addition.

The cooling water system for the existing steam units consists of a water intake channel from the Nile, extending to an intake pumphouse on the power complex west of the road fronting the plant, and a simple discharge channel outfalling to the river downstream of the intake. Underground tunnels carry water to and from the generating units. The balance of the plant consists primarily of fuel storage tanks, water treatment facilities, electrical switchyards, office and colony facilities. An extremity of an irrigation canal (El-Sahel Canal) is located on the west side of the power complex, adjacent to the combustion turbine units (figure 3).

The general area surrounding the power complex is primarily semi-rural agricultural, with strip development along roadways. A major fertilizer plant is located within about 1 km, downstream (north) of the power complex, ammonia from the fertilizer plant and stack emission from the power plant complex are apparently the major industrial sources of air pollution in the area.

4.2 DAMIETTA BRANCH, NILE RIVER SHORELINE AREA.

The outlying areas of El-Mansura occupy the east bank of the Nile opposite the plant. Although the immediate shoreline area is relatively steep it supports natural vegetation. The shoreline area on the west bank consists of two terraces between the road fronting the power complex and the river (Figure 3). Most of the uppermost terrace and a portion of the lower terrace is cultivated, truck crops (e.g. lettuce) were predominant on the upper terrace during site inspections conducted on Dec. 9 and 13, 1986. Much of the lower terrace, and all of the immediate shoreline area near the plant, support dense stands of reeds (Phragmites), pinkweed (Polygonum sp.) and other herbaceous wetland vegetation.

4.3. DAMIETTA BRANCH, NILE RIVER

4.3.1 PHYSICAL CHARACTERISTICS AND HYDROLOGY

The Damietta Branch of the Nile at Talkha occupies a shallow, v-shaped channel. A cross-section of the river at km 145 in front of the Talkha Power Plant complex, together with river stage and discharge data, are provided in Figure 3.

The channel here is approximately 144 m wide, with a maximum depth of slightly less than 4 m at normal water surface elevation, corresponding, to gage height of about 1.6 m. The nearshore zone adjacent to the plant is relatively shallow (about 1.7 m depth) from the shoreline extending to about 50 m offshore, with the thalweg (deepest position of the channel) running east of the channel centerline. The channel itself is seasonably straight for a considerable distance downstream from the Talkha Plant.

River discharge in the lower Nile, including Damietta Branch, is controlled primarily at the Aswan High Dam, with secondary control of water levels and flow distribution accomplished by a series of barrages on the mainstem and gates associated with the extensive system of irrigation canals in the Nile Delta.

The Talkha plant is located near the head of a pool maintained by the barrage at Fariskur, roughly 70 km downstream. Current operations maintain minimum pool levels at Talkha at about 1.6 m (gage), with water levels decreasing as much as about 0.5 m below normal pool elevation during extreme low river flows. Maximum river surface elevation during recent high river flows were 2.2 m (gage) in June. (Figure 3). Proposals are reportedly being considered to raise normal pool elevation at Fariskur by 1.0 m to provide for river navigation in the pool. Definite seasonal variation in river discharge occurs in the Damietta Branch. Low flows, generally average 2-4 million cubic meters/day (extremes as low as 0.2 million cubic meters/day) occur during the winter months (November - March) with maximum discharge (average 8-10 million cubic meters/day) occurring in the June - August period (Figure 3)

General site observations on December 9 confirmed very low current velocities in the river. Flow information on Figure 3. were obtained from Ministry of Irrigation data for the barrage near El-Mansura, above the Talkha Plant.

4.3.2. Water Quality Characteristics

Available water quality data for the Damietta Branch, River Nile, at Talkha are provided in Table 2. The data indicate moderately alkaline conditions (pH, 8.3-8.4,. total alkalinity, 175 mg/l as $CaCO_3$). Dissolved solids concentrations are similarly moderate (TSS,224-246, conductivity, 240-360 umhos/cm). Dissolved oxygen and indicators organic loading (COD,BOD) are similarly not excessive. Suspended solids in the river apparently are elevated under higher river flows (range of turbidity values in Table 2: 1-25), but were observed to be relatively low during the December 9, 1986 site reconnaissance.

Studies conducted in 1979 as reported by El-Gohary et al (n.d.) documented some general deterioration in water quality proceeding downstream from the Aswan High Dam. The study concluded that while river quality is generally favorable for domestic, industrial, and agricultural purposes, water quality management was recommended, local sources of pollution were documented by the study. The Talkha fertilizer factory, located about 1km downstream from the power plant complex, was particularly cited as a pollutant source on the Damietta Branch, as evidenced particularly by high organic nitrogen (primarily ammonia) Nitrate, and phosphate values (El-Gohary,etal.,n.d.).

No data giving concentrations of potentially toxic trace metals or organic compounds in the river were available. However, Stone and Webster and ECG/CH2M Hill (1985) cite studies indicating high concentrations of cadmium and lead in the lower Nile.

According to recent measurements by EEA cooling water entering the Talkha plant, the average water temperature in the Damietta Branch at Talkha ranges from approximately 14 C. in December to 30 C. in August. The thermal discharge from the existing Talkha steam plants averages about 10c above the ambient river temperature. Cooling water discharge flow from the plant amounts to 84,500 gpm (0.46 million cubic meters/day). This outfall undoubtedly creates a thermal plume in the river, but no monitoring studies of the thermal outfall or its effects have been undertaken. However, no ill-effects from this discharge have been reported to EEA from pertinent ministries or the public.

No biocides (e.g. chlorine) are utilized in the condenser cooling water systems at the existing steam plants precluding any degradation of water quality from this source. Condensers at these plants are reportedly cleaned of debris manually during shutdowns about four times per year; biofouling of system components, if any, has apparently not posed any operational problems.

4.3.3 Fisheries and Other Biota

The nearshore zone of the Damietta Branch in the vicinity of the Talkha plant supports prolific growths of emergent and floating-leaf aquatic vascular plants, including bulrushes (Scirpus sp), and water hyacinth (Eichormia crassipes). Predominant submerged aquatic plants in the area, as evidenced by accumulations on trash racks across the existing cooling water intake channel, was the coontail (Cratophyllum sp.). Water hyacinth, coontail and water milfoil (Myriophyllum sp.) are reportedly the most common aquatic plants in the Nile River system. (Fayed, 1981 as cited by stone and webster etal, 1985). Local EEA operations personnel report that, in addition to coontail, water hyacinth presents a relatively severe clogging problem at the Talkha plant intake trash racks, particularly in the May-June, and January-February periods. Growths of water hyacinth are at nuisance proportions in much of the Nile system, necessitating use of chemical and mechanical control measures.

Some 115 species of fish have been recorded in the Nile River proper (Greenwood, 1976). Table 3 contains a list of some 44 fish species potentially occurring in the lower Nile, including the Damietta Branch, based on a review of accounts by Abdel-Latief (1974) and Copley (1952).

The tiger fishes especially Hydrocynus, and the nile perch or "Samoos" (Lates niloticus) are likely to be among the top carnivores present. Both of these fishes are valued for sport and as food. Hydrocynus reportedly

spawns through most of the year. Nile perch in Spawning condition have been observed in Lake Nasser from February through the summer. Other piscivorous fishes in the system include eel or "Hannash" (Angiulla) and catfishes of the families clariidae ("Kharmout") Schilbeiaal (e.g. "Shilba") Bagridae, and Synodontidal ("Shall"). The catfishes, which also prey on insects and crustaceans, are primarily bottom dwellers. They are generally summer spawners, spawn in nests, and provide parental care to their young. Both the eel and the catfishes are valued food fishes.

The elephant snout fishes (Mormyridae) are generally bottom feeders on crustaceans insect larvae, and small fish. Locally known representatives are "Gamhoor" and "Anooma". The mormyrids are summer spawners. Although used as food, they are apparently less valued than species mentioned above.

The barbus species likely to occur locally are also apparently bottom feeders. Among these cyprinids are "Lebis" (Lebis spp) and "Benni" (Barbus spp), both of which are spring and summer spawners and are highly valued food fish.

Tilapia, locally known as "Bolti" are among the most important of the local fish used for food, Tilapia, which apparently spawn through much of the year, build nests for spawning in the shallows, and are mouth-brooders. Tilapia are generally herbivorous.

Primary small forage species in the river probably include young characinids, including "Sardina" (Alestes nurse) and "Raya" (Alestes dentex, Alestes baremose). These smaller schooling species are taken as food and used as bait.

Sport, subsistence, and small commercial fishing operations are all active on the Damietta Branch at Talkha. Locally important species include "Bolti" "Shall" "Shilba", "Kharmout", "Raya" and "Sardina", according to Mr A.G.Selim, Fishery Resources Representative in the local governorate. The author noted most of the above species, freshwater eels, elephant-snout fish ("anooma"), and Labeo ("Lebeis") in Cairo fish markets in December, 1976. During the December site reconnaissance, both hook and line and netting operations were observed to be popular at the cooling water discharge from the Talkha Plant, where fish are apparently attracted in winter. The presence of small Laber ("Lebis") and alestes ("Sardina"and/or "Raya"), and a large speainen (est. 15-20kg) of Nile perch were confirmed at that location during sits observations. EEA plant officials confirmed that most fishing activity near the plant in the summer takes place upstream from the thermal discharge.

