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Alexandria Wastewater Master Plan Study

FINAL ENVIRONMENTAL IMPACT STATEMENT

VOLUME III

COMMENTS AND RESPONSES

Camp Dresser & McKee Inc.
Environmental Planning Division
with Bookman-Edmonston Engineering, Inc.
Mayne Environmental Services

The previously released Alexandria Wastewater Master Plan Study-Draft Environmental Impact Statement* (2 volumes) together with the comments made during the review process and responses thereto contained herein, constitute the Alexandria Wastewater Master Plan Study - Final Environmental Impact Statement in accordance with Sections 216.3(a)(4) and 216.6 of the "Environmental Procedures" of the United States Agency for International Development.

* Issued under the title Alexandria Wastewater Master Plan Study-Initial Environmental Impact Statement

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1.0 SUMMARY STATEMENT OF ENVIRONMENTAL CONSIDERATIONS RELATING TO THE PROPOSED SEWERAGE PROGRAM FOR ALEXANDRIA, EGYPT

1.1 INTRODUCTION

It is the purpose of this statement to provide advice as to the steps taken to assure environmental soundness of the proposed Sewerage Program for Alexandria, Egypt.

In accordance with the requirements of 22 CFR 216, "AID Environmental Procedures", the Agency for International Development (AID) prepared the Alexandria Wastewater Master Plan Study - Draft Environmental Impact Statement (2 volumes) which included extensive marine investigations, the contents of which were reviewed by appropriate authorities in the Government of Egypt (GOE) and then released to AID on April 9, 1979. The recommendations of the Alexandria Wastewater Master Plan Study were also reviewed by the scientific and technical community in Egypt. Following a plan of action agreed to by the United States Department of State (STATE) and the President's Council on Environmental Quality (CEQ) these studies were distributed for review and comment to selected federal agencies and members of the American environmental community. On June 22, 1979 a technical review meeting was held in Washington, D.C. (see Chapter 2.0) with the study contractor, and representatives from four federal agencies and six environmental organizations. Representatives of the Egyptian and Alexandrian governments were also present.

A variety of written comments and informal communications were received by AID on the Draft Environmental Impact Statement (DEIS), and as a result significant modifications in the proposed project design were made. The written comments and formal responses are included in Chapters 3.0 and 4.0 of this Final Environmental Impact Statement (FEIS). Comments received reflected the concerns addressed in Section 1.2.

1.2 ENVIRONMENTAL CONCERNS

1.2.1 The Appropriateness of Sea vs. Land Disposal

After careful review of technical, social and economic aspects of the disposal alternatives, AID agreed with the consultant's conclusion that sea disposal is the preferred alternative for the facility design period addressed in the Master Plan Study. The alternative of land reclamation or agricultural reuse of treated wastewater is not feasible presently due to the volumes involved, the high direct and indirect costs, technical problems with high salt concentrations, poor social acceptability and the lack of an organizational unit or land owners groups to receive and utilize the wastewaters.

The approach proposed for this project provides the needed flexibility for possible future reuse schemes by the redirection of the treated waste waters into desert areas where it can be additionally treated prior to reuse. In the event the Government of Egypt adopts this option in the future as the needs for reuse decrease during the rainy season, then excess wastewater can continue to be disposed of through the sea outfall system.

1.2.2 The Level of Wastewater Treatment Prior to Discharge

AID is proposing to the Government of Egypt to modify the project to upgrade the wastewater treatment from "preliminary" as recommended in the Alexandria Wastewater Master Plan Study to "primary" prior to disposal through two sea outfalls. This modification will increase project costs by $31.2 million ($16.5 million in foreign exchange costs and $14.7 in local currency costs) and will result in an increase in operation and maintenance costs. This modification greatly reduces the possibility of sludge bank development; the possibility of wastes reaching the bathing beaches; the cost of disinfection, should it be necessary because of unfavorable oceanographic conditions and also reduces, under certain circumstances when bound to settleable solids, toxic waste discharges into the Mediterranean Sea. Toxic industrial wastes are planned to be controlled through pretreatment or exclusion. (See Sections 1.2.3 and 1.2.5 for details). The recommended outfall lengths are being retained beyond those normally required in connection with "primary" treatment as an added measure of safety rather than being adjusted to fit with an increased level for treatment. In addition the length of the diffusers will be increased at the ends of the outfalls to maximize the dispersion of settleable solids, increase dilution and decrease the possibility of bacterial contamination to the beaches.

1.2.3 The Management of Industrial and Toxic Wastes

A. The project agreement will require the engineering consultant to review the industrial and toxic waste discharges to identify any reasonable improvements that can be made in segregating these wastes and excluding them from the collection system.

B. The current Industrial Pollution Control segment of the AID funded Industrial Production Project will be expanded. This project provides technical services and grant funding for industrial plants to reduce waste discharges to acceptable limits.

1.2.4 The Management of Solid Wastes

An area wide study partially financed by AID will be undertaken dealing with the solid waste collection and disposal problems of Alexandria.

1.2.5 Operator Training, Sewer Laws and Environmental Monitoring

A. The inclusion of a covenant to the project agreement to provide continual and adequate monitoring of the aquatic systems in the vicinity of the sea outfalls and the beaches of Alexandria for changes. To assist the Government of Egypt in this activity the project includes $150,000 in foreign exchange costs for monitoring equipment.

B. The inclusion of a covenant to the project agreement concerning the enforcement of the existing "Sewer Use Law".

C. The inclusion of a covenant to the project agreement requesting the Government of Egypt to consider modifying the existing "Sewer Use Law" to upgrade it to conformance with the proposed draft "Ordinance Regulating Sewer Construction, Sewer Use and Industrial Waste Discharge"' as recommended in the Alexandria Wastewater Master Plan Study.

D. The development of an understanding with the Government of Egypt concerning the actions needed to be taken under the provisions of the "Protcol for the Protection of the Mediterranean Sea Against Pollution from Land-based Sources" developed through the United Nations Environmental Programme (UNEP).

1.3 Top Priority Projects

In 1977, with the anticipation of a major expansion to the Alexandria wastewater system, a series of Top Priority Projects (TPP) were initiated with AID funding. The ongoing projects include: (1) personnel training, (2) establishment of an improved system for collection and disposal of excluded wastes, (3) cleaning of existing sewers, (4) repair or replacement of sewer lines now in disrepair and (5) extension of sewerage services into presently unsewered areas.

1.4 Pilot/Demonstration Study

In addition, AID is planning a pilot/demonstration study on the reuse of wastewater in Egypt. This study will provide more reliable information in the areas of cost, technical reliability and social acceptability of reclaimed wastewaters and their potential reuse in Egypt.

2.0 REPORT OF REVIEW MEETING, JUNE 22, 1979

2.1 INTRODUCTION

A meeting was called by Albert C. Printz, Jr., Environmental Affairs Coordinator, United States Agency for International Development on June 22, 1979 in Washington, D.C. to discuss the Alexandria Wastewater Master Plan Study - Draft Environmental Impact Statement (DEIS). This meeting was sanctioned by the President's Council Environmental Quality (CEQ) and was intended to provide for a technical review of the proposed project. In accordance with a plan of action agreed to by the United States Department of State (STATE) and the President's Council on Environmental Quality (CEQ) the Draft Environmental Impact Statement and the Marine Studies, Volume IV of the Alexandria Wastewater Master Plan Study were distributed for advance review by selected federal agencies and members of the American environmental community. The meeting was centered around a formal presentation of findings by the study contractor followed by a discussion. The meeting provided a forum for the exchange of ideas between the study contractor, and representatives of four federal agencies and six environmental organizations. Representatives of the Egyptian and Alexandrian governments were also present.

2.2 PRESENTATION FORMAT

The format of the meeting was as follows:

I. Opening Remarks (Mr. Taubenblatt)
II. Introduction of the Chairperson, Albert C. Printz, Jr.
III. Remarks by the Chairperson
IV. Survey of Existing Conditions of the Alexandria Wastewater System (Mr. Kolsky)
V. Survey of Public Health Conditions and Problems in Alexandria as Related to Wastewater Management (Prof. Okun)
VI. Summary Presentation of the findings of the Environmental Impact Statement Study Team (Mr. Woglom)
VII. Break
VIII. Discussion Period

The presentation made use of a booklet which served to provide a summary of DEIS findings through a series of figures and tables.

2.3 REQUEST FOR COMMENTS

It was requested at the meeting both orally and through the provision of a memorandum issued to all participants that written comments on the DEIS be submitted to AID by July 5, 1979. Participants were also notified that all informal communications concerning the DEIS should be directed to either Albert C. Printz, Jr., AID Environmental Affairs Coordinator or Stephen F. Lintner, Bureau for Near East Environmental Coordinator.

2.4 MEETING ATTENDANCE LIST:

1) Ms. Susan Alexander
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4) General Clarke
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TAMS Building
655 3rd Avenue
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(*Technical consultants to the Ministry of Development and New Communities, Cairo, Arab Republic of Egypt)

5) Mr. Peter Carlson
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6) Mr. Joseph R. DeSousa
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(** Consultant to Camp Dresser & McKee Inc.)

23) Professor Daniel A. Okun**
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3.0 COMMENTS AND RESPONSES - GENERAL

The following are comments and responses to issues raised at the review meeting of June 22, 1979 (see Chapter 2.0), through written comment (see Chapter 4.0) and as a result of informal communications with the AID Environmental Affairs Coordinator, Bureau for Near East Environmental Coordinator and the Senior Sanitary Engineering Advisor, AID, Cairo, Arab Republic of Egypt. The comments have been abstracted for the ease of the reader and have been organized into the following general categories.

I. PROCEDURES (3.1 - 3.4)
II. COORDINATION AND PARTICIPATION (3.5 - 3.8)
III. COMPLEMENTARY ACTIVITIES (3.9 - 3.11)
IV. SOLID WASTE MANAGEMENT (3.12)
V. SEA DISPOSAL ALTERNATIVE (3.13 - 3.26)
VI. INDUSTRIAL AND TOXIC WASTES (2.27 - 3.32)
VII. AGRICULTURAL REUSE ALTERNATIVE (3.33 - 3.41)
VIII. LAND APPLICATION ALTERNATIVE (3.42)
IX. SEPTIC TANK TECHNOLOGY (3.43)
X. GROUNDWATER (3.44)
XI. ACCEPTABILITY OF THE TRANSFER OF UNITED STATES ENVIRONMENTAL STANDARDS ABROAD (3.45 - 3.46)

I. PROCEDURES

3.1 Why was the scope of the Environmental Impact Statement restricted to only the Alexandria Wastewater Master Plan Study? For example, why does it not address environmental health problems more fully?

The scope of the Environmental Impact Statement (EIS) was developed by the Government of Egypt (GOE) and the AID Mission in Egypt as an amendment to the existing contract between GOE and the selected consultant for the Alexandria Wastewater Master Plan Study. It was the expectation of AID in 1977 that the United States would be requested to finance foreign exchange costs for the implementation of a part of the Master Plan Study, therefore, the restricted scope of the Environmental Impact Statement was deemed adequate for AID's purposes. The EIS contains an assessment of the basic environmental health situation in Alexandria to the extent that it is either impacted or affected by the proposals of the Master Plan Study.

3.2 Why were the Alexandria Wastewater Master Plan Study and the Alexandria Wastewater Master Plan Study - Environmental Impact Statement prepared by the same consulting firm?

In 1977, when the scope of work was developed for the Environmental Impact Statement (EIS) and today, there is no legal prohibition on the employment of the same consultant for a Master Plan Study and an EIS applicable to AID financed foreign assistance activities. In addition, at the time of the selection of Camp Dresser & McKee (CDM) for preparation of the EIS as well as the Master Plan Study, there

were no existing nor pending regulations by United States government agencies prohibiting the same firm from acting as the prime contractor for the preparation of both studies on the same project. It was not until January 1979 that the U.S. Environmental Protection Agency (EPA), charged with jurisdiction over wastewater facilities in the United States, issued an Administrative Rule against this practice.

3.3 What steps were taken to maintain independence between the two divisions of Camp Dresser & McKee (CDM), which prepared the Alexandria Wastewater Master Plan Study and the Environmental Impact Statement?

The consultant employed two independent divisions with separate staffs to develop the Master Plan Study and the Environmental Impact Statement. The principal-in-charge of each study was a division president of equal rank within the corporate structure of Camp Dresser & McKee.

The staff for the environmental study made extensive use of outside technical experts from the American academic community, American consultants, the Egyptian academic community, and Egyptian specialists from the Arab Technical and Economical Consulting Office (ATECO).

Specialists from the American academic community included:

Dr. Richard Haedrich, Biological Oceanographer
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Dr. Charles B. Officer, Adjunct Professor
Earth Sciences Department
Dartmouth College
Hanover, NH 03755

Dr. Daniel A. Okun, Kenan Professor of Environmental Engineering
Department of Environmental Sciences and Engineering
The School of Public Health
University of North Carolina at Chapel Hill
Chapel Hill, NC 27514

Dr. John H. Ryther, Senior Scientist
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

American Consultant firms involved were:

Bookman-Edmonston Engineering, Inc.
1000 Vermont Avenue, Suite 1110
Washington, DC 20005

Chas. T. Main International, Inc.
Prudential Center
Boston, MA 02199

The prominant members of the Egyptian academic community involved were:

Dr. Sayaed H. Sharaf El Din
Professor of Oceanography
Head, Oceanography Department
Faculty of Science
Alexandria University

Dr. Altaf Ezzat
Professor of Marine Biology
High Institute of Public Health
Alexandria University

Dr. Fahmy M. E. Sharkawi
Professor of Sanitary Engineering
High Institute of Public Health
Alexandria University

In addition all environmental documenation was subjected to internal technical review within AID. The Draft Environmental Impact Statement and Marine Studies volume of the Master Plan Study were reviewed by selected federal agencies including the President's Council on Environmental Quality (CEQ) and United States Environmental Protection Agency (EPA) and American environmental groups such as: the International Institute for Environment and Development (IIED) and Natural Resources Defense Council, Inc. (NRDC).

3.4 Does Camp Dresser & McKee (CDM) engage in the construction of sewer systems or sewerage treatment plants?

No, Camp Dresser & McKee is not a construction firm nor is it affiliated with nor does it have any interests in any construction firms. CDM does provide design services for treatment plants and as such provides resident construction services representing the client or owner, to insure that such construction is in accordance with the design.

II. COORDINATION AND PARTICIPATION

3.5. To what extent was the preparation of the Alexandria Wastewater Master Plan Study and Draft Environmental Impact Statement coordinated with the Mediterranean Pollution Control Programme (MED POL) of the United Nations Environmental Programme (UNEP)?

During the preparation of the Draft Environmental Impact Statement (DEIS) there was direct consultation and correspondance by John J. Donohue, DEIS Project Manager with both:

Dr. S. Kecks
Director, Project Activities Center
Regional Seas Program
United Nations Environmental Program
Geneva, Switzerland

Mr. Desmond Scott
Director, Intergoveronmental Oceangraphic
Commission
United Nations Educational and Scientific
Organization (UNESCO)
Paris, France

In the preparation of both studies, CDM was in regular contact with Dr. Fahmy M.E. Sharkawi, a regular participant in the Mediterranean Pollution Control Programme (MED POL) meetings, sponsored by the United Nations Environmental Programme (UNEP). Dr. Sharkawi served as a member of the Arab Technical and Economical Consulting Office (ATECO) personnel complement and provided the CDM team with information on recent developments and access to MED POL documents as they became available.

In addition AID provided a copy of the Draft Environmental Impact Statement to the United Nations Environmental Programme for review.

In the project agreement AID has a covenant which reads as follows:

> "Consistent with the Grantee's obligations under Article 16 of the "Protocol for the Protection of the Mediterranean Sea Against Pollution From Land-Based Sources" as developed through the United Nations Environmental Programme, the Grantee shall cause to be exchanged with the contracting parties to such Protocol information concerning the environmental aspects of the Project as may be appropriate under the Protocol."

3.6 What was the involvement of Egyptian individuals and institutions in the preparation of the Draft Environmental Impact Statement.