There appears to be no indication, either through direct observation or interviews with Mr. Selim, or El-Moahamedy Sayid Eid , EEA plant personnel or local fishermen that the river segment near Talkha constitutes particularly sensitive habitat for spawning nursery, or other

critical life functions. Mr. Selim did indicate that establishment of an in-river fish rearing facility for a fish species imported from China ("Mabruka") was planned at a location on the west bank of Damietta Branch, about 3 km. downstream from the Talkha Plant.

Present information also suggests that major fish migratory activity in this segment of the river is limited. Migratory activity by marine (anadromus) species is likely inhibited to some extent by the barrage at Fariskur. The presence of freshwater eels in the Nile at Cairo, however, indicates successful migration of adult eels to spawning grounds in the Mediterranean, and successful return of the young elvers to the Nile. This phenomenon is attributable to the fact that the elvers are able to move overland, even scaling vertical obstructions, on their migration upriver from the sea.

SECTION 5.0

ENVIRONMENTAL CONSEQUENCES

5.1 GENERAL

The environmental effects of the existing combustion turbine generating facilities at Talkha were assessed by Genelersun and Porter (1976) and by Gilbert/Commonwealth (n.d.). The generating facilities were subsequently constructed in compliance with a appropriate environmental standards. Based on current project plans and a review of environmental consideration by Ebasco (1985) the potential of significant impact from the proposed project is limited to cooling water discharge, in particular the thermal effluent from the plant.

A more thorough review of environmental aspects of the plant in the analysis presented herein addresses certain other potential impacts as well, primarily to present appropriate mitigation measures that can be readily implemented within the present design specifications for the project.

Although subsequent subsections of Section 4.0 deal primarily with potential adverse effects, it must be noted that the project, by its nature, will result in substantial positive environmental benefits over major power generation alternatives, primarily in the form of energy (fuel) conservation and production of electrical power without additional air pollution.

5.2 EFFECTS ON WATER QUALITY

5.2.1 CIRCULATING WATER SYSTEM

Potential adverse effects of the cooling water system proposed for the Talkha combined cycle addition stem from the addition of heat to the river, and from injection of chlorine as a biofouling control agent. No consumptive loss of water from the Nile would result from system operation, as would be the case with a closed-cycle cooling system, using evaporative cooling towers.

A summary of temperature changes potentially induced in the Damietta Branch as a result of plant operation is provided in Table 4. The analysis takes into account the continued operation of existing steam generating units at Talkha. The analysis also assumes full load conditions and a condenser delta-T of 10C for all units, except that the cooling water discharge from the proposed Talkha units were to be limited to a mximum discharge temperature of 35 C in accordance with local water quality standards reportedly applicable to the new project. Total cooling water flow for all units was assumed to be approximately 1.0 million cubic meters/day (0.49 and 0.46 million cubic meters/day for proposed and existing units, respectively). The analysis presented in Table 4 conservatively disregards temperature losses due to evaporation and conduction from the river. On the other hand, it is assumed that no recirculation of the cooling water discharge to the plant intakes would occur, even under extreme low flow conditions.

As noted in Table 4, average temperatures of the cooling water effluent from the combined plants (i.e. average maximal plume temperatures) can be expected to range from about 24 C in the winter months to 38 C in summer. maximum discharge temperatures are expected to be only slightly warmer.

The actual size of thermal plume resulting from full station operation was not as acertainable on the basis of existing information. However, the result of simple mass balance calculations using discharge data given in Figure 3. provide an approximation of the effect of thermal loading on the river after complete mixing and therefore provide some indication of thermal plume size. These calculations conservatively indicate that, on average, ambient river temperatures will not be increased by more other 1 C in summer or 5 C in winter. As such, the discharge would to a substantive degree be in accordance with applicable temperature standards for the Nile, which specify a temperature rise of no more than 5 C (See Table 5).

Results of these calculations using maximum river ambient temperature and minimum river discharge values indicate only slightly greater temperature increases during summer as compared to average condition. During the April-October period, when only 10-27% of the river

discharge is passed through the 2 condensers, it is clear that the thermal plume would be quite small; circulating water flow amount, on average, to 20-50% of the river low flow in the cooler months, and the thermal plume would be larger.

In the extreme winter condition, the analysis indicates that maximum temperature increases of up to 8 C could occur for short periods during extreme low river flows. During such periods, ambient river flows (Figure 3) are nearly equal, or in some cases less than, plant circulating water flow (about 1 million cubic meters/second). In such cases, the river is essentially a shallow, nearly stagnant pool. Under prolonged conditions of such severe flows, the thermal plume could encompass a large proportion of the river channel cross - section. In the extreme case, which is considered quite unlikely to occur, the situation becomes untenable both from operational and environmental points of view due to conditioned recirculation of heated discharge to the cooling water intake. In such cases, plant operations would necessarily be curtailed.

Such an extreme condition appears unlikely to occur based on present plant operating experience. It may be advisable however to assess the possible frequency during the early design stages by conducting a review of the historical river flow quantities during severe conditions.

Current specifications for the proposed Talkha plant call for a chlorination system capable of shock dosing the cooling water system for 30 miniutes three times per day to a level of 0.5 mg/l residual chlorine at the outlet to the condensers for biofouling control. The potential therefore exists of discharging total residual chlorine at levels near 0.5 mg/l.

In view of the potential ill-effects of such doses on aquatic life, current U.S. EPA standards specify discharge limits of no more than 0.2 mg/l for no more than 2 hours/day/unit (Table 6). Given the potential cost savings in reduced chlorine usage and the undemonstrated necessity for chlorination at these levels, consideration should be given to conducting a chlorination optimization study early in the plant operational phase with the objective of reducing chlorine discharges to practicably low levels.

5.2.2 Low Volume Waste Stream

As noted in section 3.1.3., pertinent low volume waste streams will be treated to levels consistent with U.S. EPA standards, included in the tabular summary in Table 6. As such, no significant adverse effects on water quality are foreseen. However, it would be desirable to confirm that adequate dilution water is available in El-Sahel Canal, if wastewater with high dissolved solids content (esp. demineralizer regenerant backward) is discharged into the canal and subsequently used for

irrigation: Dissolved solid hazard for irrigation water cited by U.S. EPA are as follows:

< 500 mg/l	: no detrimental effects
500-1000 mg/l	: can have detrimental effects on sensitive crops.
1000-2000 mg/l	: requires careful management practices.
2000-5000 mg/l	: can be used for tolerant plants on permeable soils with careful management.

Provisions for a new sewage treatment system sized to accommodate both the proposed facility and the existing combined cycle operations center is considered a net positive impact.

5.3 EFFECTS ON AQUATIC BIOTA

The main concern for potential adverse effects on aquatic biota from the proposed project, as indicated primarily by Ebasco (1985), are those resulting form thermal discharge from the plant. In addition to direct thermal effects, the following analysis also addresses potential for impingement of fish on the intake screens, entrainment of small organisms (eg. fish larvae) through the cooling system, and potential ill effects of chlorine (biocide) discharges. Treatment of these impact sources are justified in the present scope of the analysis, since they are to considerable extent influenced by thermal characteristics of the circulating water and the thermal discharge.

5.3.1 IMPINGEMENT

Any detailed predictive analysis of potential losses of fish due to impingement on intake screens at the proposed plant is not possible at the rudimentary conceptual design stage as presently exists. However, under normal conditions, no significant losses of fish from this phenomenon are expected. This conclusion is based on the following:

- No significant impingement problems are reported to occur to the present intake structure at Talkha.

- Although the specified approach velocity to the screens (30 cm/s) is higher than the 15 cm/s recommended by the U.S.fish and wildlife service for U.S. facilities, it is reportedly less than that existing at the present intake, and less than many older facilities in the U.S. where fish impingement losses are relatively low.

- Major migrations of juvenile fish, which are particularly vulnerable to impingement, are not expected to occur in this river segment.

On a more cautionary note, however, an intake structure with an approach channel such as presently exists at Talkha is generally considered poor design for fish impingement protection, especially where intake velocities are high, basically due to difficulties of fish in escaping these velocities when they are fatigued. It may be that the series of trash racks across the existing channel, designed in past to prevent entry miesance aquatic plants, acts as an effective behavioral barrier for fish.

The potential for fish impingement would be greatly increased if the thermal discharge were to be recirculated to the intake structure under low flow conditions in winter, when fish can be expected to congregate in the warm thermal plume. As noted, in section 5.2.1, this phenomenon is not considered to have a high likelihood of occurrence, but at least a rudimentary assessment of this potential appears to be warranted in the early design phase of the proposed project.

5.3.2 ENTRAINMENT

Entrainment of small, unscreenable aquatic organisms (most importantly fish larvae) through the circulating water system with consequent thermal, mechanical, and biocide (chlorine stresses is an impact common to all thermal power stations. The most practical and effective means of reducing entrainment losses is to ensure that the intake structure is located remote from sensitive spawning and nursery areas where large concentrations of fish larvae are likely to occur.

A review of life history information given by Abdel Latif (1974) and copley (1952) suggests that important fishes located in the Damietta Branch spawn in nests, and the young are generally not planktonic (free floating), so they are not highly susceptible to entrainment. Also, this segment of Damietta Branch is not known to contain unusually sensitive spawning habitat, based on general site observation of Dec. 9, 1986, and on conversations with Eng. A. G. Selim, Representative from Fishery Resources, and Dr. Abdel Latif, Vice President, Scientific Research Academy.

Entrainment is therefore not expected to constitute a significant adverse impact after operation of the Talkha plant. Based on research data complied by Jinks, Lauer, and Loftus (1981) fish larvae entrained in once-through cooling systems often exhibit survival rates greater than 50% so long as short-term thermal tolerance limits (commonly about 35C for larval of many warm-water fish species in the U.S.) are not exceeded.

5.3.3 THERMAL

Thermal discharges from power plants may result in adverse effects to aquatic biota in several distinct ways, to include: direct lethal effect from heat shock; a range of more subtle adverse effects of elevated temperatures, including changes in productivity alteration of species community composition and alteration of individual physiological functions; behavioral alterations; and cold shock. The following discussion addresses these various potential effects on joura of the Damietta Branch at Talkha, using as a basis the potential thermal alterations in the river as discussed previously in Section 5.2.1.

As a means of organizing this discussion, attention is first directed towards effects on those relatively immobile (sedentary) species comprising the community, to include algae and higher aquatic plants, worms insect larvae, molluses, and the like, all of which are functional components of the system and which are used as food by many of the fish species inhabiting the Nile (see section 4.3.3). During summer conditions it is apparent that the maximum thermal plume temperatures will be in the range of 37-38C, but river temperatures, after complete mixing would be increased by only 1-2 C (ie. to average of about 30 C; table 4), and the thermal plume is expected to be quite small. Since the upper limit for a balanced community of organisms is reportedly about 32 C (U.S.EPA, 1976), it is expected that the actual area within which any appreciable impact would occur would be quite small, as well.

During winter, the plume in all areas would be less than 32 C. While some semblance of community balance would be maintained, more subtle effects, (including changes in species composition) premature emergence of insects and subsequent mortality in cold ambient air, increased primary productive from algae and increased predation on these species by fish likely to be concentrated in the plume during this time. Such effects would be most evident in the nearshore shallows downstream from the discharge, perhaps for a considerable distance.

- A key element in considering potential effects of the thermal discharge on fish is the fact that they generally tend to remain in those waters exhibiting temperatures corresponding to their thermal preferenda. Therefore, fish will avoid potentially lethal temperatures at thermal outfalls such as may occur in summer, and will tend to congregate in heated zones in winter.

Little information is readily available on thermal tolerances of resident Nile fishes. However, data for warmwater fishes whose ranges include the southern U.S. at latitudes similar to the Talkha site are provided in Table 7. Data for three species of Tilapia, one (T. Zilli) native to the lower Nile, are also included. These data suggest that potentially lethal temperature for some Nile fishes at Talkha may range as low as 33-35 C. As such, maximum plume temperatures for the Talkha plant in summer may exceed this limit. However, the area so affected would be small, and would be avoided by fishes.

Preferred temperatures for some warmwater fishes commonly range up to 31-35 C (Table 7, part B). Therefore, it may be expected that fish will congregate in the thermal plume from the Talkha plant in the cooler months of the year, as presently occurs but to a considerably greater extent. This condition can result in a decrease in available food supply, deterioration in physiological condition, increased disease incident, and increased predation (by both humans and by piscivorous fishes) for fishes resident in the plume (U.S. EPA, 1976). A potentially reduced standing crop of fishes could therefore result. However, this phenomenon would not be expected to result in any significant reduction of fish populations in the Damietta Branch.

Table 7, part C provides recommended maximum temperature limits for growth, spawning, and embryo survival for selected warmwater fishes. A comparison of these limits with discharge and river temperature in Table 4 suggest that temperatures to which resident fishes would be subjected are suitable for growth and embryo survival, and that spawning reason could be somewhat extended for species occupying thermally altered areas.

Considering the minor changes in river temperatures likely to be present during the spring and fall period when fish are most active, no inhabitation of these movements are foreseen from the thermal discharge. No long distance migratory activity, aside from the catadromous freshwater eels, reportedly occurs through this segment of the river, and no ill-effects on this migratory movement are foreseen.

Cold shock has been observed to occur at some power plants when fish acclimated to the warm thermal plume in winter are suddenly subjected to cold ambient river water when the discharge ceases, as during a plant shutdown. However, the potential for even sub-lethal cold shock is unlikely at Talkha, since it is highly unlikely that all units would shut down at the same time. Moreover, a temperature drop of over 10 C would likely be required to induce lethal cold shock at ambient river temperature existing in the Damietta Branch, based on U.S. EPA (1976) data.

5.3.4 CHEMICAL EFFECTS

The only potential ill effects on aquatic biota from chemical constituents in the cooling water discharge from the proposed Talkha plant are those associated with use of chlorine as a biocide. Considering the currently recommended limit of 0.2 mg/l total residual chlorine by the U.S. EPA (Table 6) and the high susceptibility of fishes resident in the thermal plume in cooler months of the year, effort to reduce chlorine dosage to levels minimally needed for biofouling control is suggested.

5.4 OTHER EFFECTS

Although of minor consequence overall, it is pointed out that installation of the intake and discharge structures and associated piping will result in the disruption of fertile land presently devoted to agriculture by the local citizenry. In the interest of maintaining these areas fit for such use, consideration should be given to appropriate restoration of these areas following construction.

5.5 UNAVOIDABLE ADVERSE EFFECTS

Implementation of the Talkha Combined Cycle addition as proposed will result in some local deterioration of water quality in the Damietta Branch, River Nile, primarily from the discharge of heated effluent. Cooling system operation will also result in some losses of fish and other aquatic organisms from impingement on intake screens, entrainment within the circulating water, or more subtle phenomenon associated with thermal alteration of the river. Some disturbance to small parcels of local cropland near the river can be expected from installation of circulating water facilities. None of these effects are considered significant particularly in relation to the positive environmental effects associated with this project.

5.6 COMMITMENT OF RESOURCES

Natural resources committed to this project are represented primarily by the building materials used, including steel, concrete, aggregate and other such commodities, none of which are in short supply. Petroleum products required for fuel, lubricants, plastics and the like are also committed to this project. However, implementation of the project, by its nature, has a high conservation potential for natural gas and petroleum monetary resources committed to the project are adequately addressed by USAID (1986).

In relationship Between Short-Term Uses of the Environment and Long Term Productivity the project represents a favorable trade off between local and relatively moderate adverse effects on local water quality and aquatic biota in the Damietta Branch of the Nile River, and positive effects of providing badly needed power to Egypt while at the same time maximizing use of gas and oil resources. No impairment of long term productively is expected to result from implementation of this project.

SECTION 6.0

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SECTION 7.0

LIST OF PREPARERS

- Gregory C. DeCamp

  Aquatic Biologist/Environmental Specialist
  Gilbert/Commonwealth of Michigan, Inc.

  B.S. (Chemistry), Xavier Univ., Cincinnati, OH, USA.
  M.S. (Biology, Conc. in Ecology), Bowling Green State Univ., OH, USA.

- In cooperation with management and staff of :

  Egyptian Electricity Authority
  U.S. Agency for International Development (Cairo)
  Gilbert Associates (Middle East) SAE

Gilbert/Commonwealth International, Inc. engineers and consultants

P.O. Box 1498, Reading, Pennsylvania 19603/Telephone 215-775-2600, Cable Gilasoc/Telex 836-431

APPENDIX A

ENVIRONMENTAL SCOPING REPORT

Gilbert/Commonwealth International, Inc. engineers and consultants

P.O. Box 1498, Reading, Pennsylvania 19603/Telephone 215-775-2600, Cable Gilasoc/Telex 836-431

ENVIRONMENTAL SCOPING REPORT

RELATED TO

ENVIRONMENTAL ASSESSMENT

OF THE

TALKHA COMBINED CYCLE POWER PLANT ADDITION

(USAID GRANT NO. 263-0192)

PREPARED ON BEHALF OF :

EGYPTIAN ELECTRICITY AUTHORITY

BY

GILBERT/COMMONWEALTH INTERNATIONAL, INC

24

TABLE OF CONTENTS

INTRODUCTION AND SUMMARY

MEETING NOTES (ENGLISH)

ATTENDEES

DISCUSSION

MEETING NOTES (ARABIC)

ATTENDEES

DISCUSSION

ENVIRONMENTAL SCOPING DOCUMENT

INTRODUCTION AND SUMMARY

In accordance with USAID environmental procedures (22 CFR216.6) a formal Environmental Scoping Meeting related to the proposed Talkha combined cycle plant addition was held on December 13, 1986, in the offices of the Egyptian Electricity Authority (EEA) Lower Egypt Zone, Talkha. The purpose of the meeting was to inform representatives of pertinent government agencies and other appropriate parties about the project, and to identify the nature and significance of environmental issues of potential concern. Results of the meeting, in conjunction with previous environmental reviews, form the basis for an Environmental Assessment of the project.