Egyptian input into the Draft Environmental Impact Statement (DEIS) involved both consultation and direct participation. Camp Dresser & McKee (CDM) and its project affiliates, in particular the Arab Technical and Economical Consulting Office (ATECO) were involved in informal and formal consultation with the following:

1. Ministry of Housing and Reconstruction (MOHR)
2. Ministry of Public Health
3. General Organization for Sewerage and Sanitary Drainage (GOSSD)
4. General Organization for Industrialization (GOFI)
5. Governorate of Alexandria
6. Local Council of Alexandria
7. People's Council of Alexandria
8. Alexandria University
9. Representatives of local industries
10. Representatives of local organizations
11. Various property owners in the Alexandria Area

In addition CDM was in a partnership with an Egyptian engineering firm, Arab Technical and Economical Consulting Office (ATECO), which provided over half the technical input and support to the Master Plan Study. ATECO employed some of Egypt's best scientists and engineers, many from the nation's leading universities. This resulted in a good interchange of ideas and sensitivity to local conditions.

Egyptian scientists who served on study team for the Draft Environmental Impact Statement included:

Dr. Sayaed H. Sharaf El Din
Professor of Oceanography
Head, Oceanography Department
Faculty of Science
Alexandria University

Assisted in the preparation and execution of the oceanographic studies.

Dr. Altaf Ezzat
Professor of Marine Biology
Oceanography Department
Faculty of Science
Alexandria University

Assisted in the fisheries survey.

Dr. Fahmy M. E. Sharkawi
Professor of Sanitary Engineering
High Institute of Public Health
Alexandria University

Assisted in conducting the study of Lake Maryut and provided liasion with the Mediterranean Pollution Control Programme (MED POL), United Nations Environmental Programme (UNEP).

3.7 What was the involvement of the Government of Egypt in the review of the Alexandria Wastewater Master Plan Study and Draft Environmental Impact Statement?

The Alexandria Wastewater Master Plan Study and the Environmental Impact Statement contract were administered and technically reviewed by the Ministry of Housing and Reconstruction (MOHR). MOHR was assisted in this task by Tippetts-Abbett-McCarthy & Stratton (TAMS), an American engineering consultant which frequently reviews contract products submitted to the ministry. The General Organization for Sewerage and Sanitary Drainage (GOSSD) had a team of five engineers working as a liaison committee with Camp Dresser & McKee (CDM) reviewing the technical reports they produced in the course of the Master Plan Study.

Egyptian review included several public briefings and hearings on the proposed Alexandria project. These meetings were reported in the Egyptian press and resulted in limited debate within the scien-

tific and technical community. Several symposia were held in Alexandria, ranging from one which involved scientists from the Southern California Coastal Water Research Project (SCCWRP) who advocated sea outfall systems to that of the International Academy on Environmental Safety (IAES) which recommended that no wastewaters be disposed into the Mediterranean Sea. The People's Council of Alexandria, with 110 members, reviewed the project and voted unaminously to endorse the project and its implementation. The project has been endorsed by both the Ministry of Housing and Reconstruction and the Ministry of Health.

3.8 Describe the technical input to the Environmental Impact Statement from the Department of Oceanography, University of Alexandria and the Institute of Oceanography and Fisheries.

The technical input to the Environmental Impact Statement from the Department of Oceanography and Fisheries consisted of discussions with Project scientists in Alexandria during October, November and December 1977. Discussions of particular importance where held with Dr. Sharaf El Din, Dr. Ezzat, and Dr. Sharkawi. The following scientific papers and technical reports developed by these and associated Egyptian institutions were used in the course of the study:

1. Aleem, A.A., "Effect of River Outflow Management on Marine Life,", Mar. Biol., 15, 1972, pp. 200-208.

2. Aleem, A.A., and Samaan, A.A., "Productivity of Lake Maryut, Egypt, Part I, Physical and Chemical Aspects," Int. Rev. ges. Hydrobiol., 54, 1969, pp. 313-355.

3. Aleem, A.A., and Samaan, A.A., "Productivity of Lake Maryut, Part II, Primary Production," Int. Rev. ges Hydrobiol., 54, 1969, pp. 491-527.

4. Al Kholy, A.A., and El Wakeel, S.K., "Fisheries of the Mediterranean Sea Along the Egyptian Coast," Bull. Inst. Oceanogr. Fish. A.R.E., 5, 1975, pp. 1-279.

5. Anwar, Y.M., and Mohamed, M.A., "The Distribution of Calcium Carbonate in Continental Shelf Sediments of Mediterranean Sea North of the Nile Delta in U.A.R.," Bull. Inst. Oceanogr. Fish. A.R.E., 1, 1970, pp. 449-460.

6. Botros, G.A., El Maghraby, A.M., and Soliman, I.A.M. "Biometric Studies on Sardinella maderensis and Sardinella aurita From the Mediterranean Sea at Alexandria, U.A.R.," Bull. Inst. Oceanogr. Fish. A.R.E., 1, 1970, pp. 83-128.

7. Davidar, N.M., "The Phytoplankton of the Mediterranean Waters of Egypt, I, A Checklist of the Species Recorded," Bull. Inst. Oceanogr. Fish. A.R.E., 4, 1974, pp. 319-344.

8. Davidar, N.M, and El Maghraby, A.M., "The Neritic Zooplankton of the Southeastern Mediterranean, I, Distribution and Ecology of the Zooplankton Organisms With Special Reference to Copepoda and, II, Consideration of the Total Zooplankton Community," Bull. Inst. Oceanogr. Fish. A.R.E., 1, 1970, pp. 225-303.

9. Desert Institute Water Resources Department. Report on the Regional Hydrogeological Studies of the West Nubareya Area. Ministry of Land Reclamation, A.R.E., February 1974.

10. El Hehyawi, M.L.E., "Changes in the Salinity and Landings of the Six Fish Species on the Shelf North to the Nile Delta", Bull. Inst. Oceanogr. Fish. A.R.E., 4, 1974, pp. 437-458.

11. El Maghraby, and Halim, Y., "A Quantitative and Qualitative Study of the Plankton of Alexandria Waters," Hydrobiologia 25, 1965, pp. 221-238.

12. El Maghraby, A.M., Botros, G.A., and Soliman, I.A.M., "Age and Growth Studies on Sardinella maderensis and Sardinella aurita from the Mediterranean Sea at Alexandria U.A.R.," Bull. Inst. Oceanogr. Fish. A.R.E., 1, 1970, pp. 47-82.

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III. COMPLEMENTARY ACTIVITIES

3.9 Describe the current Agency for International Development (AID) and United States Environmental Protection Agency (EPA) programs for the control of industrial wastes and toxic substances in Alexandria.

In concert with the Government of Egypt and its various subdivisions, AID and the EPA have engaged in the following actions for the control of industrial wastes and toxic substances in Alexandria:

3.9.1 Industrial Wastes Study

Through Amendment No. 5 to the Alexandria Wastewater Master Plan Study, the Toxic Industrial Wastes Study, Supplemental Report was prepared in, 1978. Toxic industrial wastes were defined for the purposes of the study as those liquid discharges from industrial premises which because of one or more constituents make the discharge incompatable with the downstream sewerage system, treatment plant and/or disposal environment. Included are wastes containing heavy metals, chlorinated hydrocarbons, pesticides, high or low pH, inflammables, and excessive amounts of oil, grease and suspended solids.

The objective of the study was to develop an outline of required pretreatment facilities, with cost estimates for each industry identified as a "toxic" waste contributor and to examine and recommend institutional modifications to the Alexandria industrial waste situation. The study was performed by surveying each industry within the study area, having a wastewater flow of over 230 m3/day and those industries having less than this flow, where "toxic" waste discharges were anticipated. A total of 168 industrial plants were surveyed. Based upon the information obtained in these surveys, 85 industries were identified as requiring pretreatment. Schematic pretreatment process designs were then developed along with estimates of the equipment and construction costs. Estimates of the annual operation and main-

tenance costs were also developed based upon chemicals required, power, manpower, supplies and where applicable, the costs for sludge handling and disposal.

An implementation and financing plan was then prepared. This addressed educational and institutional requirements, the development of sewer use regulations and associated monitoring program, and consideration of the ways and means available to industry for financing the facilities, including the identification of possible sources of foreign loans and grants.

3.9.2 Industrial Pollution Control Program

The Industrial Production Project (AID Project, 262-0101) is to improve the capability of the Ministry of Industry and the public sector industrial companies in the planning, upgrading and implementation of industrial production. As a part of this project $20.5 million in grant financing is available for the purpose of reducing detrimental environmental effects created by the uncontrolled discharge of industrial wastes.

The need for assistance to industrial concerns in eliminating industrial waste hazards, both in the plant and external to the plant, was identified in the Alexandria Wastewater Master Plan Study. This study showed that at least 11 major polluters were discharging toxic waste into Alexandria's wastewater system. The industries maintain that nothing can be done because of the lack of funds. This project provides not only the funds, but the technical and engineering expertise needed to control and restrict harmful industrial waste from reaching Alexandria's collection system. AID plans to make additional financing available in the future to help correct the serious industrial pollution problem in Egypt.

3.9.3 Covenants to Project Agreement

To assist in the control of industrial wastes and toxic substances in Alexandria, the following covenants have been included in the project agreement:

"The Grantee and GOSSD shall take necessary actions to provide continuous and adequate monitoring of the aquatic systems in the vicinity of the sea outfalls and the beaches of Alexandria to detect any changes in such systems resulting from the Project." (To assist the Government of Egypt in this activity the project includes $150,000 in foreign exchange costs for monitoring equipment.)

"The Grantee and GOSSD shall take necessary actions to establish the organizational structure to insure that the existing "Sewer Use Law" applicable to this Project is enforced".

"The Grantee shall consider modifying the existing "Sewer Use Law", applicable to this Project, in order to conform with the proposed draft "Ordinance Regulating Sewer Construction, Sewer Use and Industrial Waste Discharge", as recommended in the Alexandria Wastewater Master Plan Study".

"The Grantee and GOSSD shall consult with GOFI and other responsible agencies to ensure coordination with regard to problems related to industrial wastes and the disposal of toxic materials and within one year of the signing of the Agreement submit a plan of action which would indicate how this problem is to be addressed".

"The Grantee and GOSSD shall undertake necessary studies to evaluate the problem of disposal of solid waste and within one year of the signing of the Agreement propose a plan to exclude from the public sewer system solid wastes such as mazaut, oil, grease, manure, septage, slaughterhouse and tannery wastes and trash."

In addition to the project agreement will require the engineering consultant to review the industrial and toxic waste discharges to identify any reasonable improvements that can be made in segregating these wastes and excluding them from the collection system.

3.9.4 Environmental Protection Agency Activities

The U.S. Environmental Protection Agency (EPA) has been involved with Egyptian counterparts in the following U.S. Public Law 480 (P.L. 480) funded projects:

A. PROJECT NUMBER: 3-542-3

TITLE AND DESCRIPTION:

"Studies of Water Quality of Marine Recreational Waters"

To determine the relationship between the incidence of disease in swimmers at salt water beaches of Alexandria and the sanitary quality of bathing water as measured by any of several possible indicator systems.

PRINCIPAL INVESTIGATOR:

Dr. Kamal Hakim
High Institute of Public Health
Alexandria University

DURATION: 6/1/76-6/1/79

B. PROJECT NUMBER: 3-542-4

TITLE AND DESCRIPTION:

"Integrated Study of Pollution Control in Moharrem Bey Industrial Complex"

To investigate various alternatives for treating wastewater from the Moharrem-Bey Industrial Complex including food oil and fat production, paper reprocessing, textile finishing, yeast and starch production and other minor industries. Alternatives evaluated included: pretreatment and discharge to lake; in plant modifications; combined treatment of industrial and municipal wastes in Alexandria's Sewage Treatment Plant.

The scope of this project was expanded in July, 1979 to include an assessment of industrial effluents which includes characterization, estimation of waste loads, evaluation of toxic constituents and removal of pollutants through treatment processes. This expanded study is focusing on the preliminary survey of the five major industrial complexes in Alexandria - Abu Kir, El Mex, Kafr el Dawr, Nouzha and Siouf.

PRINCIPAL INVESTIGATOR:

Dr. Ahmed Hamza
High Institute of Public Health
Alexandria University

DURATION: 7/1/77 - 7/15/84

C. PROJECT NUMBER: 3-542-6

TITLE AND DESCRIPTION:

"Investigation of Level and Effects of Pollutants in Saline Lakes and Littoral Marine Environments"

To identify and quantify pollutants entering marine waters from municipal, industrial and agricultural sources and to determine the effects of these pollutants on marine life.

PROJECT MANAGER:

Dr. A.F.A. Latif
Institute of Oceanography and Fisheries
Egyptian Academy of Scientific Research and Technology
Cairo

PROJECT COORDINATOR:

Dr. A.R. Bayoumi
Egyptian Academy of Scientific Research and
Institute of Oceanography and Fisheries
Egyptian Academy of Scientific Research and Technology
Cairo

DURATION: 9/30/77-3/30/82

3.10 Describe existing or planned activities of the Government of Egypt, Agency for International Development (AID), and other organizations which will complement the proposed action.

The proposed action will be complemented by the following activities:

3.10.1 Water Supply

The International Bank for Reconstruction and Development (IBRD/World Bank) and the Government of Egypt are currently engaged in a major program to improve water supply to Alexandria.

3.10.2 Advance Actions

In 1977, with the anticipation of a major expansion to the Alexandria wastewater system, a series of Top Priority Projects were initiated with AID funding. The ongoing projects include: (1) personnel training, (2) establishment of an improved system for collection and disposal of excluded wastes, (3) cleaning of existing sewers, (4) repair or replacement of sewer lines now in disrepair and (5) extension of sewerage services into a presently unsewered areas.

3.10.3 The Evaluation of Industrial and Toxic Wastes

The continuation of the Public Law 480 (P... 480) funded program which has involved the United States Environmental Protection Agency (EPA) and various Egyptian counterparts in the evaluation of industrial and toxic waste problems (see Section 3.9.4 for details).

3.10.4 The Management of Industrial and Toxic Wastes

A. The project agreement will require the engineering consultant to review the industrial and toxic waste discharges to identify any reasonable improvements that can be made in segregating these wastes from entering the collection system.

B. Expansion of the current Industrial Pollution Control segment of the AID funded Industrial Production Project. This project provides technical services and grant funding for industrial plants to reduce waste discharges to acceptable limits (see Section 3.9.2 for details).

C. The inclusion of a covenant to the project agreement requiring that the General Organization for Sewerage and Sanitary Drainage (GOSSD) shall consult with the General Organization for Industrialization (GOFI) and other responsible agencies to ensure coordination with regard to problems related to industrial wastes and the disposal of toxic materials and within one year of the signing of the project agreement propose a plan which would indicate how this problem is to be addressed.

3.10.5 The Management of Solid Wastes

A. An area-wide study partially financed by AID will be undertaken dealing with the solid waste collection and disposal problems of Alexandria. The full scale project design resulting from this study will be submitted to AID for financing.

B. The inclusion of a convenant to the project agreement requiring that the General Organization for Sewerage and Sanitary Drainage (GOSSD) shall undertake necessary studies to evaluate the problem of disposal of solid waste and within one year of the signing of the Agreement propose a plan to exclude from the public sewer system deleterious solid wastes such as mazaut, oil, grease, manure, septage, slaughterhouse and tannery wastes and trash.

3.10.6 Environmental Monitoring

The inclusion of a covenant to the project agreement providing for continuous and adequate monitoring of the aquatic systems in the vicinity of the sea outfalls and the beaches of Alexandria for changes. To assist the Government of Egypt in this activity the project includes $150,000 in foreign exchange costs for monitoring equipment.

3.10.7 Sewer Use Laws

A. The inclusion of a covenant to the project agreement requiring that the General Organization for Sewerage and Sanitary Drainage take the necessary actions to establish the organizational structure to insure that the existing "Sewer Use Law" applicable to this Project is enforced.

B. The inclusion of a covenant to the project agreement requesting the Government of Egypt to consider modifying the existing "Sewer Use Law" to upgrade it to conformance with the proposed draft "Ordinance Regulating Sewer Construction, Sewer Use and Industrial Waste Discharge", as recommended in the Alexandria Wastewater Master Plan Study.