An Environmental Scoping Document (copy attached) was distributed to all attendees prior to the meeting. Following initial introductions by Eng. Mahmoud Abdel Motaal, Chairman, EEA Lower Egypt Zone, a description of the project was provided by Mr. G. C. DeCamp, Gilbert/ Commonwealth, and Eng. Reefat El-Metwally, EEA Maintenance Manager of the Talkha Gas Turbine Plant. Discussion then ensued regarding potential environmental effects of the project. Concerns were focused on the potential effects of the cooling water system, in particular thermal effects on Nile River fisheries. However, it was concluded that the plant would be unlikely to result in significant adverse effects, especially in view of thermal limitation imposed on the plant discharge.

Eng. Metwally and Eng. A. H. Ramadan served as interpreters for the meeting, in addition to having a participatory role in the discussions.

MEETING NOTES (ENGLISH)

ATTENDEES:

- Eng. M. Abdel Motaal
  EEA Chairman, Delta Zone

- Gen. H. El-Saidy
  Gen. Sec. Dakhalia Governorate

- Eng. A. El-Shahawy
  Under Sec. Ministry of Agriculture, Dakhalia

- Mr. A. Metwally Abdel Aziz
  Chief of Batra Village

- Eng. Samir Fayek
  Deputy Director of Gen. Irrigation
  Department West Dakhalia

- Mr. Bahi El-Din Hegab
  Head of Region and Talkha City

- Dr. M. Seliman
  Health Planning Manager
  Dakhalia Health School

- Eng. A. Galal Selim
  Representative of Fishery Resources
  in Governorate

- Eng. M. Demian
  EEA network Gen. Inspector,
  Lower Egypt Zone

- Eng. R. Metwally
  EEA Maintenance Director for Talkha
  Gas Turbine Station.

- Eng. A. H. Ramadan
  Managing Director, Gilbert Associates ME. (SAE)

- Mr. Gregory C. DeCamp
  Environmental Specialist, Gilbert/Commonwealth, Inc.

DISCUSSION:

The Scoping Committee met at approximately 11:00 AM on December 13, 1986 in the office of Eng. M. Abdel Motaal, the Chairman of Lower Egypt Zone, in Talkha. The meeting consisted of providing a description of the proposed combined cycle project to outside participants, followed by a discussion of its potential impact on the environment. Highlights of the discussion are provided as follows:

- The new combined cycle project shall provide a generating power of capacity of 100MW over the present production of 200MW from Talkha gas turbines.

- The new additional power shall be produced without additional fuel consumption and will upgrade the economic efficiency of the present gas turbine plant from 25% to 46% by means of utilizing the flue gases from the gas turbines in heat recovery steam generating units in order to produce enough steam capacity to feed 2X50MW steam turbines.

- The representative of the Ministry of Irrigation informed the group that a rise in temperature of 5C that would occur from cooling water discharge from the new project would not affect agriculture at all. The Representative from the Ministry of Agriculture agreed with this statement.

- The Representative of Governorate for fishery resources confirmed the same with respect to fish in the Damietta Branch, Nile River.

- Mr. M. Abdel Motaal explained that research in the field of irrigation, agriculture, fishery resources and public health resulted in determination of the thermal pollution up to a limit of 5C are not likely to pose a severe impact on irrigation, agriculture, fishery resources or public health.

- A discussion was held between Eng. M. Abdel Motaal and Gen. H. El-Saidy, the Gen. Sec. of Dakhalia Governorate and the other members of the committee with respect to the present operational condition of Talkha Steam Power Plant (130MW Capacity). It was pointed out that cooling water from the Nile at Talkha has been used for about 40 years in the cooling system of this steam plant, and the resultant thermal discharge had precipitated no apparent problems or complaints from Fishery Resources, Irrigation, Agriculture or Public Health. It was stated that implementation of the proposed project constitutes an increase in the quantity of the presently utilized cooling water. As such, this situation cannot be considered as a new impact on the present environment.

- All the members of the committee agreed that 5 C increase in Nile Water will likely not have any significant impact on the environment in general and fishery resources in particular.

- It was noted by Mr. DeCamp that low volume waste streams would be treated to meet U.S.E.P.A. standards prior to discharge and that sewage treatment facilities at the site would be upgraded from its present condition. It was also noted the environmental assessment may contain a recommendation to minimize chlorine in the cooling water system.

- The participants were informed that the completion period of the new project will be 2 years from the date of signing the Contract between the manufacturing company and EEA.

- It was noted that the primary objective of this meeting is that Gilbert/Commonwealth will prepare the Environmental Assessment report about this subject, to include the discussion carried out on this committee, including the conclusion of the committee that the proposed project is likely to have no significant impact on the surrounding environment, to include irrigation, agriculture, fishery resources and public health.

- Gilbert/Commonwealth will submit the Environmental Assessment report to USAID in accordance with USAID environmental procedures.

- Meeting adjourned at 1:30 PM.

MEETING NOTES (ARABIC)

ATTENDEES

م. محمود عبد المتعال
اللواء احمد الصعيدي
م. علي أحمد الشطوري
السيد/ أحمد متولي عبد الشافي
السيد/ سعيد نافع
عبد الرحيم صباح
دكتور. محمد سلامة
مهندس/ عادل جلال سليم
مهندس/ محب رمضان
مهندس/ رفعت المتولي محمد
مهندس/ أحمد حافظ رمضان
Gregory G. Decamp/ مهندس

رئيس مجلس مدينة كفر الدوار
سكرتير عام محافظة البحيرة
وكيل وزارة الزراعة بالبحيرة
رئيس مركز بطرة
وكيل الادارة العامة لري غرب الدلتا
رئيس مركز ومدينة ايتاي البارود
مدير بمكتب السيد السيد محافظ البحيرة
مندوب الثروة السمكية بالمحافظة
مفتش عام الشبكات بمنطقة بحيرة
مدير الصيانة لمركز كفر الدوار
شركة جلبت
شركة جلبت

- اجتمعت اللجنة من الأعضاء السابق ذكرهم يوم ١٢/١٢/٨٦ بمكتب السيد المهندس/ رئيس منطقة كفر الوجه الري بطنطا السيد المهندس/ محمود عبد المتعال. وذلك ابتداء من الساعة الثانية عشرة ضحاً.
- وتمت مناقشة موضوع تأثير مشروع الدورة المركبة لمحطة كفر بادر طلمبات الكهربية المزمع إنشائها بالموقع وذلك على البيئة بصفة عامة.
- والدورة المركبة الجديدة ستكون بقدرة ١٠٠٠٠٠ ك.و.س مضافة للطاقة الحالية لمحطة كفر بادر طلمبات الكهربية التي تقدر بـ ٢٠٠٠٠٠ ك.و.س وستكون الإضافة الجديدة بدون استهلاك وقود إضافي وسوف يرفع الكفاءة الاقتصادية لمحطة طلمبات الكهربية من ٢٥٪ حتى ٤٦٪. وذلك بأخذ عادم غازات الوحدات الكهربية الشغالة حالياً إلى عدد ثمانية فرنات لتنتج بخار يكفي لتشغيل عدد ٢ × ٥٠ م.وات توربينة بخارية.
- وقد أفاد السيد المهندس/ مندوب وزارة الري بأنه رفع عدد ٥ م٣ لمياه النيل من مجرى مياه الترعة الداخلة والخارجة إلى المشروع الجديد. ثم إلى النيل مرة ثانية. أفاد سيادته بأنه هذا لا يؤثر على الزراعة بأي حال. وأفاد السيد المهندس/ مندوب وزارة الزراعة بذلك أيضاً. وأفاد السيد/ مندوب الثروة السمكية بأنه رفع درجة حرارة مياه النيل ٥ م° لا يؤثر على الثروة السمكية بفرع دمياط بأي حال من الأحوال.
- وقد شرح السيد المهندس/ محمود عبد المتعال رئيس المنطقة الأبحاث العالمية في مجال الري والزراعة والثروة السمكية والناحية الصحية وكانت نتيجة المناقشة بأن رفع درجة حرارة مياه النيل ٥ م° لا يؤثر بحال على الري أو الزراعة أو الثروة السمكية أو الناحية الصحية.

- وقد ناقش السيد المهندس/ محمود عبد المتعال والسيد/ حامد الصعيدي سكرتير عام محافظة الدقهلية والأعضاء أنه حالياً تصل مياه الري لحتى التاريخ قدره ١٣٠ م٣/ث باستعمال مياه تعديه من النيل وأن ذلك قائم منذ ٤٠ عاماً دون أية مشاكل من ناحية الثروة السمكية أو الري أو الزراعة أو الصحة. وأن التوسع الجديد سوف يضيف فقط كمية مياه تعديه إلى الكمية المستعملة حالياً. وأن هذا وضع قديم وليس وضع جديد. وقد اتفق الجميع على ذلك وعلى أن رفع درجة حرارة مياه النيل ٥ م° لا يؤثر بحال على البيئة عموماً وخصوصاً الثروة السمكية.

- وسوف يستغرق المشروع الجديد سنتان من تاريخ توقيع العقد بين الشركة الصانعة والهيئة كما ورد بعد.