3.10.8 Operator Training

AID is presently involved in financing one half billion dollars in foreign exchange costs of seven water and sewerage projects in Egypt with a total constructed value of $2 billion. This work involves not only physical facilities, but managerial and financial, operations and maintenance and training along with the needed support equipment. Over the next five years it is anticipated that an estimated 1,000 Egyptians will receive some form of training to better equip them to handle their position in either the water supply or wastewater fields.

3.10.9 Pilot/Demonstration Study

AID is planning a pilot/demonstration study on the reuse of wastewater in Egypt. This study will provide more reliable information in the areas of cost, technical reliability and social acceptability of reclaimed wastewaters and their potential reuse in Egypt.

3.11 Explain the lack of emphasis on non-constructional activities, such as solid waste management, system maintenance, and personnel training, in the Alexandria Wastewater Master Plan Study.

3.11.1 General

The Ministry of Housing and Reconstruction has in process an extensive AID funded management and tariff study relative to water and sewerage systems within Egypt. The objectives of this study, being performed by an international consulting team, is:

A. To assess alternative organizational approaches for the management of water and wastewater systems and to recommended a specific organizational approach to both current and future service by these utilities in Egypt.

B. To provide the basis for enabling the water and wastewater utilities in Egypt to become financially viable, self-sustaining organizations that can provide the level of service desired by the people of Egypt.

Due to the objectives of this ongoing project and because of the scope of work developed by the Government of Egypt (GOE) was to prepare a Facilities Master Plan, non-constructional activities were not included in any great detail in the Final Report of the Master Plan Study. However, many of these activities were considered and

discussed in Special Report No. 4 of the Alexandria Wastewater Master Plan Study and are being addressed in the Top Priority Project's design phase, which has been underway now for about a year and a half. The Top Priority Projects (TPP) program addressed implementation of a sewer use law, establishment of an improved system for collection and disposal of excluded wastes, sewer cleaning programs, sewer reconstruction and rehabilitation and extension of sewers into unsewered areas.

3.11.2 Solid Wastes Management

The need for improved solid wastes management is obvious to anyone living and working in Alexandria. This problem, as it impacted the wastewater collection system, was addressed in the excluded wastes study. These excluded wastes are those which are dumped or discharged into the sanitary system and cause malfunction. The study included investigation of the particularly urban-Egyptian private syndicate ("Zabeleen") system of trash collection and resource recovery, as well as of quantities and types of solid wastes produced. Included in the Top Priority Projects program was a study to educate the populace concerning the direct impacts and health risks associated with the practice of dumping solid wastes into sewers.

3.11.3 System Maintenance

A major feature of the Master Plan Study was the cleaning and rehabilitation of much of the existing sewer system. A very early component of the Top Priorities Projects contract was a sewer cleaning demonstration program, which has now been in operation for well over a year. In this program, an American operation/demonstration team, together with workmen from the local sewerage authority, the General Organization for Sewerage and Sanitary Drainage (GOSSD), have been using modern sewer cleaning equipment (high pressure water sprays, large-volume vacuum cleaners) to remove many years' accumulation of grit from many kilometers of Alexandria's sewers. Results were most notable after a sudden downpour in December 1978, which hitherto would have flooded many lowlying intersections and underpasses; but which this time caused little or no flooding.

While achieving such immediate results, the prime objective is to gain acceptance, familiarity and competence with the vacuum equipment.

Originally the sewer cleaning work was thought to be too great a task to be accomplished with GOSSD's maintenance crews alone. The plan was to use an American sewer cleaning contractor to train GOSSD crews and to do the majority of the work. GOSSD's crews, utilizing the equipment purchased by the cleaning contractor at the completion of the contract would continue to keep sewers clean and in good condition. However, it was discovered that GOSSD's crews could not only handle the new types of clean-

ing equipment with a minimum of training, but could handle the bulk of the work backlog. Therefore, it was decided to do all the cleaning work with GOSSD's crews after purchase of new cleaning equipment. This resulted in a foreign exchange cost savings to the project of approximately $4 million.

3.11.4 Personnel Training

One of the major components of the Top Priority Projects was the development of an extensive training program for GOSSD personnel. This program provided for the following:

A. A review of the GOSSD programs and the development of complimentary training programs in the fields of operation, maintenance, surveying, drafting, engineering, management, administration, and procurement which would be designed to fill gaps not addressed by GOSSD training programs.

B. Training of GOSSD personnel in Sewer Cleaning techniques and equipment through on-the-job performance with an American operation/demonstration sewer cleaning team (see 3.11.5 for details).

C. Training of GOSSD personnel to perform supervisory and instructional roles in the areas of operation and maintenance. As a part of this program, Dr. Ronald Layton, a director of an American training center for wastewater treatment plant operators, performed an evaluation of potential training programs.

D. Assistance to GOSSD on the functional aspects of the design of the proposed GOSSD training center.

E. Assistance of a wastewater laboratory chemist for a period of eleven months to assist GOSSD personnel in bringing the Alexandria wastewater laboratory into operation, establishing wastewater and effluent quality monitoring procedures and to provide on-the-job training for GOSSD laboratory and sampling personnel.

F. Furnishing on-the-job training for five GOSSD design engineers during the Alexandria TPP design period and furnishing on-the-job training of three GOSSD engineers in survey work during the TPP work. Also quarterly training seminars were conducted in Alexandria for GOSSD personnel in the various aspects of sewer system design, construction and operation.

G. To arrange for the participation of up to four senior GOSSD staff members in seminars, visits to operating wastewater utilities and inspections of facilities in the U.S. and for attendance in the U.S. by a senior GOSSD staff engineer nominated by GOSSD, at a meeting of the CDM's Technical Review Committee dealing with this project.

3.11.5 Management

In addition to the activities described in Sectin 3.11.1, operating and management plan for sewer maintenance was prepared in the course of the Top Priority Projects study.

IV. SOLID WASTE MANAGEMENT

3.12 Why does the Draft Environmental Impact Statement not address the problem of solid waste management in detail?

The Draft Environmental Impact Statement did not address the problem of solid waste management in detail because of the ongoing excluded* wastes segment of the Top Priority Projects (TPP) and the anticipated development of an area wide study partially financed by AID dealing with the solid waste collection and disposal problems of Alexandria. It was felt that such studies and their resulting programs would serve to compliment activities funded under the proposed project.

During the development of the Alexandria Wastewater Master Plan Study the consultant identified major problems caused by the disposing of excluded wastes within the collection sewers of Alexandria. As a result, a special amendment to the study contract was developed with the Government of Egypt and AID for the specific study of excluded waste problems. The findings of this study are included in Special Report No. 4.

The project provides funding for a comprehensive study of solid waste collection and disposal problems of Alexanderia. The full scale project design resulting from this study will be submitted to AID for financing. In addition, the agreement for this project contains the following covenants:

"The Grantee and GOSSD shall take necessary actions to establish the organizational structure to insure that the existing "Sewer Use Law" applicable to this Project is enforced".

"The Grantee shall consider modifying the existing "Sewer Use Law", applicable to this Project, in order to conform with the proposed draft "Ordinance Regulating Sewer Construction, Sewer Use and Industrial Waste Discharge", as recommended in the Alexandria Wastewater Master Plan Study".

*Excluded wastes are those which will be excluded from sewers by implementation of the existing "Sewer Use Law" and include solid and liquid wastes such as mazaut, oil, grease, manure, septage, slaughterhouse and tannery wastes, and trash

"The Grantee and GOSSD shall undertake necessary studies to evaluate the problem of disposal of solid waste and within one year of the signing of the Agreement propose a plan to exclude from the public sewer system solid wastes such as mazaut, oil, grease, manure, septage, slaughterhouse and tannery wastes and trash".

V. SEA DISPOSAL ALTERNATIVE

3.13 What would be the construction phase environmental impacts of the proposed sea outfalls? How will these impacts be mitigated?

The environmental impacts will be (a) turbidity generated in trenching and bedding, and (b) fish kill due to blasting in trenching operations. The turbidity generated will be of the order of that generated by wave action during storms, near shore. Farther offshore, the turbidity may be somewhat more than that generated by anchors being deployed and retrieved in a ship anchorage. Adverse impacts of blasting can be minimized by observing criteria and procedures referred to in the attached memorandum dated 19 October 1976.

In addition, potential adverse impacts upon the beach now or in the future consisting of silt, sand, rocks, debris, etc., resulting from trenching and bedding or similar construction activities, would be mitigated through the use of booms, nets and desilting caissions or similar procedures. There will also be some temporary navigational detours necessary because of construction vessels, shore storage facilities near outfall alignments (especially for pipe), and aesthetic disturbances because of construction activities.

There will be considerable disruption of traffic and other normal local activity in the vicinity of the outfall construction sites at and near the shoreline. The extent of land area needed for construction plant and materials will depend to a great extent upon the construction method employed by the contractor. It is presumed that pipe manufacture will take place at a remote industrial site and the large pipes will be hauled to the construction site thus increasing heavy traffic. It is possible also that the contractor may build a temporary jetty or loading dock projecting into the sea at this site for barge delivery of materials. A portion of the beach will be withheld from its normal usage during the construction period. These impacts could be partially mitigated through advance planning and coordination of operations.

MEMORANDUM

TO: Files

FROM: J.A. French

DATE: 19 October 1976

SUBJ: Fish kill by submarine blasting

1. General Technique. Literature survey

Dupont Manual (1)

a. Charges on the surface of the rock in a regular pattern. This method is most effective where the hard material is relatively thin and overlies a softer deposit; or where formation to be blasted is fairly soft and removal of only a few feet is required.

A typical blast layout consists of 50 lb charges on 8 to 10 ft square spacings. Charges are fired simultaneously over a considerable area and depths on the order of 3 to 4 ft per blast may be realized.

The procedure requires a water depth of at least 25 ft, and is generally considered more costly than conventional drilling and blasting except under favorable conditions.

b. Buried charges. The most important point in submarine blasting is to drill the holes to the proper depth below grade. One rule is to have the bottoms of the boreholes the same distance below grade as the spaces between the holes. A number of contractors who specialize on submarine work drill all holes 10 feet below grade irrespective of the depth of the cut to be made. The maximum spacing recommended is on 10-ft centers.

It is sometimes necessary to conduct submarine blasting in congested areas where ground vibration is critical and must be held to a minimum by limiting the size of individual blasts and by employing short interval firing with MS delays.

The quantity of explosives required in submarine work depends upon the hardness of the material, the depth of the water, and the depth of the boreholes, and varies over a wide range. In softer rocks and shallow water one pound of dynamite per cubic yard of rock drilled is sometimes sufficient. With hard rock, in deep water, and in certain special cases, five pounds per cubic yard, or even more, may be required. The average is of the order of two to three pounds per cubic yard, depending on the depth of excavation.

Gates, "Blasting design criteria" (2)

Based on the results from a wide variety of rock excavation projects, the quantity of explosives per unit volume of bank rock may be determined from:

$$Y = \frac{T}{j\sqrt{L}}$$

Where:

Y = pounds of explosives per cubic yard of rock

T = ultimate tensile strength of rock, in psi

L = length of borehole in ft, not including subdrill

j = an empirical constant ranging from 150 to 200. A reliable average value is 175.

Average values of ultimate tensile strength, T, for various kinds of rock, are presented in the following table. The value of T may be increased by 50 percent and reduced by 33-1/3 percent (i.e., T $\div$ 1.5) for varying strengths of each class of rock.

Rock	Tav, psi
Granite	900
Trap and schist	800
Dolomite and shale	700
Limestone	600
Slate and conglomerates	500
Sandstone	400
Glacial till	300

Graves, "Air-bubble curtain in sub-aqueous blasting at Muddy Run" (3)

The Cole formulation of maximum pressure from an explosion of a spherical charge freely suspended in water is:

$$P = k \left(\frac{Q^{1/3}}{R} \right)^{\alpha}$$

Where:

P = anticipated pressure, in psi
Q = weight of charge, in pounds
R = distance from charge, in feet
k = 21,500 } empirical constants
α = 1.14

Pressure generated from submerged drill hole blasting are reduced by a factor of 7 to 14 (i.e. $10 \div \sqrt{2}$) compared to blasts from freely suspended charges, for a concentration of 2 lb of explosives per cubic yard of rock.

Wiss, "Effects of blasting vibrations on buildings and people" (4)

It has been found that at a particular blasting site, the vibration at any location will be determined by a ratio of the distance and the square root of the explosive weight.

Groves and LaFrenz, "Rapid excavation with explosives" (5)

(From the figures in the article, I infer that at optimum burial of the charge, the excavated trench is twice as wide as it is deep.)

The environmental impact of ground shock and airblast must always be evaluated. Relatively accurate methods are now available for predicting both of these effects which can be reduced to insignificant levels by sequential detonation of charges and rows of charges. It has been found that a 2-millisecond delay between 1-ton charges placed in a row produces only insignificant changes in crater dimensions, but reduces ground shock and airblast effects to those of the largest single charge within the row.

Fish kill and ejecta distribution were originally considered limiting factors on underwater detonations. Experience to date indicates that these effects are not serious. Although ejecta is spread over the marine bottom several hundred feet from a detonation [of several tons of explosives], the disturbance is no greater than that caused by conventional construction. Fish kill is also limited to several hundred feet from the cratering detonation. On Project TUGBOAT, where 40 tons [buried] were detonated at one time, the fish kill in pre-positioned cages did not extend beyond a 300 ft radius from the point of detonation.

2. Comments and Analysis

The full report on Project TUGBOAT (6) should have some very useful information on fishkill bioassays, as briefly alluded to in Reference (5). It is on order but not yet received. Meanwhile, we may note:

a. While neither the Cole formula nor the "scaled-distance" formula of Wiss is directly applicable to fish kill, each does deal with intensity of disturbance, which is relevant to fish kill.

b. From the Cole formula we may infer that, other things being equal, the radius of fish kill will be proportional to the cube root of the weight of the charge.

c. From the Wiss formula we may infer that, other things being equal, the radius of fish kill will be proportional to the square root of the weight of the charge.

d. The Cole formula deals with underwater detonations, hence is relevant. The Wiss formula deals with buried charges. For buried charges underwater, it is not yet clear which root-law is more applicable. Therefore, we shall consider both for the moment.

e. The Groves-LaFrenz article (Ref. 5) provides us with a single data point: 300-ft kill radius for a 40-ton buried underwater detonation. We await amplification, clarification, and more data in Ref. (6). Meanwhile we use what we have.

f. Buried charges underwater generate 1/10 the pressure of unburied charges. By the Cole formula, burying the charges will reduce the kill radius by a factor of $10^{1/\alpha} = 7.5$, for $\alpha = 1.14$.

On the basis of these notes, we plot the curves on the following pages:

Fig. 1 <u>Kill radius vs. charge weight</u>

a. Buried charge, $R \propto Q^{1/3}$, curve passing through 300 ft/40 tons

b. Buried charge, $R \propto Q^{1/2}$, curve passing through 300 ft/40 tons

c. Exposed charge, $R \propto Q^{1/3}$, same as curve (a) but increased by a factor of 7.5

Fig. 2 <u>Kill area vs. charge weight</u>

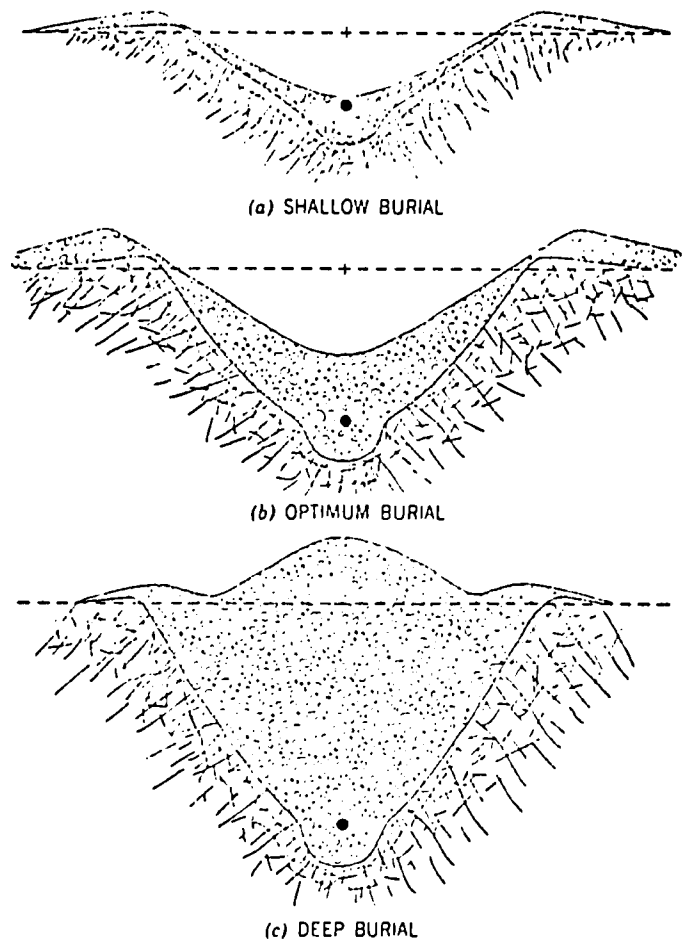
Kill area = $(\text{kill radius})^2 \times \pi$. The three curves correspond to the three curves in Figure 1, but with radius converted to area.

3. Probable conditions at Nobska Point

a. Rock type. Further investigation is of course necessary, but let us assume now that we are dealing with a fairly hard rock, with T = 800 psi.

b. Depth of trench. The pipe will be 24" internal diameter, and should have 4 ft of cover, or more. The trench should be at least 6 ft deep.

By rough scaling from the sketch in Ref. 5, copied here, a charge of optimum size buried 6 ft deep will excavate a trench 7.5 ft deep and 15 ft wide, for a cross-sectional area of 112.5 ft^2, or 12.5 sq. yd.



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c. Yardage excavated per charge. Assume charges placed on 6-ft centers, 6 ft deep. The area excavated is 12.5 yd^2; the trench length is 6 ft = 2 yd, so that volume is 12.5 x 2 = 25 cu yd.

d. The strength of the charge is 25Y

$$Y = \frac{T}{j\sqrt{L}}$$

T = 800 psi

j = 175

L = 6 ft

∴ Y = 1.87 lb/cu yard

25 Y = 46.6 lb; say <u>50 lb per charge</u>

e. Provide MS delays between adjacent charges.

f. From Figure 1, the kill radius will be 26 ft, by the Cole formula. From Figure 2, the kill area will be 2100 ft^2.

References

1. Blasters' Handbook, Dupont (CDM library)

2. Gates, M., Civil Engineering, January 1964, p. 54±

3. Graves, M., Civil Engineering, June 1968, p. 59

4. Wiss, J.F., Civil Engineering, July 1968, P. 46

5. Groves, R.H., and R.L. LaFrenz, Civil Engineering, August 1972, p. 60

6. "Project TUGBOAT Explosive Excavation of Harbor in Coral," EERL Tech Report B-72-23, TID 4500UC35, Available through NTIS.

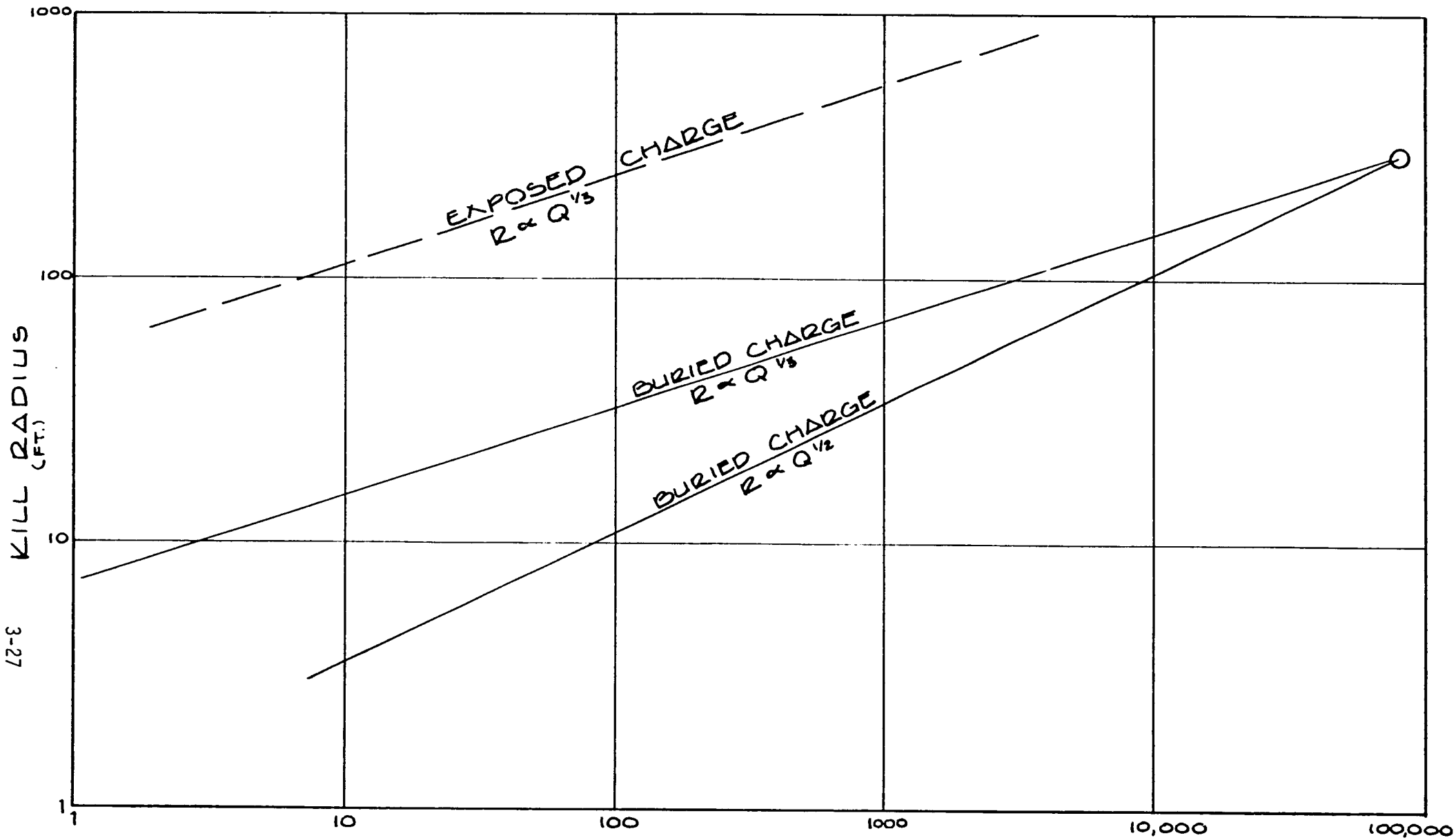
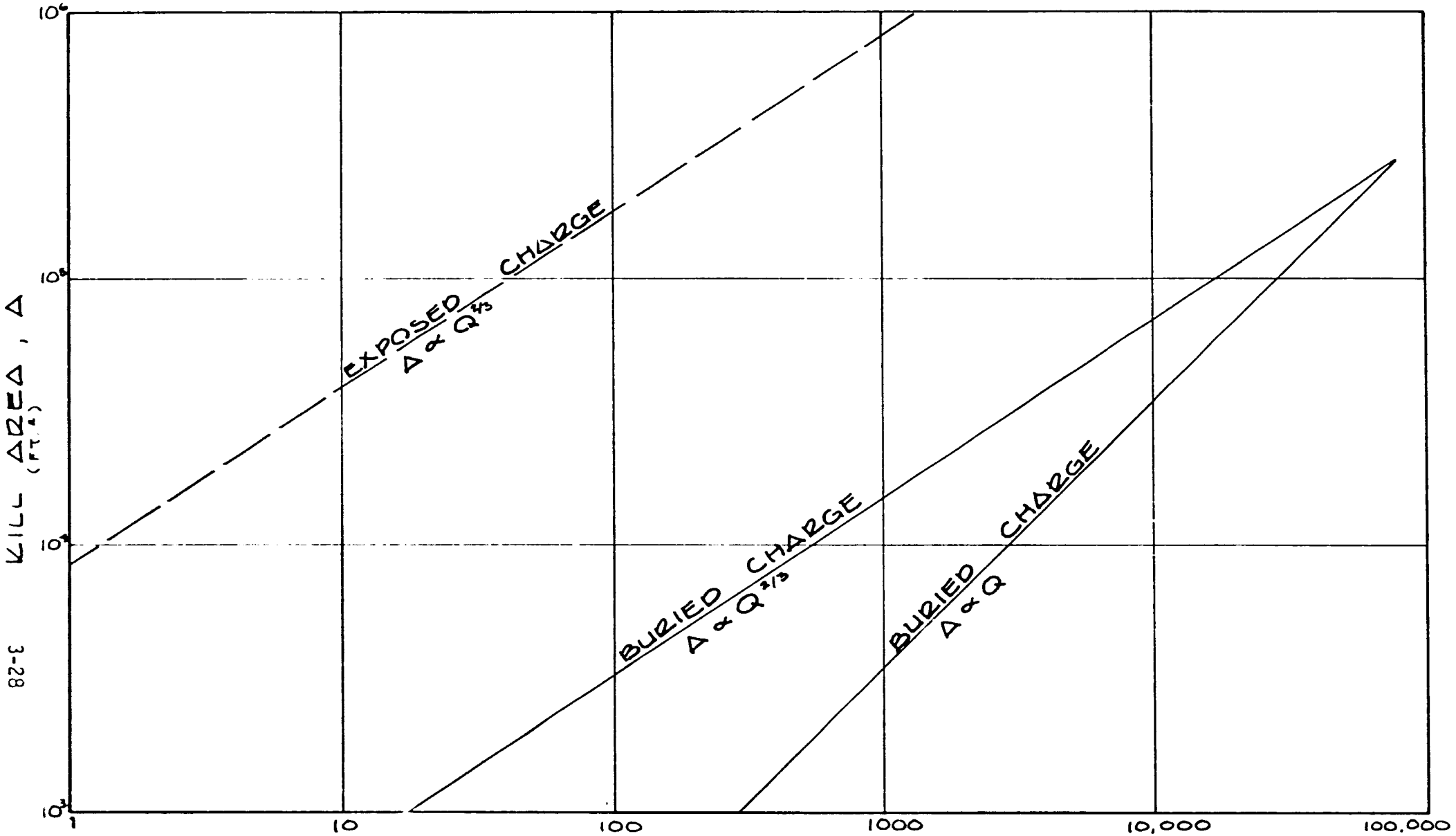

1000
100
10
1
KILL RADIUS (FT.)
EXPOSED CHARGE
R ∝ Q^1/3
BURIED CHARGE
R ∝ Q^1/3
BURIED CHARGE
R ∝ Q^1/2
1
10
100
1000
10,000
100,000
Q POUNDS OF EXPLOSIVE

FIGURE 1.


KILL AREA, A
(FT.²)
10⁶
10⁵
10⁴
10³
1
10
100
1000
10,000
100,000
EXPOSED CHARGE
A ∝ Q^4/3
BURIED CHARGE
A ∝ Q^2/3
BURIED CHARGE
A ∝ Q

3.14 Which Egyptian Government organization(s) will be responsible for the management, monitoring and regulation of marine discharges?

Management and regulation should be the responsibility of the General Organization for Sewerage and Sanitary Drainage (GOSSD), as is the monitoring of industrial effluents admitted to the sewerage system. For monitoring of the marine environment, institutions that logically could be involved are:

1. Institute of Oceanography and Fisheries, Alexandria (field sampling, biological analysis).

2. Oceanography Department, Alexandria University (field sampling, biological analysis).

3. Faculty of Agriculture, Alexandria University or National Research Centre, Cairo (analyses requiring a gas chromatograph/mass spectrotometer, GC/MS).

4. High Institute of Public Health, Alexandria University (water quality analyses).

Institutional arrangements for monitoring have not yet been made, they will be formally determined at the design phase (see Chapter 5.3 for proposed monitoring program).

3.15 Describe the planned monitoring system for marine discharges. Provide detail on institutional, staffing, and technical aspects. How will toxics be monitored?

See the descriptions of proposed monitoring programs in Chapter 5.3 and 5.4.

3.16 What will be the incremental contribution of the Alexandria system to the municipal and industrial wastewater discharge loading of the Mediterranean Sea on a regional and comprehensive basis? What would be the cumulative impact of this increment?

Much of the population of countries bordering the Eastern Mediterranean Sea is concentrated in coastal centers. The total population of major coastal cities alone in this area is estimated to be at least 12 million, with perhaps twice that number distributed amongst smaller coastal and estuarine towns. The common method of sewage disposal from most of these urban centers is by discharge to the sea, generally through short outfalls providing inadequate dilution and dispersion. In most cases the sewage is discharged either untreated or after only partial primary treatment. Elsewhere in the Eastern Mediterranean, problems related to marine disposal of sewage have been studied at such places as Izmir, Athens, Tel Aviv, Beirut and the Adriatic Sea. Often, the pattern is of pollution and/or eutrophic conditions in nearshore areas and embayments containing the discharge sites, but near-pristine conditions in open waters not far away.

In comparison with the Western Mediterranean region the industrial wastewater load is not heavy, but it is increasing at a substantial rate as industrialization programs are implemented. Pollution of coastal waters and beaches because of oil and rubbish disposed of mainly from ships is a recognized problem in the Eastern Mediterranean, particularly since the reopening of the Suez Canal.

The possibility of cumulative effects on the Mediterranean was a design concern from the beginning of the Master Plan Study. The outfall planning philosophy with respect to each of the major wastewater parameters was:

1. Bacteria: provide initial dilution and discharge sufficiently far from vulnerable areas (beaches; shellfish beds) so that bacterial numbers will be sufficiently reduced due to dilution and the time required to travel from the outfall discharge to these areas.

2. Biological Oxygen Demand (BOD): provide sufficient initial dilution that exerted BOD never depletes dissolved oxygen levels below that necessary for fish to thrive (2.0 to 3.0 mg/l).

3. Suspended Solids (SS): provide sufficient initial dilution that water clarity is not impaired to any significant degree. Settleable solids may accumulate in an area near the outfall, but to a degree far less than SS in the Nile floods that built the Nile delta. (Primary treatment as proposed will significantly reduce SS discharged.)

4. Nutrients: there is now no danger of eutrophication in the nutrient-poor Eastern Mediterranean as a whole, although there are biologically overstimulated areas near shoreline sewer discharges. Provide sufficient dilution to benefit the food chain over a large area, thereby replacing a small fraction of the nutrients lost to the Mediterranean by impoundment of Lake Nasser by the Aswan Dam.

5. Toxic Materials: control these at their source to the extent recommended by the Mediterranean Pollution Control Programme (MED POL), United Nations Environmental Programme (UNEP) whose recommendations will be based on continuing local marine toxicological research. The outfalls have been planned to dispose of primary treated effluent. Toxic industrial wastes shall be controlled through pretreatment or exclusion. The outfall discharge effluent quality will not exceed MED POL water quality guidelines.

In this manner, adverse cumulative effects are to be kept within standards, and beneficial cumulative effects (nutrients) are to be permitted.

3.17 Discuss the technical adequacy of preliminary treatment prior to sea disposal in the case of Alexandria. Does primary treatment prior to sea disposal constitute a reliable alternative to preliminary treatment?

The recommendation of preliminary treatment in the Alexandria Wastewater Master Plan Study is based upon the conclusion that wastewater pollutants can be adequately dispersed and assimilated in the sea water. Preliminary treatment is provided to remove floatables which otherwise might drift to shore and to remove trash, rags and grit which may adversely affect the operation of the outfall pipeline and diffusers.

Primary treatment constitutes a reliable alternative to preliminary treatment as it affords the same treatment needed to remove flotables and to insure successful operation of the outfall. In addition, primary treatment also removes a substantial percentage of the settleable solids and reduces by up to one-third the effluent Biological Oxygen Demand (BOD).