- والسبب الذي من أجله الاجتماع هو قيام شركة جلدت بكتابة تقرير مفصل عن هذا الموضوع وما دار في مناقشات في اللجنة ونتيجة المناقشات وما اتفقت اللجنة عليه من أن إضافة مشروع الدوث المركبة لمحطة كهرباء طلخا القائمة وهي ١٠٠٠٠٠ ك.و.س لا يؤثر على البيئة من جميع النواحي وهي الري والزراعة والثروة السمكية والظاهرة الصحية. وسوف يقوم المسئولين عن شركة جلدت برفع هذا التقرير إلى الحكومة الأمريكية. وسوف يتطلب على المشروع قانون المتلوث.

وانتهى الاجتماع الساعة ٢٠ من اليوم ١٩٨٦/١٢/١٣

Gilbert/Commonwealth International, Inc. engineers and consultants

P.O. Box 1498, Reading, Pennsylvania 19603/Telephone 215-775-2600, Cable Gilasoc/Telex 836-431

APPENDIX B

ENVIRONMENTAL SCOPING REPORT

MEETING AGENDA HANDOUT

DECEMBER 13, 1986

Gilbert/Commonwealth International, Inc. engineers and consultants

P.O. Box 1498, Reading, Pennsylvania 19603/Telephone 215-775-2600, Cable Gilasoc/Telex 836-431

ENVIRONMENTAL SCOPING DOCUMENT

RELATED TO

TALKHA COMBINED CYCLE POWER PLANT

PREPARED ON BEHALF OF

EGYPTIAN ELECTRICITY AUTHORITY

BY

GILBERT/COMMONWEALTH INTERNATIONAL INC.

DECEMBER 1986

USAID GRANT 263-0192

34

TABLE OF CONTENTS

INTRODUCTION

EXISTING ENVIRONMENT

Talkha Power Station

Plant Surroundings and Nile River

PROJECT DESCRIPTION

POTENTIAL ENVIRONMENTAL EFFECTS

ENVIRONMENTAL ASSESSMENT REPORT

LIST OF FIGURES

SITE LOCATION MAP

SITE PLOT PLAN

INTRODUCTION

The Egyptian Electricity Authority (EEA) proposes to install additional electrical generation capacity at the existing Talkha Power Station complex, located on the west bank of the Damietta Branch of the River Nile near El Mansura, approximately 100 km north of Cairo (See attached location map). The project consists of converting the eight existing combustion turbine generators (8x24MW) at the site into combined cycle units through the addition of heat recovery steam generators (HRSG's) and steam turbines. The conversion would result in utilization of waste heat from the existing combustion turbines to produce an additional 110 MW (approx.) of power. No additional fuel consumption is required for the converted units. The project is being undertaken with the financial support of the United States Agency for International Development (USAID).

The purpose of this Scoping Document and associated Environmental Scoping Session is to inform interested parties about the project and environmental issues identified to date, and to provide an opportunity for these parties to express any concerns regarding potential environmental effects of the proposed project. Input from previous studies and this scoping session will be used to determine the scope and focus of an Environmental Assessment for the project, to be prepared in accordance with USAID procedures.

EXISTING ENVIRONMENT

TALKHA POWER STATION

The Talkha Power Station complex is situated on the west bank of the Damietta Branch of the River Nile opposite the city of El Mansura. Existing electrical generation at the site consists of eight combustion turbine units and six steam turbine units (see attached site plot plan). Total rated generating capacity of the power station complex is 319.5 MW.

The eight combustion turbine units were installed in 1979. They are General Electric (GE) frame 5 units each with design rating of 24 MW (total=192 MW). The units can burn either natural gas or solar. These units have been well maintained and are in good condition.

The steam electric units on the Talkha site consist of three 12.5 MW units placed in service in 1955-56 and three 30.0 MW units placed in service in 1966-67 (total = 127.5 MW). The cooling water system for these units consists of a circulating water intake structure on the Nile, underground supply tunnels extending to the condensers, and underground tunnels extending to a discharge canal. The balance of the plant site consists primarily of fuel storage tanks, water treatment facilities, electrical switchyards, and engineer and labor colony facilities.

(See attached plot plan).

PLANT SURROUNDINGS AND NILE RIVER

The power station is located about 1 km from Talkha. The general area surrounding the station is cultivated. A large fertilizer plant is also present a short distance north of the power station.

The Damietta Branch of the Nile at the Talkha Power Station has a shallow, U-shaped channel about 144m (422 feet) wide, with a maximum depth of approximately 4 meters (13 feet) under low flow conditions. Various data, including EEA records at the Talkha Station, indicate that the Nile here has an average high temperature of 27 C (in July and August) and an average low temperature of approximately 15-17 C (in January). Flow of the Nile at Talkha varies seasonably, reaching a minimum in December and increasing during the summer. The maximum river flow reportedly occurs in October. Approximate minimum and maximum flows in the Damietta Branch at Talkha have been estimated to be 130 CU.M/s (4600 cfs) and 1,954 Cu.M./s (69,000 cfs), respectively.

The Nile River at Talkha reportedly supports a diverse fish fauna, which includes tilapia, Nile perch, barbels, catfish, elephant snout fish, tiger fish, and smaller forage species. Sport and Subsistence fishery exists in Nile at Talkha, with fishing activity concentrated in and near the cooling water discharge area during the winter months.

PROJECT DESCRIPTION

The proposed project consists of upgrading the existing combustion turbine units and constructing a nominal 110 MW steam cycle addition to these units. The steam cycle addition is represented by eight HRSG's (one for each of the eight combustion turbine units) to extract heat from the gas turbine exhaust gases to make steam. The steam output from the HRSG's is combined in a header and directed to two (2) dedicated steam turbines (four HRSG's per turbine).

The circulating water system will consist of cooling water intake and discharge structures on the Nile River. Circulating water flow is expected to be about 5.7 CU.M/s (90,000 GPM). Pertinent specifications related to this system include:

- Intake structure at Nile River shoreline.
- Three (3) vertical traveling screens capable of automatic or manual operation, constructed of 3/8 inch mesh stainless steel cloth.
- Screen wash system.
- Trash Racks

- Maximum approach velocity in approach channel =0.3 m/s (1 fps)
- Maximum through screen. velocity = 0.6 m/s (2fps)
- Maximum temperature rise through condenser = 10 C

Maximum discharge temperature is limited to 35 C by existing water quality standards for effluent to the Nile.

Provisions for biofouling control in the condenser and circulating water system include an Amertap system and chlorination. Other notable components of the proposed facility include a raw water treatment plant, demineralizer plant, and sewage treatment plant. The proposed sewage treatment plant consists of a 3000 gallon/day capacity extended aeration, actuated sludge facility designed to serve the combined cycle installation and the existing service building as well.

Equipment and facilities will be provided to collect, treat, and dispose of all wastes generated by the proposed combined cycle plant addition. The waste streams for which waste treatment and disposed facilities shall be designed include makeup pretreatment, clarifier blowdown and filter backwash, neutralized demineralizer regenerate wastes, HRSG blowdown, and process and equipment drainage. A drainable oil/water separator will be provided for the latter waste stream. Plant specifications stipulate all of these volume wastes will be treated to levels consistent with USEPA standards and disposed of in a manner that minimizes adverse impact on the environment.

POTENTIAL ENVIRONMENTAL EFFECTS

The environmental effects of the existing combustion turbine generating facilities at Talkha were assessed in 1976-77 prior to construction of the plant. These generating facilities were subsequently constructed to assume compliance with appropriate environmental standards.

Based on current project plans and a review of environmental considerations by Ebasco Services, Inc. in 1985, the potential for significant adverse environmental effects from this project would be quite limited. No change in any airborne contaminates would result from the project since no additional fuel will be burned. Sanitary waste treatment at the site will be improved as a result of installing a new sewage treatment facility. The various process waste water streams from the plant will be subjected to neutralization, settling, and oil separation as necessary to protect the aquatic environment prior to discharge. Water treatment sludges and other solid wastes will be properly disposed at disposal sites in the plant vicinity designated for such wastes. The EBASCO study concluded that the only significant potential for environmental impact resulting from the proposed combined cycle conversion would be related to the thermal discharge to the Nile. Therefore, it is currently intended to focus the Environmental Assessment on the potential effects on Nile River biota that may result from cooling water discharge.

ENVIRONMENTAL ASSESSMENT REPORT

Upon completion of the Environmental Assessment a report will be written in the form generally prescribed by USAID environmental regulations. The major sections of the report will be as follows:

Summary

Purpose

Proposed Project and Alternatives

Affected Environment

Environmental Consequences

List of Preparers

NOTE : Figures 1 and 2 presented in the Environmental Assessment were included with this Scoping Document.