3.18 What would be the advantage of a mixed wastewater treatment program which would involve sea disposal for the present urban core and agricultural reuse/evaporation ponds for future developments at the urban fringe?

There is a large dense urbanized population now needing sewerage and sewage disposal, by a means relatively quickly attained. The means should be effective, rugged, reliable and operable by the infrastructure presently available in Egypt. It also must be well planned and flexible so that it forms a core system upon which to enlarge and build for future needs.

The agricultural sector is not at present prepared to accept any Alexandria wastewater for irrigation. Numerous constraints presently exist to the reuse of wastewater among them are the high cost when compared to Nile water, lack of a proper delivery system, poor social acceptability and the lack of an organization unit or land owners groups to received and utilize the treated wastewaters. In the future, the agricultural sector may develop to the point where it could reclaim and use some wastewater in some seasons, depending on the demand which may develop for Nile River waters.

The first sewerage service areas to contribute to such a wastewater reuse scheme would most logically be areas such as Dekheila and Ameria which are on the western outskirts of the city, and for which stabilization pond treatment is the prefered and recommended alternative of the Master Plan Study.

Conceivably, the demand for wastewater for irrigation could grow, to the extent that some wastewaters from more central areas, at some seasons, would be treated and conveyed to the west for irrigation. However, it must be borne in mind that it is highly unlikely that all of Alexandria's wastewater in all seasons would be welcomed for irrigation, certainly not now, or within planning horizon of the Master Plan Study. future. Therefore, a balanced disposal approach consists of a safe and dependable outfall system now, with the option kept open for stepwise conversion to irrigation reuse of treated wastewater in the future.

3.19 Discuss the reversibility of the proposed sea disposal plan for the later possibility of adding on agricultural reuse systems or evaporation ponds.

The proposed wastewater system could be modified to allow for the redirection of wastewaters from the urban areas if a future demand developed for reuse in agricultural irrigation. With the addition of conveyance and force mains, flows from the Ras el Soda system would most likely be tapped first, because of the easier construction from Ras el Soda to the west than from Kait Bey. Whatever the means of disposal, it has been determined in the Master Plan Study that sewage from the central areas should be collected at two central points. (Due to high population density and very high water tables, on-site disposal at each house is not at all feasible.) At Ras el Soda, it will be a relatively simple design matter to provide for diversion of the pumped flow to a line carrying the sewage to the west, either for treatment at the irrigation area, or after treatment at Ras el Soda, or a combination. The diversion would not be permanent, nor would it necessarily be a complete diversion, since the sea outfall would still be in use part or all of the time.

Reversibility in the Kait Bey system is not as easily attained, due to the costs of building a large force main from the end of the Anfushi Peninsula back through the heavily built-up city. The collection point is proposed to be at the end of the Anfushi Peninsula because that is where it is now in the existing system, and the Master Plan Study engineers have made it a point to make the most use possible of the existing system.

3.20 Compare the physical, chemical and biological quality of the waters of the southeastern Mediterranean Sea with those of the Mediterranean Sea in general?

The Mediterranean may be divided into an eastern and western basin separated by a shallow sill across the Straits of Sicily, and by the Strait of Messina.

The eastern Mediterranean is a relatively isolated ocean basin of moderate depth. The water is clear, warm (13-28°C), and salty (38-39 o/oo), with evaporation exceeding precipitation. The generally counter-clockwise circulation is fairly sluggish. The continental shelf is narrow, rarely more than 8 km wide except in the vicinity of the Nile cone where it extends more than 60 km from the coast. There are some 120,000 km^2 of shelf in the region, of which 28,750 km^2 (24%) are in Egyptian waters. There are no significant inputs of fresh water since the damming of the Nile at Aswan but there are in places, particularly the delta region of Egypt, a number of brackish to saline shallow lakes connected by narrow channels to the sea. The western basin is, on the average, slightly cooler than the eastern basin and slightly less saline, particularly at the surface.

Nutrient levels are very low. In fact, the Mediterranean is the most impoverished large body of water known. Typical phosphate levels in the western basin range from 0.10 to 0.30 microgram-atoms per litre; in the eastern basin typical values range from .09 to 0.20 microgram-atoms per litre.

Before the building of the Aswan High Dam, at a local exception to the low-nutrient regime were the waters just off the Nile Delta, which due to infusions of nutrients during the annual Nile flood were very productive. However, production off of the Nile Delta now is much like that of the eastern Mediterranean as a whole, very low.

The fauna of the Mediterranean is imperfectly described, with considerable problems in systematics, nomenclature and identification still remaining to be solved. However, it may be said that the region is very poor in species, primarily as a result of its isolated position. The only natural connection of the Mediterranean with the rest of the oceans is through the narrow strait at Gibraltar. As might be expected almost all the affinities of the Mediterranean fauna are thus with the Atlantic. The Suez Canal has recently provided access to the Mediterranean from the species-rich Red Sea. A number of fishes have made the passage through the canal, despite the considerable difficulty, and have established themselves in the eastern Mediterranean. Of the 285 fishes known from the area, 30 (10.5%) are Red Sea immigrants.

Because of the low nutrient levels, fish production in the Mediterranean is not great. The poorest region of all is the eastern basin, which accounts for only about six percent of the total Mediterranean catch. Many stocks suffer now from overfishing, and management including mesh size regulation is needed to preserve them. In Egypt the marine fishery has declined in recent years, while the fresh water fishery, mainly because of the developing fishery in Lake Nasser, has increased.

3.21 What is the nature of the geology in the vicinity of the proposed sea outfalls?

Geophysical studies of the sea bed indicated that the dominant physiographic pattern is a series of narrow, rocky ridges running parallel to the shore, with plains or slopes of granular material between them. The ridges rise as much as ten meters above the neighboring grade elevations, and sometimes have fissures or creases along the scarps. Because they trend parallel to the present shoreline, the ridges may be related to ancient erosional shorelines.

In the areas of granular material between these ridges, over distances of up to several kilometers, the bottom often rises in a seaward direction (i.e., water depth decreases with increasing distance from shore) by as much as several meters in elevation. This is particularly true off the Anfushi Peninsula.

The rock ridges become broader and more complex closer to shore. Many of the features can be traced from one end of the survey area to the other.

With increasing distance from shore, and increasing water depth, the granular material tends to become finer in grain size.

There are hard, nearly flat areas apparently composed of coquina and denser limestone. They are cut by small sandfilled fissures often about 20 to 40 cm deep and 30 to 60 cm wide. Some of these areas are "lumpy," with protrusions above grade of one-half to one meter.

Apart from the rock ridges, there are several areas with "boulder"-like rock features, generally five to ten meters across and two to three meters high. These "boulders" might appear at first to be discrete rocks resting on the surrounding granular material; however, it is likely that they are part of the underlying bedrock, with the "neck" at the surrounding grade elevation caused by erosion by the sand.

The rock nearly everywhere contains interconnected pores of the order of one to ten mm in size.

At 5 km from shore, in 31 meters of water off Sidi Bishr, large sand ripples, likely created by wave motion, were observed.

Seismic activity in the area is understood to be very infrequent.

3.22 Do commercially valuable or biologically unique species utilize the proposed sea outfall discharge areas for habitat or spawning?

The proposed discharge sites are on sandy plains, where attached sessile benthos are least likely to be present and any settling solids are least likely to be trapped in rock crevices. The sites are in wide open ocean waters far from coasts, promontories, or inlets to coastal lakes or lagoons. Investigation revealed nothing geographically unique about the sites, habitat types appear to be limited.

Biological studies were conducted from August 1977 to July 1978 and included plankton tows, sampling for benthic abundance and biomass, fish market surveys and a short study of fouling organisms. The results of these studies have been tabulated Chapter 3.4 Tables 3-46, 3-47, 3-48 and 3-49 of Marine Studies Volume V, Alexandria Wastewater Master Plan Study. The plankton sampling was analyzed for historical trends by reviewing previous studies accomplished in 1970 and 1965. The sampling data indicates that there is no aquatic life considered unique to the site areas.

3.23 Are the sites of the proposed sea outfalls currently pristine or have they been environmentally degraded by current pollution?

Alexandria's shoreline is now environmentally degraded by shoreline discharge of wastewater overflows, the majority of the discharge is combined sanitary and industrial wastewaters and storm runoff. The discharged water tends to cover the surface of the sea with a distinctive oily "slick." These discharges, along with the relatively fresh irrigation return water and runoff which are pumped into the sea at Mex and Tabia, tend to form a lens of lighter weight water along the entire Alexandria shoreline. The discharged pollutants are generally contained within the lens. Dispersion from this lens is relatively slow. The result is that the nearshore water is turbid and of poor quality.

However, this condition is limited to the first four km nearest the shore. At the outfall discharge sites, 8 to 10 km from shore, conditions are essentially pristine.

3.24 Where are the fishing areas of the Western Nile Delta? Will they be impacted by the proposed offshore discharge of wastewaters?

The commercial trawling areas off the Western Nile Delta are in waters 40 to 50 meters deep, over areas of sandy bottom. Fishing with gill nets and sieves is also conducted, often in waters closer to shore. Line fishing from small boats and from rock revetments and breakwaters is common, particularly near the sewer discharges.

It is anticipated, provided that industrial and toxic wastewaters receive adequate pre-treatment, that the proposed offshore discharge of wastewater will have a beneficial impact on the fishery by increasing the supply of nutrients to the food chain. (It is recognized that a large part of this nutrient supply will be a redistribution of nutrients now discharged near shore, which are poorly dispersed and have stimulated considerable floral growth in the surf zone.)

3.25 What would be the effect of chlorination on fisheries?

The United States Environmental Protection Agency (EPA) has suggested that free residual chlorine in seawater in excess of 0.01 mg/l can be hazardous to marine life. Were there to be free residual chlorine in the effluent at the point of discharge in concentrations of the order of 1.0 mg/l, the initial dilution of 150:1 would reduce this concentration to less than 0.01 mg/l.

At the same time with the addition of primary treatment prior to effluent discharge as well as effluent disinfection (chlorination) the potential adverse impact of chlorinated organics impacts upon fisheries should be reduced considerably. It should be noted that chlorinated organics are one of the chemical constituents recommended for monitoring and laboratory analyses (see Chapter 5.2 and 5.3).

3.26 What would be the effect of chlorination on bathers?

Should the effluent be chlorinated for disinfection (reduction of fecal coliforms in particular), the distance of the discharge sites from shore (8 km and 10 km) would ensure a physical dilution of at least 1000 to 1 and a drift time in the order of 10 to 20 hours. Therefore, the free or residual chlorine would be minimal. The free chlorine would essentially not be in evidence in bathing areas, certainly far less than in a normally chlorinated swimming pool. Therefore, the potential for any adverse impacts on bathers from chlorinated organics would be minimal.

VI. INDUSTRIAL AND TOXIC WASTES

3.27 Is the government of Alexandria prepared to institute and enforce a pretreatment program?

During the development of the Alexandria Wastewater Master Plan Study, the then Governor of Alexandria, Mr. Hodeib, proposed a meeting of managers of the larger industries in Alexandria to discuss the problem of industrial wastewater discharges. He and his staff proposed to institute a rather uncompromising and severe program wherein the industries would be required to adopt pretreatment. This was at the time Camp, Dresser & McKee was developing the Toxic Industrial Wastes Study Supplemental Report and it was decided by the Governor to await the results of the study prior to decision making. Since attaining office the present Governor, Dr. Helmi, has indicated considerable interest in improving public health conditions.

It should be noted that according to Dr. F.H. Garranna, Chairman of the Local Council of Alexandria and a member of the governing board of several large industrial complexes that the industries in Alexandria have started a working group on pollution abatement.

3.28. Is pretreatment practical for Alexandria industry? What will be the costs? Who will bear them?

Pretreatment of industrial wastes is practical in Alexandria. Considerable pretreatment could be precluded with a concerted effort by the industries to "clean up" their processes and plants, to modify their processes (example, convert the chlorine manufacturing from mercury cell process to the porous membrane process), to separate wastewaters within the plant and to exercise care in day-to-day operations. The scope of work and the time allotted for the Toxic Industrial Wastes Study, Supplemental Report, Alexandria Wastewater Master Plan Study did not allow detailed study of each plant to come up with recommendations for modifications, process changes or waste stream separation. It addressed the wastewater streams as they existed at the time of the study. In order to refine the costs presented in the toxic industrial wastes study, time must be allotted and the effort made to carefully analyze each plant situation for opportunities to reduce pollutant discharges and where appropriate, develop pretreatment systems. The costs of pretreatment may, in some cases, be a burden to an industry and government financial assistance, including United States foreign assistance, may be appropriate. However, taking care of production wastes is a part of manufacturing and these costs are conventionally recovered by the product pricing structure.

3.29. Describe the planned monitoring system to ensure thorough industrial pretreatment prior to discharge to the municipal wastewater system. Does this specifically address the discharge of toxics?

See the description of the proposed monitoring program in Chapter 5.4.

3.30. In addition to enforcement and monitoring of the proposed sewer use ordinance, what non-constructional activities could be done to control toxics in Alexandria?

A zoning ordinance should be prepared and enforced which would require toxic producing industries to locate only in suitably designed industrial parks. Industries should be made aware of and educate their employees to exercise careful control over their industrial processes and especially waste by-product generation. This may require government incentives. Also, industries in concert with the government, should develop an adequate educational and personnel training program for the proper management and operation of toxic pretreatment facilities.

3.31 Pretreatment programs usually result in decreases in the quantity of wastewater produced and a change in the concentration of wastes in the waste stream. These factors should influence the design of the entire sewage treatment program. Significant financial savings can be realized through anticipating changes in the industrial waste stream. How are such issues addressed in the design of the proposed wastewater system?

It is not anticipated that pretreatment in Alexandria will significantly reduce the volume of wastewater produced. Pretreatment implies the reduction of pollutants discharged but, unless the pretreatment efforts result in a reduction in water use (which may happen), the volume of wastewater to dispose of should not be significantly reduced. It would be difficult to anticipate at this planning stage what reductions could be safely counted on; therefore, it is not considered advisable to arbitrarily reduce expected wastewater volumes based on the experience elsewhere.

3.32 Pretreatment programs might generate sludges and other solid and semi-solid residues which need to be properly handled and removed from Alexandria. How is this problem addressed in the Alexandria Wastewater Master Plan Study?

It is proposed that sludges and toxic liquid wastes from pretreatment of industrial wastes in Alexandria would be disposed of to appropriate landfill sites. The toxic liquids and solids would be disposed of to appropriately designed and located hazardous-waste sites, probably in the desert beyond developable areas. The non-toxic sludges would be disposed of to the local solid waste landfill sites. The volume of these wastes, when compared to the regularly developed solid wastes in the city, would be relatively small, approximately 360,000 m^3/year. In perspective, this volume would require a disposal area of 36 hectares if placed one meter deep.

VII. AGRICULTURAL REUSE ALTERNATIVE

3.33 What were the technical assumptions utilized in the analysis of agricultural reuse alternative?

3.33.1 General

In considering the alternative in four geographical areas there are interrelated facts and assumptions relating to (1) potential lands to be irrigated; (2) quality of wastewater effluent; (3) potential crops, (4) quality of water for irrigation, and (5) water requirements for crops.

3.33.2 Potential Lands to be Irrigated

Lands - (Facts)

Abu Kir Drain Area - These are nearly level presently irrigated lands near sea level with a water table at approximately 50 cm or less. Soils range from Class 1 loads east of the Abu Kir Drain to sandy soils underlain with clay along the west side of the area. To the east there are stratified clay soils. Salinity of the soil saturation extract ranges from 2 to 4 millimhos/centimeter (mmhos/cm).

Abis Area - Consists of nearly level presently irrigated lands reclaimed from Lake Maryut, lying some 2 to 4 meters below sea level, and with water table ranging in depth from 50 cm to approximately 1 meter. Clay surface soils predominate with highly stratified subsoils as expected in lacustrine soils. Salinity is generally less than 4 mmhos/cm.