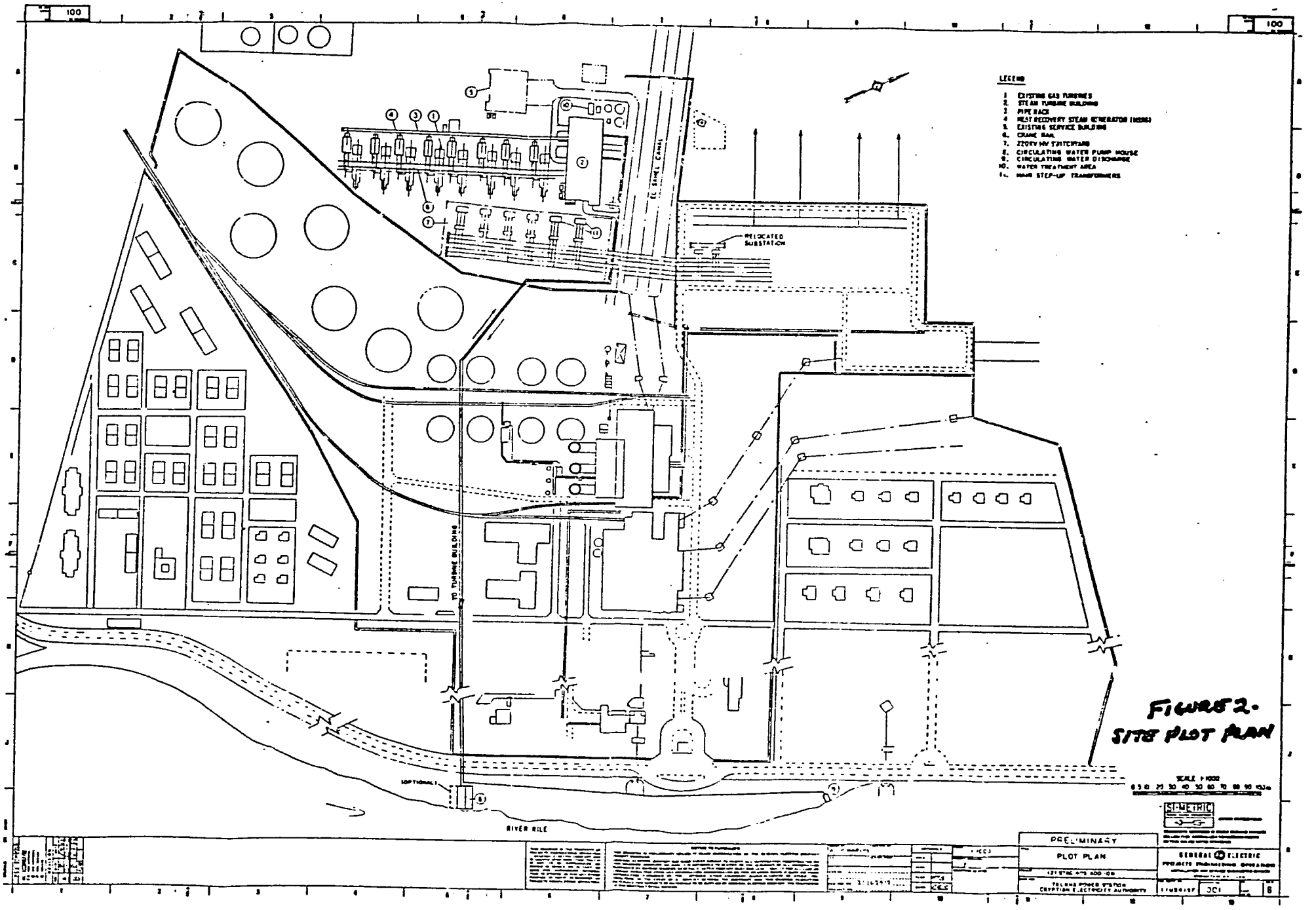


FIGURE 2.
SITE PLOT PLAN

40

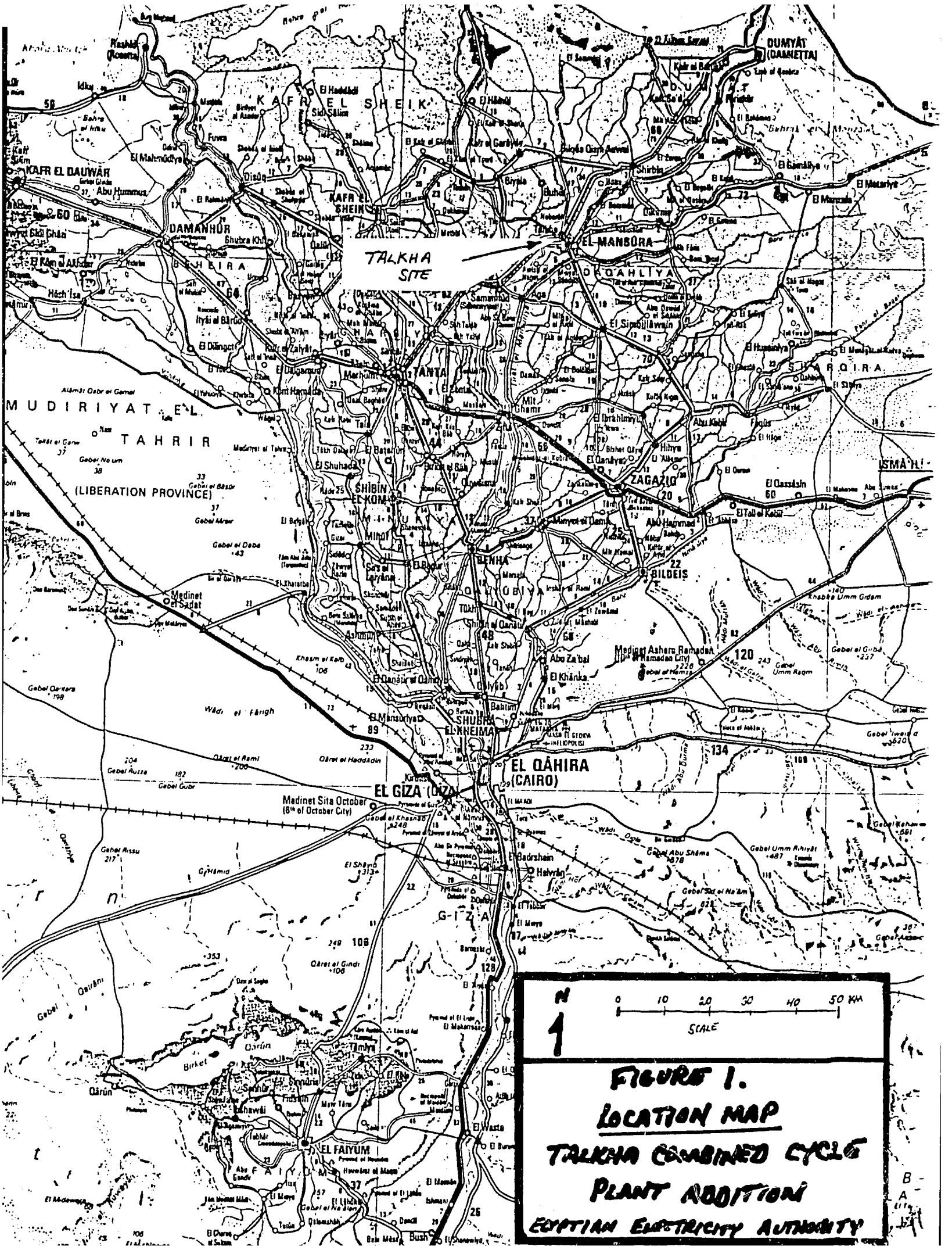
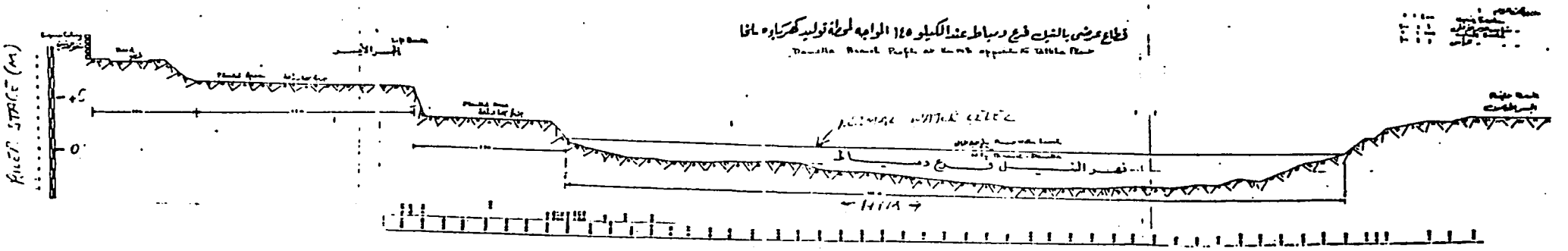


FIGURE 1.
LOCATION MAP
TALKHA COMBINED CYCLE
PLANT ADDITION
EGYPTIAN ELECTRICITY AUTHORITY



MONTH	RIVER STAGE (M)		Q_D = RIVER DISCHARGE ($M^3 \times 10^6$/DAY)		
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM	AVERAGE [(MIN + MAX)/2]
JAN	1.1	1.5	0.2	3.9	2.0
FEB	1.5	1.8	2.0	7.1	4.6
MAR	1.6	1.9	1.4	6.6	4.0
APR	1.6	2.2	4.5	7.5	6.0
MAY	1.8	2.1	5.9	7.5	6.7
JUN	1.9	2.2	7.1	12.8	10.0
JUL	1.8	2.0	7.5	9.3	8.4
AUG	1.3	2.0	6.6	12.3	9.5
SEP	1.6	2.0	4.8	7.9	6.4
OCT	1.6	1.7	3.6	5.1	4.4
NOV	1.9	1.8	0.2	5.1	2.6
DEC	1.6	1.7	2.0	4.2	3.1

DATA FROM MINISTRY OF IRRIGATION

RIVER CROSS-SECTION FROM EGYPTIAN ELECTRICITY AUTHORITY

FIGURE 3

RIVER CROSS-SECTION AND HYDROLOGIC DATA

DAMIETTA BRANCH RIVER NILE AT TALKHA

شكل (٣)

FIGURE 3

المتصرف في النيل شهريا

أمام محطة طلخا .