Maryut Sector - This is a desert plain sloping eastward and lying 10 to 30 meters above sea level. It is largely irrigated, but has a limited water supply. The soils are predominantly fine-textured clays and clay loams underlain by lime or gypsum. The water table averages approximately 1.5 meters in depth and salinity levels are generally high.

Ameria North-West Area - This is an undeveloped ridge (35 to 45 meters in elevation above the Maryut plain), with valleys of deep clay loam soils and interspersed ridges of shallow non-arable soils. Groundwater is 30 meters or more in depth and salinity levels are low.

Lands - (Assumptions)

A. That on poorly drained lands with high water table, fine-textured and stratified soils, and moderate to high salinity levels there are dangers in substituting wastewater effluent for irrigation with high salinity and sodium absorption rates, for any part of the presently used Nile River water.

B. That even with the Nile water currently being used it is difficult to leach and maintain salt balance in these highly stratified fine-textured soils.

C. That in nearly all of the presently irrigated areas it will be necessary to deepen drains, lower water tables, and increase the leaching of salts to assure sustained irrigation with the present water supply.

3.33.3 Quality of Wastewater Effluent (Facts and Assumptions)

The Mahmoudia Canal provides the present irrigation supply for the Abu Kir Drain and Abis areas. Water analyses were available from Alexandria Water Authority and samples were taken by Camp, Dresser & McKee (CDM) in 1977. These analyses were slightly modified by adding sulphates to attain ionic balance, and by assuming that the carbonates, reported at pH 7.2, were actually bicarbonates. The results:

Ions	Mg/l
Ca	32.72
Mg	14.43
Na	48.74
HCO_3	84.84
SO_4	77.72
Cl	49.00
NO_3	4.81
SiO_2	11.57
	328.84
EC (mmhos/cm)	0.39
*SAR	2.52

With this water as the input to Alexandria, the measured Total Dissolved Solids (TDS) of the wastewater output varies from 1080 to 1600 mg/l as cited on page 6-5 of the Alexandria Wastewater Master Plan Study, Volume II, Technical Report.

The Noubaria Canal through the Maryut Canal serves the irrigated lands of the Maryut Sector, and is also the probable source of Municipal and Industrial (M&I) water for Ameria from which sewage water would be derived to irrigate either a part of the Maryut Sector or the underdeveloped lands northwest of Ameria. Salinity of Noubaria Canal water above Nasser Canal is similar to Mahmoudia Canal water. Salinity increases northward due to saline return flows. Data for 1976 from the Food and Agricultural Organization (FAO), United Nations indicated average TDS near the Maryut Canal was 500 mg/l, but ranged up to 1000 mg/l during low flows. CDM analyses in 1977 ranged above 750 mg/l even in high flow stages. Adding the increases due to M&I uses results in a wastewater effluent of approximately 1100 mg/l and an Electrical Conductivity (EC) of 1.5 mmhos/cm or greater. If the proposed Noubaria Outfall Drain, financed through a loan from the International Bank for Reconstruction and Development (IBRD/World Bank), reduces return flows and Ameria is provided a water supply that does not exceed 500 mg/l, then the wastewater from Ameria would have approximately 850 mg/l of TDS and an EC of about 1.2 mmhos/cm.

* Sodium Absorption Ration (SAR) = $Na/\left(\frac{CA \ \& \ Mg}{2}\right)^{1/2}$

3.33.4 Quality of Water for Irrigation - (Assumptions)

That the guidelines for interpretation of water quality for irrigation as set forth in Table 1 of FAO, Irrigation and Drainage Paper 29, Water Quality for Agriculture, are reasonably accurate.

3.33.5 Potential Crops - (Assumptions)

A. That in presently irrigated areas the farmers would, to a high degree, continue to keep a relatively high percent of the land in rather intensive fruit and vegetable production for economic survival.

B. That crop tolerances and related yield decrements expected to result from increased salinity are essentially as projected in FAO's Irrigation and Drainage Paper 29 on pages 26-31.

3.33.6 Water Requirements - (Assumptions)

As no evapotranspiration (Et) measurements that could be fully interpreted were available for the area, Et was computed by a method developed for FAO by consultant P.E. Rijtema, et al., and by William O. Priutt, Irrigation Engineer, University of California, Davis. The monthly results were adjusted to reflect effective precipitation, irrigation efficiency, and leaching requirements.

3.34 What types of salts would be contained in the effluents available for agricultural reuse? What types of problems would they present? What types of vegetable, field and forage crops would be most suitable for irrigation with these effluents?

The types of salts that will be contained in the effluents available for irrigation are listed in the response to question 3.33. Of great concern are the high levels of Total Dissolved Solids (TDS), high Electrical Conductivity (EC) and high sodium salts (which exceed the calcium) and, therefore, will have a tendency to reduce soil permeability by sodium absorption. These characteristics are especially critical and marginal for wastewater use on the poorly drained soils where it would be difficult to obtain the drainage and leaching needed to grow salt sensitive fruits and vegetables for the Alexandria market. The types of crops most tolerant to high salinity include field crops of barley, cotton, sugar beets and wheat. Few, if any, fruit crops are tolerant to high salinity. Date palms are moderately tolerant. Among vegetable crops, beets, tomatoes, broccoli, and cucumbers will tolerate electrical conductivities up to 1.7 to 2.7 millimhos/centimeter (mmhos/cm) without significant yield decrement.

3.35 Discuss the methods and assumptions utilized in the economic analysis of agricultural reuse alternative.

3.35.1 General

The economic analysis of agricultural reuse focused on first identifying economic benefits for each of four agricultural areas -Abu Kir, Abbis, Maryut, and Ameria. Benefits accruing to Abu Kir and Abbis which have ample supplies of water from the Nile River are assumed to be equivalent to the value of fertilizer contributions of wastewater and the additional productivity resulting from use of wastewater. Contributions include savings in fertilizer costs and added productivity per feddan*. In Maryut and Ameria which do not have sufficient supplies of water from the Nile River, net economic benefits are assumed to be the net value added per feddan resulting from use of wastewater. The net value added represents net gains to the Egyptian economy resulting from the use of wastewater. The analysis discounts all future benefits to the year 1977 using a discount rate of 10%. All agricultural commodity, fertilizer and net value added are equivalent to non-distorted prices based on, in part, World Bank and Ford Foundation studies. Specific assumptions utilized in the economic analysis for each of the four study areas are discussed below.

3.35.2 Abu Kir Area

The analysis assumes that 20,080 feddans could receive a 50% wastewater freshwater mixture in the year 2,000. Annual savings per feddan in fertilizer would be equivalent to LE 19**. In addition, it is assumed that use of wastewater would increase productivity per feddan 10% over what would prevail in absence of application of wastewater. Productivity gains would represent an additional net annual value added per feddan of LE 48. Total net annual benefits would be LE 67 per feddan in the year 2000. The present worth of annual benefits accruing to 20,080 feddans starting in the year 2000 discounted to the year 1977 would be LE 1.9 million.

3.35.3 Abbis Area

Net annual benefits resulting from increased productivity and savings in fertilizer costs would be LE 58 per feddan. It is assumed that these benefits would accrue to 23,885 feddans in the year 1980 if wastewater were available for agricultural reuse. The discounted net present value of these net benefits starting in the year 1980 would be LE 10.4 million.

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* 1 Egyptian feddan = 0.4206 hectare = 1.038 acres
** 1 Egyptian pound, LE 1.0 = U.S. $1.43, Dollars

3.35.4 Maryut Area

In the Maryut area there is currently a shortage of water for irrigation. Therefore it is assumed that use of wastewater would result in the irrigation of land which, in absence of wastewater, would not otherwise be cultivated. The net annual value per feddan estimated by the Ford Foundation is assumed to be LE 200. This value is used as an estimate of benefits of reuse of wastewater. It is also assumed that by the year 2000 there would be sufficient supplies of wastewater to irrigate 4890 feddans. The present worth of benefits starting in the year 2000 would be, given the above assumptions, LE 1.1 million.

3.35.5 Ameria Area

Currently there is a shortage of water in Ameria. Therefore, as in Maryut, it is assumed that use of wastewater would result in the irrigation of land which, in absence of wastewater would not otherwise be cultivated. Net annual value added per feddan including savings in fertilizer costs is assumed to be LE 220. In the year 1990 there would be sufficient wastewater to cultivate 1518 feddans and in the year 2000 there would be wastewater to cultivate an additional 2492 feddans. The present value of benefits would be LE 1.1 million.

3.35.6 Conclusion

The present value of benefits for each of the above areas was included as a negative cost in calculating the present value of total costs of waste treatment for agricultural reuse. These benefits do not, however, offset incremental capital, energy and other operating costs of treatment and conveyance of wastewater for agricultural purposes. As discussed in Draft Environmental Impact Statement (DEIS), Volume II, Chapter 7 with benefits included as negative costs, the agricultural reuse alternative would have a present worth cost 24% above the least cost sea disposal alternative.

3.36 Why is it assumed that secondary treatment is necessary before effluent can be applied to crops? This is contrary to some recent recommendations of the U.S. Environmental Protection Agency (EPA) on agricultural reuse.

A secondary level of treatment has been adopted as a necessary requirement for the disposal of wastewater through crop irrigation. Protection of public health is the principal reason for this requirement. Significant advantages such as the need for less land area, less extensive distribution systems, and considerably less maintenance of the soil surface from clogging, also accrue if secondary treatment effluent is involved. Unless a reasonably stable effluent is applied to the land, an odor nuisance can result, which is particularly significant since several thousand hectares of land would be necessary for land application for all of Alexandria's wastewater.

While the EPA does not set standards for the safe direct use of wastewater for irrigation of crops, it does make some recommendations. Where the objective is to use wastewater as the source of water supply for irrigation, EPA recommends using the "Statewide Standards for the Safe Direct Use of Reclaimed Wastewater for Irrigation and Recreational Impoundments," as issued by the State of California Department of Public Health, February 1973.

The publication, Water Quality Criteria, by the Federal Water Pollution Control Administration, April 1968, discusses at some length the danger of the spread in irrigation water of microorganisms, and pathogenics to plants, animals and humans. After citing various research and literature reviews, the conclusion was resolved on page 163 that:

> "Minimum levels of 4 mg/l Dissolved Oxygen (DO) and a maximum of 20 mg/l, 5-day 20°C Biological Oxygen Demand (BOD) levels were also recommended for water used primarily for irrigation. These criteria likewise are consistent with quality that can be maintained by secondary treatment plus disinfection of all waste sources." (emphasis added)

Also, it should be pointed out that the rural Egyptian uses the canal water for all his water needs. He uses it for bathing, laundry, dish washing and other domestic purposes. Children play in the water and animals drink it. It will be impossible to institute and enforce the controls that would be necessary to prevent these uses and it would be unsafe under Egyptian conditions to allow the use of this water for crop irrigation, particularly for food crops, unless secondary treatment and effective disinfection are provided. Further, the polluting effects on the canals for treatment less than at the secondary level would turn them into unacceptable condition, increase the chance of sludge banks and could promote unacceptable growths of algae and weeds.

3.37. How was the economic value of recycled nutrients evaluated in the agricultural reuse alternative?

Recycled nutrients in wastewater used for irrigation could substitute for fertilizer which, in absence of available wastewater, would have to be purchased and applied to irrigated farm land. As discussed on page E-35 of the Alexandria Wastewater Master Plan Study, Volume III, Appendices, it is assumed that the annual savings resulting from reduced fertilizer applications would be approximately LE 16/feddan (1977-78 Prices). Annual labor savings resulting from reduced fertilizer application requirements were estimated to be LE 3/feddan. The economic analysis considered fertilizer and labor savings as benefits of agricultural reuse of wastewater in Abu Kir and Abbis where sufficient supplies of water are available for irrigation. As discussed in the response to question 3.35 in Ameria, fertilizer and labor savings were also considered as a

benefit in the economic analysis. Benefits were included in the analysis by adding the savings to typical value added benefits per feddan calculated by the World Bank and Ford Foundation studies. This methodology of calculating benefits was used because elimination of the costs of fertilizer and labor required to apply it would increase the average value added per feddan and concommitantly increase the net benefits of reuse of wastewater.

3.38 Discuss the pricing of fresh water drawn from the Nile, explain assumptions. Does the price reflect capital costs?

As discussed on page E-36 of the Alexandria Wastewater Master Plan Study, Volume III, Appendices, Egypt's share of the additional storage at the Aswan High Dam was 7.5 billion M^3 at a capital cost of LE 100 million, or 0.0133 LE/m^3. With an annual cost of 10 percent for interest, operation, maintenance and replacement, this amounts to .0013 LE/m^3. The Ministry of Irrigation has estimated to total water cost, including downstream distribution and control, at 0.002 LE/m^3.

3.39 Alexandria's present land use plan would require that land treatment facilities be located at a large distance from the city. The Draft Environmental Impact Statement assumes that this aspect of the land use plan is inflexible, no evidence is offered for this assumption.

The proposed land treatment facilities are located in accordance with Alexandria's land use plan. The existing and proposed land use for Alexandria is shown on Figures 9 and 17 of the Draft Environmental Impact Statement (DEIS), Volume I. These maps represent the existing and proposed future land use objectives and plans of the Governorate of Alexandria and as such were used as a guide in the site selection process. This was done to avoid, to the extent possible, consideration of alternatives which would result in creation of incompatible land use patterns. Noncompliance with the plan could result in location of wastewater facilities adjacent to densely population residential areas which would be negatively impacted by odors and vectors from evaporation ponds.

As shown in Figure 17, there are no in-city intermixed open spaces or other areas sufficient in size and distance from residential areas which could be used as sites for land treatment facilities. Furthermore, failure to recognize the land use plan during site selection could result in siting evaporation ponds in areas planned or suited for agricultural production adjacent to the urban core. Such loss of potentially productive agricultural land was considered to be an unacceptable impact in Egypt which needs to increase food production and which should preserve potentially arable land resources.

Finally, from a purely economic point of view, costs of purchasing large tracts of land (approximately 300 square kilometers) adjacent to densely populated areas could be prohibitively expensive. In 1977, for example, average residential land costs adjacent to central Alexandria were approximately 20 times greater than in outlying areas. (See Alexandria Wastewater Master Plan Study, Status Report, Number 2, page 3-50). It is probable that savings in conveyance costs resulting from location of evaporation ponds closer to densely populated areas would be significantly less than increased land costs.

3.40 Wastewater facility plans should consider a number of land treatment configurations in order to choose the most practicable and economical. The Draft Environmental Impact Statement (DEIS) evaluates only one configuration, a single huge facility 90 km. from Alexandria in the western desert. Development of a number of smaller facilities located closer to the urban core might greatly reduce the cost estimates.

As discussed in the answer to question 3.39, added costs of land closer to the urban core would offset reduced costs of conveyance.

3.41 Discuss the constraints to the social acceptability of the agricultural reuse of treated wastewater in the Egyptian context. How might these constraints be overcome?

In Egypt, as in other Near Eastern countries, there is presently a great reluctance on the part of governmental organizations, land owners, farmers groups and individual farmers to accept treated wastewater for agricultural reuse in the irrigation of crops. This has been attributed to conflict with traditional Islamic concepts of pollution (contact with human fecal matter, urine, menstural wastes, etc.) and technical concerns which include:

1. The possible damage to the productivity of lands receiving the application of treated wastewater. This concern is focused on the possible problems posed by concentrated deposits in soils of dissolved salts and toxic wastes (especially heavy metals) from treated wastewaters. The salinization of soils resulting from conventional irrigation schemes has been the topic of extensive news media coverage and has resulted in a high level of awareness of this problem in Egypt.

2) Concern over public health risks during the conveyance and application processes, especially with reference to microorganisms, pathogens and toxics. Attention has been given in particular to risks associated with consumption of and/or contact with treated wastewaters during conveyance through canals. Traditionally canal waters are used for drinking, bathing, dish washing, laundry and other domestic purposes.

3) Concern over the possible impacts of the consumption of treated wastewaters by livestock.

There also exists a reluctance among decision makers to adopt, on a large scale, a technology which has not been adequately tested under Egyptian conditions.

These constraints might be partially overcome through the development of a series of pilot/demonstration studies on the reuse of treated wastewater such as that currently planned by AID. These studies should place particular emphasis on agricultural cropping alternatives, energy generation, forage crop potential, economic, socio-cultural, technology transfer aspects, and the maintenance of public greenery. The findings of such studies could be incorporated in the planning and evaluation of subsequent phases of the Alexandria Wastewater System, particularly as it pertains to providing services to the urban fringe expansion areas. It is suggested that such projects will provide information which would resolve problems of high cost, technical reliability and poor social acceptability of the agricultural reuse of wastewaters in the Egyptian context.

Additional actions might address institutional, educational and training aspects of the reuse of treated wastewater. A program could be coordinated with the pilot/demonstration studies which would address the institutional development of organization units or land owners groups to receive and utilize treated wastewaters. Technical training on the agricultural reuse of wastewaters could involve in country seminars by outside experts and/or the attendance of Egyptian participants at training courses such as those sponsored by the United States Environmental Protection Agency (EPA).

VIII. LAND APPLICATION ALTERNATIVE

3.42 In development of the Alexandria Wastewater Master Plan Study, was disposal through infiltration-percolation land disposal systems analyzed?

One of the basic alternatives considered in detail was disposal by evaporation ponds located in the desert beyond the reclaimable land areas. While nominally infiltration-percolation land disposal may be considered to be different from evaporation ponds, after a few months operation it is very likely that the land surfaces to which the wastewater is applied in this instance would be thoroughly blinded or clogged by salts left behind by evaporation of the water. When this happens, the only disposal of water is through evaporation. It was computed that, given all of Alexandria's wastewater, an evaporation rate of 2 meters per year and the total salts content of the Alexandria wastewater, the annual accumulation of salts left behind will be on the order of 3

mm in thickness over the 96 sq km of net pond area needed. Further, recent experience in the Ameria area southwest of Alexandria with application of irrigation water to the desert areas for agricultural crop production, where no underdrains were provided because it was thought that drainage would occur through the sandy soil column, resulted in complete and serious waterlogging of the soil column in less than 8 years. Cropping has been suspended while drainage canals and conduits are constructed, a costly exercise after irrigation canals and roads have been constructed.

IX. SEPTIC TANK TECHNOLOGY

3.43 Discussion of the septic tank leach field problems failed to reflect recent advances in our understanding of this technology. The Alexandria Wastewater Master Plan Study recommends that the large unsewered areas of the city be sewered at great expense. The Master Plan Study fails to consider improvements in the operation and maintenance of existing onsite systems, use of septic tank effluent pumping systems, small diameter pressure sewers, grinder pumps, dosing, or other alternative techniques. The use of these techniques, even if they do not solve all the problems, will almost always improve the situation.

The selection of sanitation technology is highly dependent on water consumption and population density, as well as topography and soil conditions. There are indeed alternatives to conventional sewerage, such as aqua-privies with small-diameter sewers or septic tank effluent pumping systems. In future design reports, such systems could possibly be recommended for areas of low density or for the Mex-Dekheila area where houses have been built in exhausted rock quarries, and piped sewerage collection systems in the highly irregular topography would be very difficult indeed (in Special Report No. 4 of the Alexandria Wastewater Master Plan Study, it was strongly suggested as a non-constructional alternative that house building in Dekheila be curtailed).

By contrast, Ras el Soda is a district in a flat, low-lying area on the southeastern side of the city. To avoid the high costs of sewerage, the sewerage authority experimented with publicly sponsored holding tanks and leaching pits. The authority now recognizes this as a dismal failure; sewage regularly overflows from septic tanks, flooding the area between adjacent houses.

While in some situations septic tank-type alternatives have lower capital costs, they usually require greater, and more localized, maintenance programs. Experience in Egypt indicates that centralized operation and maintenance of sewerage facilities is more likely to succeed than maintenance, public or private, of thousands of individual units. Furthermore, in those areas of Alexandria most desperately needing wastewater disposal, such as Ras el Soda, the groundwater table is very close to the ground surface.

The only realistic wastewater answer for the densely urbanized sections of Alexandria, is the use of piped sewers.

X. GROUNDWATER

3.44 What would be the impacts on groundwater of implementation of the Alexandria Wastewater Master Plan?

Groundwater plays a very insignificant role in the potable water systems of Alexandria. The principal water supply is from the Nile River transported to the Alexandria area through a canal system. Groundwater is used by some industries in the area for cooling and process use. There is minor use of groundwater in rural western sections of Alexandria for irrigation.

South of the low limestone ridge running through the city parallel to the sea coast, much of the land is low, at or below sea level, and ground water and other drainage is dammed behind major irrigation and navigation canals. Water consisting of raw wastewater, storm runoff and ground water, ponds in many areas which contributes to unsanitary conditions for inhabitants.

It is expected that implementation of the Master Plan Study will remove the wastewater from the vicinity of dwellings and significantly improve sanitary conditions. Polluted groundwater should improve over time once the failing septic systems are abandoned and discharges piped to the new sewer systems; the failing sewer systems are repaired and excluded wastes program implemented; and the recommended building restrictions observed.

It is expected that no significant change in the groundwater would occur in areas northerly of the limestone ridge that extends longitudinally and parallel to the sea coast. These areas within Alexandria are the most intensely developed and for the most part are improved with piped sewerage facilities.

XI. ACCEPTABILITY OF THE TRANSFER OF UNITED STATES ENVIRONMENTAL STANDARDS ABROAD

3.45 The proposed marine discharge system, if adopted by an American city, would be contrary to United States (U.S.) Law. The State Department should take care that its actions are consistent with United States national policy on marine protection, as that policy is set out in law and expressed in American position papers at Law of the Sea conferences and other international forums.

The U.S. recognizes that decisions of a sovereign nation on environmental issues with respect to development remain free and independent of our laws and regulations. Under 22 CFR 216, "AID

Environmental Procedures" it is required that AID develop environmental analyses to provide American decision-makers with a full understanding of foreseeable environmental consequences of Federally funded development activities. While AID's precedures require the dissemination of environmental studies to cooperating governments they do not dictate actions on foreign soil or impose U.S. requirements on recipients of foreign assistance.

It should be noted that under the provisions of the Clean Water Act of 1977, Public Law 95-217 (P.L. 95-217), Section 301(h), (see Section 3.46 for details) it is possible to obtain a waiver for a treatment system and marine outfall which employs less than secondary treatment. This section of the Act allows for a municipal marine discharger to present its case to the United States Environmental Protection Agency (EPA) for review and approval. As of June 1979 approximately 225 communities have filed preliminary applications for waivers.

In informing U.S. decision-makers of potential environmental consequences of its own actions, the laws, standards and policies of the foreign government must be taken into account. Regulations concerning the discharge of liquid wastes are contained in Egyptian Law No. 93 of 1962, issued by the Ministry of Housing and Reconstruction. The law covers the implementation and management of sewerage works in general. The law lists no specific standards for discharges to lakes or the sea; it states only that discharges are permitted if they do not contain any matter which may adversely affect swimming beaches.

Consideration must also be given to existing or anticipated agreements of the countries bordering the Mediterranean Sea. Since September 1974, efforts have been underway to reach agreements on control of sources of pollution through the Mediterranean Pollution Control Programme (MED POL), United Nations Environmental Programme (UNEP). A protocol against pollution from ships and aircraft in 1976 resulted in a listing of prohibited and restricted substances. A subsequent agreement was reached on June 29, 1979 to a "Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources" by all Mediterranean countries. This tentative protocol calls upon all parties to develop and implement programs for improved planning, control and coordination to abate regional pollution. The project agreement contains a covenant concerning the development of an understanding with the Government of Egypt as to the actions needed to be taken under the provisions of this protocol.

3.46 The US Environmental Protection Agency (EPA) recently published a detailed set of regulations governing marine discharge of municipal waste. These should be reviewed in great detail to determine if any of them might appropriately be applied to the situation in Alexandria.

In 1972 the Federal Water Pollution Control Act was amended to require all publicly owned treatment works ("POTWs") to achieve by July 1, 1977, secondary treatment as defined by United States Environmental Protection Agency (EPA). In 1973, EPA defined secondary treatment in terms of four parameters - biochemical oxygen demand (BOD), suspended solids (SS), pH and fecal coliform bacteria - and established national uniform minimum effluent limitations for these pollutants to be attained by all POTWs by the 1977 deadline.

Since the enactment of the 1972 amendments and the promulgation of EPA's secondary treatment regulations, a number of municipalities, primarily from the West Coast, argued to both Congress and EPA that secondary treatment of municipal ocean discharges is not necessary to protect the marine environment or to assure the attainment and maintenance of water quality in ocean waters, only primary treatment with effluent disinfection.

Those same municipalities contended that secondary treatment traditionally has been defined in terms of pollutant parameters and levels of pollutant reduction which are important for freshwater ecology where the discharge of oxygen-demanding wastes and sedimentation of suspended solids results in distinct environmental degradation, but which have little significance for oceanic and saline estuarine waters where wastes are rapidly assimilated and dispersed by currents and tidal action.

As a result of their testimony, Congress, in amending the Clean Water Act in 1977, added section 301(h), which allows a municipal marine discharger to present its case to EPA. Section 301(h) provides that the Administrator, upon application of a POTW and with the concurrence of the State, may issue an National Pollution Discharge Elimination System (NPDES) permit which modifies EPA's secondary treatment requirements if the applicant: (1) discharges into certain ocean and estuarine waters; and (2) demonstrates, to the satisfaction of the Administrator, that the modification will not result in any increase in the discharge of toxic pollutants or otherwise impair the integrity of the receiving waters.

The technical considerations that stand behind the regulations for 301(h) waiver applications may usefully be applied in considering the Alexandria situation. The 301(h) regulations express concern about the following three subjects:

1. Protection of public water supplies (since discharges are to be to sea, with no water supply via desalination nearby, this is not of concern in Alexandria).

2. Allowing recreational activities in and on the water. (This aspect has been addressed in great detail in the Master Plan Study, to a degree far beyond anything suggested, in the 301(h) regulations.)

3. Protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife outside the zone of initial dilution.

As noted in responses to questions 3.22 and 3.24, no serious adverse impact to marine biota is anticipated, however, for illustrative purposes responses are presented for one of the 301(h) regulation sections, in particular the Biological Assessment Questionnaire (Section 7):

Is there reason to believe that the applicant's discharge may have caused or will cause:

7-1 Interference with the protection and propagation of a balanced indigenous population of marine life characteristic of the biogeographic zone in which the outfall is located?

Yes, but in a limited zone only (radius of a few hundred meters).

7-2 Biological communities within the zone of initial dilution to be different from those that would naturally occur in the absence of the outfall?

Yes.

7-3 Differences in the structure and function of biological communities (e.g., vertical and horizontal stratification, species composition, abundance, diversity, productivity, trophic structure, etc.) beyond the zone of initial dilution from those characteristics of the biogeographic zone in which the outfall is located?

Yes, but in a limited zone only (radius of a few hundred meters).

7-4 Increases in the abundance of any marine plant or animal organism (especially nuisance of toxic species, or phytoplankton whose blooms cause adverse ecological effects) within or beyond the zone of initial dilution not characteristic of the biogeographic zone in which the outfall discharge is located?

Yes, but not a nuisance or toxic species; more likely, large population of healthy sessile organisms as often seen on outfall diffuser pipes.

7-5 Domination of marine communities within or beyond the zone of initial dilution by pollution resistant species (e.g., slime forming algae or bacteria, fouling, boring, nuisance or opportunistic species of finfish, invertebrates, etc.)?

No.

7-6 A deleterious effect on distinctive habitats of limited distribution such as kelp beds and coral reefs either within or beyond the zone of initial dilution?

No.

7-7 Within or beyond the zone of initial dilution, an increased incidence of disease in marine organisms?

Not to a great extent. On the Palos Verdes Shelf in California, the site of a major outfall system, the most frequently observed disease with external systems is fin erosion in Dover sole. In Alexandria the only important comparable fish is Solea vulgaris, which generally prefers shallow muddy sandy to sandy-mud bottoms. It enters coastal ponds and estuaries, and can even be abundant there. During the summer months, it appears to migrate offshore somewhat, and so could come near the discharge sites.

7-8 An abnormal body burden of any toxic material in marine organisms collected within or beyond the zone of initial dilution?

No, providing that toxic materials are adequately pretreated and excluded from the sewerage system.

7-9 Adverse effects on commercial or recreational fisheries within or beyond the zone of initial dilution?

No.

7-10 Mass mortality of fishes or invertebrates due to a typical growth of marine algae, anoxia or other conditions within or beyond the zone of initial dilution?

No.

7-11 Adverse ecological impacts either within or beyond the zone of initial dilution other than those addressed in the preceding questions? Is so, please explain.

No.

The following question must be answered only by applicants who propose a discharge into stressed waters.

7-12 Is there reason to believe that the applicant's discharge has enhanced or will perpetuate adverse ecological alterations resulting from other sources of pollution? Is so, please explain.

Not applicable.

4.0 WRITTEN COMMENTS ON THE ALEXANDRIA WASTEWATER MASTER PLAN STUDY - DRAFT ENVIRONMENTAL IMPACT STATEMENT

The following letters received by AID on the DEIS are presented in chronological order.

4.1 UNITED STATES DEPARTMENT OF STATE, BUREAU OF OCEANS AND INTERNATIONAL ENVIRONMENTAL AND SCIENTIFIC AFFAIRS, OFFICE OF ENVIRONMENT AND HEALTH

4.2 AMERICAN CLEAN WATER ASSOCIATION

4.3 NATURAL RESOURCES DEFENSE COUNCIL, INC.

OPTIONAL FORM NO. 10
JULY 1973 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : AA/PPC - Albert C. Printz DATE: July 3, 1979

FROM : OES/ENH - Donald R. King

SUBJECT: Alexandria Waste Water Master Plan Study

We have appreciated the opportunity to review and comment upon the Alexandria waste water plan and to participate in AID's June 22 meeting on the subject. We are impressed with the effort that has gone into the plan and the thorough review which has been given to it. I would like to emphasize one aspect of the proposal which we believe deserves careful attention. That is the critical problem of toxic waste disposal.

As you know, the United States is increasingly concerned about the problem of toxic waste disposal. The Mediterranean Sea area countries, including Egypt, have voiced similar concern about toxic waste discharges from rivers and coastal outfalls in their recent agreement against pollution from land-based sources. (An early draft of the agreement is attached. Note Principles 2,5 and 6(a)(ii).)

We note that AID's Alexandria plan calls for treatment of industrial waste water containing toxic materials through separate collection and transportation to an evaporation pond, and through industrial pretreatment before discharge to the municipal systems. The latter method could well lead to discharge of some toxic materials into the Mediterranean Sea, particularly if local industrial firms do not adequately treat such material. With the ever present problem of enforcement of treatment standards this problem could become serious.

In light of this we would encourage AID to make every effort possible in developing and in implementing the plan to ensure that high priority is placed on toxic waste treatment and disposal.

Attachment:

As stated.

OES/ENH:WHMansfield:fjn
7/2/79 x22418

5010-110

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ATTACHMENT

The attachment with this letter was "Report of Intergovernmental Consultation Concerning a Draft Protocol for the Protection of the Mediterranean Sea Against Pollution From Land-Based Sources, Athens, 7-11 February 1977." This document has been superceded by the "Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-based Sources" which was agreed to by participating nations on June 29, 1979, in Geneva, Switzerland.

AMERICAN CLEAN WATER ASSOCIATION

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Executive Vice President
Clean Water Fund
EXECUTIVE DIRECTOR
Larry Silverman

July 16, 1979

Albert C. Printz
Environmental Affairs Coordinator
U.S. Agency for International Development
The State Department
Washington, D.C. 20523

Dear Mr. Printz:

Thank you for inviting me to comment on the draft Environmental Impact Statement for the Master Plan for Wastewater Treatment in Alexandria, Egypt.

Importance of the Study: The management of wastewater in one of Egypt's populous cities will have large and long lasting consequences for Egyptian health, environment, recreation, industrial development, and agricultural productivity. The size and scope of the project will make it a model for all the cities of the Middle East, perhaps for all the cities of the Mediterranean Sea. The decisions reached by the State Department and the government of Egypt in this matter will help determine whether the Mediterranean Sea becomes, in Jacques Cousteau's words, a "cradle or a grave."