الشهر	اقل تصرف	اعلى تصرف
يناير	٢٠٠ر—	٣٩٠٠ر٣ م٣
فبراير	٢ر— مليون متر٣	٣١٠٠ر٣ م٣
مارس	١٤٠٠ر١ " "	٦٥٠ر٤
أبريل	٤٥٠٠ر٤ " "	٦٠٠ر٧ "
مايو	٥٩٠٠ر٥ " "	٥٠٠ر٧
يونية	٧١٠٠ر٧ " "	٨٢٠ر١٢
يوليه	٥٠٠ر٧ " "	٢٠٠ر٩ "
أغسطس	٦٥٠ر٦ " "	٣٠٠ر١٢ "
سبتمبر	٨٥٠ر٤ " "	٩٠٠ر٧ "
أكتوبر	٦٠٠ر٣ " "	١٠٠ر٥ "
نوفمبر	٢٠٠ر " "	١٠٠ر٥ "
ديسمبر	٢ر— " "	٢٠٠ر٤

— يتضح أن أقل تصرف هو ٢٠٠٠٠٠ متر٣ خلال شهر يناير " السده الشتوية " .

— اعلى تصرف هو ١٢٫٨٢٠ مليون متر٣ خلال شهر يونية "بداية الري " .

المناسيب في النيل خلال العام ١٩٨٦ " إمام محطة طلخا "

يناير	١٤ر١ مترا	٤٨ر١ مترا
فبراير	٥٠ر١ "	٨٠ر١ "
مارس	٥٧ر١ "	٨٨ر١ "
ابريل	٦٥ر١ "	٢٠ر٢ "
مايو	٨٤ر١ "	١٢ر٢ "
يونيه	٩٠ر١ "	١٨ر٢ "
يوليو	٨٠ر١ "	٩٩ر١ "
أغسطس	٦٣ر١ "	٩٦ر١ "
سبتمبر	٥٣ر١ "	٩٦ر١ "
أكتوبر	٥٥ر١ "	٧٣ر١ "
نوفمبر	٢٥ر١ "	٧٧ر١ "
ديسمبر	٥٨ر١ "	٦٧ر١ "

— يتضح أن أقل منسوب هو ١٤ر١ في شهر يناير " السده الشتويه .

— اعلى منسوب هو ٢٠ر٢ في شهر أبريل .

TABLE 1

ESTIMATED COST SUMMARY FOR FEASIBLE COOLING WATER ALTERNATIVES FOR TALKHA COMBINED CYCLE ADDITION[a]

ONCE - THROUGH COOLING

	CASE I .630M INTAKE PIPE .DISCHARGE TO CANAL	CASE II .1250M INTAKE PIPE .DISCHARGE TO CANAL	CASE III .630M INTAKE PIPE .DISCHARGE TO NILE	CASE IV .1250M INTAKE PIPE . DISCHARGE TO NILE
Investment Cost(LE)	1,257,160	1,663,960	1,690,560	2,025,360
25 year operational cost (LE)	17,325,000	25,641,000	17,325,000	25,641,000
Total Cost (L.E)	18,582,160	27,204,960	18,995,560	27,666,360

COOLING TOWERS

	FORCED DRAFT TOWERS		NATURAL DRAFT TOWER
	DELTA-T = 20 F	DELTA-T= 13 F	DELTA T= 20F
Investment Cost (LE)	601,600	429,170	1,335,000
25 Year Operational Cost(LE)	27,720,000	22,811,250	12,705,000
Total Cost (LE)	28,321,600	23,307,420	14,040,000

[a] From Sabbour Associates (1982)

TABLE 2
WATER QUALITY CHARACTERISTICS
DAMIETTA BRANCH, RIVER NILE, NEAR TALKHA

A. Typical values as supplied by EEA for Talkha Plant

Chloride as $CaCO_3$, ppm	50	
P-Alkalinity, ppm	0	
M.O. Alkalinity, ppm	175	
Sulfate as $CaCO_3$, ppm	25	
	250	Total Anions
Total Hardness, ppm	158	
Sodium, ppm as $CaCO_3$	90	(By Difference)
Potassium, ppm as $CaCO_3$	2	
	250	Total Cations
SiO_2, ppm at SiO_2	14.6	
Divalent iron, ppm as Fe^{++}	0.125	
Organics, ppm as $KMNO_4$	14	
Conductivity, micromhos /cm	350	
Turbidity, NTU	25	

Data for March 1979 from El-Gohary (n.d)

Constitent (Units)	Values at Upstream From El Mansura	Values at Talkha Fertilizer Plant
pH (std Units)	8.4	8.3
Turbidity (NTU)	1	1
Conductivity (umhos/cm)	360	-
Dissolved Oxygen (mg/l)	9.6	9.6
BOD 5 (mg/l)	2.5	2.8
COD (mg/l)	12	18
Total Susp. Solids (mg/l)	14	14
Nitrate (mg/l as N)	0.06	0.02
Kjeldahl N (mg/l as N)	0.6	3.6
Phosphate, Tot. (ug/l)	90	164
Tot. Diss. Solids (mg/l)	246	224
Chloride (mg/l)	24	-

Data for March 14,1985 from Montreal Engineering (1985)

P Alkalinity (mg/l)	0
M. O. Alkalinity (mg/l)	175
Conductivity (umhos/cm)	240
Hardness (mg/l)	125
Chloride (mg/l)	0.75
pH (std. Units)	8.4
Silica (mg/l)	3
Iron (mg/l)	0.014
Organic Matter (mg/l)	23

TABLE 3

SELECTED FISHES POTENTIALLY OCCURING IN THE DAMIETTA BRANCH, RIVER NILE, AT TALKHA.[a]

MORMYRIDAE:	ELEPHANT-SNOUT FISHES:
Mormyrops anguilloides	Gamhoor
Petrocephalus bane	Arminya; Glumaya
Marcusenius isidori	Anooma
Gnathoremus cyprinoides	Om-shifefa
Mormyrus kannume	Anooma
Mormyrus caschive	Anooma
Mormyrus niloticus	Anooma
CHARACINIDAE:	TIGER-FISHES:
Hydrocynus forskalii	Tiger-Fish
Hydrocynus brevis	Tiger-Fish
Alestes nurse	Sardina
Alestes dentex	Raya
Alestes baremose	Raya
ANGULLIDAE:	FRESHWATER EELS:
Anguilla anguilla	Eel, Hannash
CITHARINIDAE:	
Distichodus niloticus	Wachoni
Citharinus citharas	Amara
Citharinus latus	Amara
CYPRINIDAE:	MINNOWS:
Labeo forskalii	Lebeis El Hagar
Labeo niloticus	Lebis Abyad
Labeo coubie	Lebis
Labeo horie	Lebeis
Barbus binnie	Barbel, Benni
Barbus werneri	Barbel
Barbus perince	Benni
Barbus neglectus	Barbel
Barbus anema	Benni
CLARIIDAE:	AIR-BREATHING CATFISHES:
Clarius lazera	Hout, Kharmout
Clarius anguillaris	Hout, Kharmout
Heterobranchus longifilis	Hout, Kharmout

SCHILBEIDAE:	
Eutropius niloticus	
Schilbe mystus	Shilba, Butter Fish
Siluranodon auritus	
Bagrus bayad	Bayad
Bagrus docmac	Semutundu, Docmac
Chrysichthys rueppelli	
Auchenoglanis biscutatus	
Auchenoglanis occidentalis	Bubu
SYNODONTINDAE:	
Synodontis schall	Karkar, Shall
Synodontis serratus	Karkar, Shall
MALAPTERURIDAE:	ELECTRIC CATFISHES:
Malapterurus electricus	Ra'ash, Ra'ad
CICHLIDAE:	
Tilapia nilotica	Bolti
Tilapia galilaea	Bolti Molowi
Tilapia zillii	
CENTROPOMIDAE:	
Lates niloticus	Nile Perch, Samoos, Ishr-Bayyad
TERTODONTIDAE:	
Tetrodon Fahaka	Fahaka

---

[a] Compiled from a review of Abdel-Latif (1974) and Copley (1952)

TABLE 4

TEMPERATURE SUMMARY FOR DAMIETTA BRANCH, NILE RIVER AND COOLING WATER DISCHARGES FROM TALKHA STEAM PLANTS

APPROX. TEMPERATURE (C°)

MONTH	AMBIENT RIVER (ABOVE TALKHA) [a] (TR1) Average	Max.	COOLING WATER FROM TALKHA PLANTS (EXISTING & PROPOSED) [b] (TD) Average	Max.	RIVER BELOW TALKHA PLANTS [c] (TR2) Average	Max.	RIVER DELTA-T (TR2-TR1) Average	Max.
JAN	-	-	TR1+10	TR1+10	TR1+5	TR1+8	5	8 [d]
FEB	-	-	,,	,,	TR1+2	TR1+5	2	5
MAR	-	-	,,	,,	TR1+2	TR1+7	2	7
APR	-	-	,,	,,	TR1+2	TR1+2	2	2
MAY	-	-	,,	,,	TR1+2	TR1+2	2	2
JUN	-	-	,,Assumed	,,Assumed	TR1+1	TR1+1	1	1
JUL	29	29	37	37	30	30	1	1
AUG	30	30	38	38	30	31	1	1
SEP	27	30	36	38	28	32	1	2
OCT	23	24	33	34	25	27	2	3
NOV	18	19	28	29	22	27 [d]	4	8 [d]
DEC	14	16	24	26	17	21	3	5

(a) Intake water temperatures at existing Talkha Plant supplied by EEA. Data for Jan-Jun unavailable.

(b) Based on condenser delta-T for existing units of 10 C; condenser delta-T for proposed units of 10 C, but discharge temp. no to exceed 35 C; and equal volumes contributed by existing and proposed units. (Actual discharge for existing units = 0.46 million oubic meters /day; actual for proposed = 0.49 million cu. meters/day).

(c) By simple mass balace calculations using ave., max. temperatures and ave., minimum river discharge from Figure 3.

$$TR2 = \frac{[(QD)(TD)] + [(QR - QD)(TR1)]}{QR}$$

(d) Assuming no recirculation from discharge to intake.

TABLE 5

SUMMARY OF LAW 48/1982 AND MINISTERIAL ORDER NO. 8/1983 FOR PROTECTION OF RIVER NILE & WATER BODIES AGAINST POLLUTION(1)

MINISTRY OF IRRIGATION

ARAB REPUBLIC OF EGYPT

PARAMETER mg/1(2)	I SPECIFICATIONS OF WATER: RIVER NILE & CANALS	II SPECIFICATIONS OF WATER: DRAINS WHICH ARE REUSED IN IRRIGATION	WASTEWATER EFFLUENT SPECIFICATIONS	III SPECIFICATIONS OF WATER: DRAINS, PONDS & LAKES
			SANITARY WASTES	
Color (degrees)	100	100	Nil	----
Temperature (°C)	5 (3)	5	35	5
pH (units)	7-8.5	7-8.5	6-9	7-8.5
BOD_5	6	10	60	----
COD, Dichromate	10	15	80	----
COD, Permanganate	10	6	40	----
Dissolved Oxygen	5 (4)	5	4	4
Oil & Grease	0.1	1	10	----
Total Dissolved Solids	----	650	2,000	650
Suspended Solids	----	500	50	----
Sulphates	200	----	1	----
Phosphate, Organic	----	1	----	----
Nitrate	45	45	50	----
Phenol	0.02	0.02	----	0.001
Fluoride	0.5	----	----	----
Heavy Metals, Total	----	----	1	----
Mercury	0.001	0.001	----	----
Lead	0.05	----	----	----
[illegible]	0.01	0.01	----	----
[illegible]um	0.05	0.01	----	----

(cont'd)

SUMMARY OF LAW 48/1982 AND MINISTERIAL ORDER NO. 8/1983 FOR PROTECTION OF RIVER NILE & WATER BODIES AGAINST POLLUTION(1)

MINISTRY OF IRRIGATION

ARAB REPUBLIC OF EGYPT

PARAMETER mg/l(2)	I SPECIFICATIONS OF WATER: RIVER NILE & CANALS	II SPECIFICATIONS OF WATER: DRAINS WHICH ARE REUSED IN IRRIGATION	WASTEWATER EFFLUENT SPECIFICATIONS	III SPECIFICATIONS OF WATER: DRAINS, PONDS & LAKES
			SANITARY WASTES	
Copper	1	1	-----	-----
Iron	1	1	-----	-----
Manganese	0.5	-----	-----	-----
Zinc	1	1	-----	-----
Cyanide	0.05	0.1	-----	-----
Detergents	0.5	0.5	-----	0.5
Nitrogen	1	-----	-----	-----
Ammonia	0.5	0.5	-----	
Alkalinity, Total	20-150	50-200	-----	
Pesticides	----	-----	Nil	-----
Turbidity (Units)	----	50	-----	50
Cyanate	0.1	-----	-----	-----
E. coli (MPN/100ml)	----	5,000	5,000	5,000

(1) Concentrations for all parameters shall not be more than the specified amounts, unless indicated otherwise.

(2) Unless indicated otherwise in parentheses following an individual parameter.

(3) Not more than 5°C rise above ambient temperature.

(4) Not less than the indicated concentrations for this parameter.

Information supplied by USAID (Cairo)

TABLE 6

SUMMARY OF US EPA NEW SOURCE PERFORMANCE

STANDARDS FOR STEAM-ELECTRIC POWER PLANTS (40 CFR 423)

WASTEWATER STREAM	PARAMETER	LIMITATION[a] AVERAGE	MAXIMUM
All Waste Streams	Polychlorinated Biphenyls (i.e. PCB's)	Zero	Zero
All Waste Streams Except Once-through Cooling Water	pH	6.0 - 9.0 (std. units)	
Once-through Cooling Water	Total Residual Chlorine	- (For no longer than 2 hours/day/unit; simultaneous multi-unit chlorination is permitted)	0.2mg/l
Low Volume Waste Streams: (boiler blowdown, demineralizer regenerant waste, etc)	Oil and Grease	15mg/l	20mg/l
	Total Susp. Solids	30mg/l	100mg/l
Metal Cleaning Wastes	Copper, Total	1.0mg/l	1.0mg/l
	Iron, Total	1.0mg/l	1.0mg/l

[a] limitation for chemical constituents determined as the quantity (mass) of constituent obtained by multiplying the above concentrations by the flow of waste stream to which the limitation applies.

TABLE 7

SUMMARY OF RESERACH DATA ON TEMPERATURE

TOLERANCE OF SELECTED WARMWATER FISHES[a]

A. Upper Tolerance Temperature of Fish (Temperatures Cited as LD-50's for 12, 24, 48, 96 hours, critical thermal maxima, or other measure)

Species	Common Name	Life Stage	Lethal Temperature (C)
Cyprinus carpio	Common Carp	Juveniles	35.7 - 40.5
Ictalurus catus	White Catfish	Larvae	33.0
		Juv & Adults	29.2 - 34.2
Ictalurus melas	Black Bullhead	Juv.	35.0 - 35.7
Ictalurus natalis	Yellow Bullhead	Adult	36.4
Ictalurus nebulous	Brown Bullhead	Young-of-year	35.7
		Juv-Adults	36.5 - 37.8
Ictalurus punctatus	Channel Catfish	Young-of-year	36-37.8
		Juv.	35.5-38.0
Lepomis macrochirus	Bluegill	Young-of-year	25.6-36.2
		Juv-adults	36-40
Micropterus salmoides	Largemouth Bass	Young-of-Year	35.6-36.2
		Juv-Adults	36-40
Notmigonus chrysoleucas	Golden Shiner	Adults	30.5-38.5
Notropis lutrensis	Red Shiner	Adults	39
Tilapia zillii	Tilapia	Adults	39.5-40.2
Tilapia rendalli	Tilapia	Fry	>41
Tilapia mossambica	Tilapia	-	41.9

B. Summary of observation Teperatures of warm water fish at power plants sites.

Species	Common Name	Temperature (C) That Fish: Preferred Many observed	Generally Avoided Few observed	Avoided one obseverved
Anguilla restrata	American Eel	-	-	35
Carpiodes carpio	River Carpsucker	24-34.5	33-35.5	34-39
Cyprinus carpio	Common Carp	26-35	>34.5	33-39.5
Ictalurus catus	White Catfish	-	35	40
Ictalurus nebulus	Brown Bullhead	-	33.6	40
Ictalurus Punctatus	Channel Catfish	26-35	>36	34-41
Lepomis Macrochirus	Bluegill	22-34	-	33-38
Micropterus Salmoides	Largemouth Bass	24-31	-	30-35
Notemigonus Chrysoleucas	Golden Shner	30-32	-	30-40

C. Summary of temperature limits Applicalbe to selected warm water fish for growth and reproduction.

Species	Common Name	Max. Weekly Ave. For Growth	Max. Weekly Ave. For Spawning	Short-Term Max. For Embryo Survival
Lepomis Macrochirus	Bluegill	32	25	34
Ictalurus Punctatus	Channel catfish	32	27	29
Cyprinus Carpio	Common Carp	-	21	33
Micropterus Salmoides	Largemouth Bass	32	21	27
Tilapia Zillii	Tilapia	34	25+	-

[a] Data obtained from U.S EPA (1976), Talmage and Opresko (1981), Houser (1977, Carlton (1975), and Platted Houser (1978).