Also at stake is the reputation of American aid programs and American environmental and health technologies. Inevitably, this project will be compared with the Aswan Dam -- that great Egyptian monument to Russian technology and lack of foresight. Whatever the benefits of Aswan, its environmental ill effects have proven to be severe and persistent. These unwanted side effects, while entirely foreseeable, were unforeseen. The purpose of an Environmental Impact Statement is to insure that all the environmental consequences of projects assisted by the United States government are indeed foreseen, that bad consequences are avoided or mitigated. The analytical process required by the National Environmental Policy Act, if scrupulously followed, will benefit the people of Egypt for generations to come.

If the Egyptians wish to avail themselves of the full benefits of American technological genius, they will insist that the analytical process used by Americans for their own most serious engineering efforts be employed on Egypt's behalf as well. While the process may involve some months of time, it should result in decades of benefits won and and problems avoided. An $800 million project requires the

exercise of foresight. Egypt would do well to look askance at any significant departure from normal EIS procedures.

The Master Plan Fails to Identify and Adequately Address Alexandria's Severe Public Health Problems: Public health is the primary justification for the Master Plan. The health problems of concern are of two sorts. The first class includes a tragically high infant mortality rate and a very high rate of cholera, dysentery, and other contagious diseases. These problems, which were identified by the public health consultant through a review of available mortality and morbidity statistics, are associated with poor sanitation.

In the second class are the less immediate, though equally serious, "modern" perils associated with the discharge into waterways of industrial toxins and heavy metals. These include cancer, heart disease, nervous disorders, birth and genetic defects, mental retardation and the like. The EIS indicates large uncontrolled discharges of many dangerous substances but fails to identify or prioritize the public health consequences of each. This omission is regrettable for two reasons: first, it will frustrate attempts to identify emergency conditions and to establish priorities in dealing with Alexandria's many toxic problems. Second, it will make it more difficult for Egyptian authorities to build the type of consensus of informed opinion which, in other parts of the world, is an essential element of any toxic control strategy. The problem of industrial toxics is discussed more fully in the section on pretreatment below.

Alexandria's sanitation problems are multifaceted. Those discussed by the contractors include:

- discharges of raw sewage in close proximity to people;
- effluent from failed septic tanks and leach fields and broken sewer mains bubbling up on the streets;
- enclaves of "farms", mostly dairy farms, in crowded urban areas, without adequate facilities for handling cattle wastes; and
- the lack of municipal garbage and trash collection systems.

The public health statistics cited by the health consultant should have prompted an investigation of the city's drinking water system as well. Although drinking water problems are alluded to in the study, the treatment of this subject is inadequate to guide

public health investments. The government of Egypt has limited capital with which to address compelling water related public health problems. Its objective should be to get the most health benefits for the dollar spent. This in turn requires an understanding of all of the major environmental causes of disease, with a sense of their relative importance. This the EIS and the Master Plan do not provide.

Similarly, although the Plan acknowledges the solid waste problem, no suggestions are offered for alleviating it. This is particularly unfortunate, since a failure to institute a solid waste system will frustrate efforts to operate and maintain a new sewage treatment system. Loose trash and garbage today clog up Alexandria's old sewers. Is there any reason to believe that they will not have a similar effect on the new sewers? Are new pipes less susceptible to clogging than old ones?

The health consultant characterized the conditions of the urban agricultural enclaves as among the most unsanitary in the world. Despite this characterization, no plan is offered for alleviating the problem, other than the implicit recommendation that Alexandria's agriculture be obliterated. The social and economic costs of doing so are not discussed. (Ironically, the most advanced urban thinking in the United States encourages urban agriculture. The U.S. Department of Agriculture has a small subsidy program to this end). Based on the limited information supplied by the contractor, I believe that the sanitation and waste management practices of the agricultural areas can be greatly improved without great expense or social disruption. Regrettably, the engineering consultants failed to address this issue. In general, the presence in a city of agricultural enclaves should be viewed as an opportunity for enhancing the urban environment.

The discussion of the septic tank leach field problems failed to reflect recent advances in our understanding of this technology. The consultant recommends that the rather large, unsewered areas of the city be sewered at great, and unspecified, expense. The Master Plan fails to consider improvements in the operation and maintenance of existing on site systems, use of septic tank effluent pumping systems, small diameter pressure sewers, grinder pumps, dosing, alternating leach fields, evapotranspiration beds, and other innovative techniques. The use of these techniques, even if they do not solve all the problems, will almost always improve the situation. The failure to evaluate or even mention these techniques is a major defect of the Plan. The possible benefits of these techniques are: immediate or short term amelioration of health problems; reduction of costs of any centralized collection systems by reducing the areas to be sewered; and reduction of the waste load imposed on central treatment facilities. Improvements in on site waste systems should be

integrated with efforts to better manage agricultural areas.

Similarly, with regard to discharges from broken sewer mains and malfunctioning treatment facilities, the Master Plan fails to explore or develop a strategy for improving operation and maintenance. This is in sharp contrast to the policy which the United States government follows internally: to improve the operation and maintenance of existing facilities in order to minimize capital expenditures. If this is sound policy for the United States -- with its overwhelming capital resources-- it is essential policy for Egypt.

An immediate program for upgrading operation and maintenance of all existing facilities -- however inadequate those facilities may be -- should be a first priority. An operator training and education program should be instituted as soon as possible. If the Egyptians cannot maintain what they have now, they will not be able to maintain what they expect to have later.

In general, although the Master Plan establishes the existence of a health crisis, it fails to analyze and identify all of its major waste related causes. The solutions offered -- a huge investment in a new sewage collection and Sea disposal system -- is not comprehensive enough to work on its own. The consultants have focused all their attention on the elements of a solution which will take many years and large infusions of foreign capital and know how. They have slighted those elements of the solution which can be instituted immediately or in a short time, at a modest cost by the Egyptians themselves. This lack of balance and comprehensiveness is the major defect of the Master Plan. In fact, the Master Plan is not a master plan at all. It is only one small portion of a plan.

The Pretreatment and Industrial Waste Problems Need Furtner Study: The disposal plan recommended by the consultant -- discharge of nearly raw sewage to the central Mediterranean -- presupposes a program of pretreatment designed to keep industrial toxins and heavy metals from entering public sewers. The United States should oppose any plan which would result in the toxification of international waters. If the Sea disposal option is chosen, a monitoring system to insure that toxics are not passing through the system should be instituted. The consultant's report does not deal adequately with the monitoring question.

What pretreatment might mean in the context of Alexandria's industry is unclear from the consultant's report. Is pretreatment practicable for Alexandria's industry? What will be the costs? Who will bear them? Is the government of Alexandria prepared to institute and enforce a pretreatment program? Do they have the space or the technologies? These questions need to be answered more fully before significant sums are invested in a system which might result in severe economic dislocations or environmental problems.

In the United States, the most qualified experts on industrial waste treatment tend to work for industry. I recommend that the government of Egypt invite the environmental directors of American industrial corporations with the best environmental records whose businesses most approximate Alexandrian industries to meet with Alexandrian industrialists to devise pretreatment and other waste treatment programs. The most efficient and least costly programs will involve process changes and other steps best understood by industrial engineers. U.S. government regulators of industrial wastes could also offer helpful advice. There is also a small number of independent consultants and academics who specialize in industrial waste management.

Two other aspects of the pretreatment problem underscore the need for advance planning. First, pretreatment programs usually result in decreases in the quantity of waste water produced (an average of 29% in the United States) and a change in the concentration of wastes in the waste stream. These factors should influence the design of the entire sewage treatment program. Significant financial savings can be realized through anticipating changes in the industrial waste stream. Failure to anticipate these changes could result in large, otherwise avoidable costs.

Second, pretreatment programs might generate sludges and other solid and semi solid residues which need to be handled in some way. The Alexandrians should consider the feasibility of combining industrial solid waste management with municipal garbage and trash collection and street cleaning.

In general, the consultant's comments on pretreatment, while helpful, are superficial. The suggestion that a portion of the industrial wastes be diverted from the main system to an evaporation lagoon appears to be a good one.

The EIS fails to recognize or exploit the large resource potential of Alexandria's municipal waste waters. The Aswan Dam resulted in a sharp decline in the fertility of the lower Nile. Alexandria's municipal waste water is a significant non petroleum based nutrient substitute. It is an important resource which ought not to be squandered by dumping it into the Sea. The EIS does not adequately consider the option of using the waste water as an agricultural resource (land treatment).

The consultant's estimate of the cost of land treatment is distorted by the assumption that secondary treatment is needed before effluent can be used on crops. This is contrary to current thinking on the subject, as reflected in recent U.S. Environmental Protection Agency recommendations.

Alexandria's present land use plan would require that land treatment facilities be located a large distance from the city. The consultant assumes that this aspect of the land use plan is inflexible. No evidence is offered for this assumption. Given the cost and importance of waste water treatment, such inflexibility would be extremely unwise. The projected costs of land treatment could be greatly reduced by locating the system close to the city. This should have been explored. The consultant indicated that agriculture near the city is being crowded out by urban sprawl. One of the advantages of land treatment is that it permits agricultural land to be located near cities and helps establish urban green belts. There are numerous environmental and economic benefits from this arrangement.

The consultant states that the high salt level of the effluent precludes its use for irrigation. The analysis does not support this conclusion. A proper analysis would identify the type of salts involved -- a critical factor -- and review various "facilitative actions." These include crop rotation, selection of salt resistant crops, and dilution of the effluent. The failure to consider these factors does not speak well for the consultant's understanding of irrigation technology.

Waste water facility plans should consider a number of land treatment configurations in order to choose the most practicable and economical. The consultant considers only one configuration -- a single huge facility 90 km. from Alexandria in the western desert. Development of a number of smaller facilities -- closer in -- might greatly reduce the cost estimates.

In general, for the reasons stated, the consultant's cost estimates for the land treatment alternative are, in my judgment, unreliable.

The consultant also argued that fresh Nile River water could be brought to the desert region more cheaply than municipal effluent. I have two observations on this subject. First, water with nutrients added has more agricultural value than "fresh water." Second, irrigation with waste water serves three functions: irrigation of crops, fertilization of crops, and waste water treatment. The idea is to apportion the costs among the three functions, not to impose the entire costs on to the farmers. The combining of these functions into one operation benefits both the farmers and the cities. A storage reservoir, for example, is an important component of a land treatment system and a valuable addition to an irrigation system.

The most important objection to land treatment is the statement of the Egyptian officials that Egyptian farmers are unwilling to use effluent for irrigation and that the Ministry of Agriculture

is reluctant to approve its use. The social acceptability of land treatment has been a key obstacle to its deployment in the United States as well as in Egypt. This problem should be confronted head-on. In the United States a program of public education aimed at farmers and agricultural organizations has begun to break down the barriers. Today, land treatment is a preferred technology in the United States. It has a long history of use in France, Germany and Australia. Land treatment is employed extensively in the Middle East, particularly in Libya, Saudi Arabia, and Israel.

Farmers and agricultural officials from different countries who use waste water resources should meet with their Egyptian counterparts to discuss and explore this issue. Other educational programs should be developed. Upgrading and reforming agricultural practices is, I know, a difficult task. It is nonetheless an essential task, which the Egyptians should begin at once. No country -- not the United States, not Egypt -- is so wealthy that it can afford to dump its resources into the Sea. However difficult it may be to educate farmers and agricultural officials to the agricultural value of properly treated municipal waste water, failure to do so will create greater difficulties.

The government and industries of Egypt should pay special attention to the potential of certain land treatment techniques for handling and detoxifying industrial wastes. This is a rather new technique which is understood by only a relatively small number of waste treatment engineers.

Land treatment, unlike sea disposal, produces clean water. This is its principal benefit.

The consultant does not provide adequate information for me to make a judgment as to the feasibility and cost of land treatment as a complete or partial solution to Alexandria's waste treatment needs. This subject should be explored more fully by experts with a record of recent achievements in this field. Such an exploration will benefit Alexandria and other Egyptian cities as well.

Insufficient Consideration Has Been Given to the Environmental Impact of Sea Disposal: Before the United States government agrees to assist in a plan to discharge as much as 1400 million gallons per day of nearly untreated sewage into the east central Mediterranean, the following steps should be taken:

1. The government of Egypt should demonstrate that it can, and will, prevent the discharge of toxics into the system.

2. Water quality standards should be developed on the basis of criteria for the impacted area.

3. Other discharges into the Mediterranean from other cities and countries should be identified so that the cumulative impact of all the discharges can be measured.

4. Simple, low energy, conventional waste treatment prior to sea discharge should be explored.

5. The environmental impacts of constructing a long outfall pipe into the Mediterranean should be identified, and appropriate mitigation measures should be taken.

6. A creditable biological and chemical monitoring system should be established, preferably by an international agency.

I have tried to encourage the Cousteau Society to look into this question of sea discharge. Captain Cousteau has studied the pollution problem of the Mediterranean and of the Nile River. His conclusions as to the environmental impact of the proposed disposal methods would, I believe, be acceptable to me and to most Americans. I hope you can prevail upon him to offer his expert opinion.

The proposed marine discharge system, if adopted by an American city, would be contrary to American law. The State Department should take care that its actions are consistent with American national policy on marine protection, as that policy is set out in law and expressed in American position papers at Law of the Sea conferences and other international forums.

The U.S. Environmental Protection Agency recently published a detailed set of regulations governing marine discharge of municipal waste. These should be reviewed in great detail to determine if any of them might appropriately be applied to the situation in Alexandria.

Legal and Ethical Concerns: The consultant, Camp, Dresser and McKee, designed the Master Plan and wrote the Environmental Impact Statement, which evaluates it. I understand that the consultant has an interest in preparing the final designs and specifications for the project. This procedure is highly irregular. Usually Environmental Impact Statements are written by persons with no financial or other connection with the original designers.

The State Department should look rather carefully into the ethical and legal implications of its actions in this regard.

From a practical point of view, the State Department's decision not to hire an independent reviewer denies to the government of Egypt the benefit of a "second opinion" on the proposed plan. From our point of view, the lack of an independent review detracts from the plan's credibility.

Limitations of These Comments: I have never been to Egypt, never interviewed the managers of community utility systems, never spoken with farmers, business people and civic officials, never toured the areas to be served by the proposed system. Many other otherwise qualified commentators are in the same situation. Like them, I must rely for basic information on the EIS draft prepared by the consultant. This obviously limits my ability to be useful to A.I.D., and the government of Egypt.

The government of Egypt should consider sending a delegation of Americans to Alexandria to investigate the situation firsthand and meet with Egyptians to exchange opinions and perspectives. The members of the delegation should have no financial or other connections to the consultant. They might include representatives from the Department of Agriculture, the U.S. E.P.A., a public works director of a large American coastal city, an engineer with special qualifications in land application techniques, a marine biologist, a farmer who uses municipal waste water, and an environmental advocate. Such an effort might mitigate A.I.D.'s failure to choose an independent firm to perform the EIS.

A Message to the Government of Egypt: I have not had an opportunity to poll all the members of the American Clean Water Association on the subject of waste treatment for Alexandria. I believe, however, that they would join me in actively supporting American assistance for any well thought out program for water and waste management in Alexandria. I am confident that we could help in mobilizing support from many other American citizens and associations.

The development and management of the water and waste systems of a great city is an enormously difficult, but exciting challenge. The government of Egypt has the unique opportunity of building the most modern, least costly, and most efficient big city water and waste management system in the world. Some of the recommendations made here can and should be implemented immediately. Others will require time and further study. Success demands foresight, careful planning. If the Egyptians can exercise the same constancy, perserverance and patience in the pursuit of clean water and public health that President Sadat has demonstrated in the pursuit of peace, their efforts, in my judgment, are sure to prosper.

Sincerely,

Larry Silverman,
Executive Director, ACWA

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July 19, 1979

Mr. Albert C. Printz, Jr.
Environmental Affairs Coordinator, AA/PPC
Room 3243 NS
Agency for International Development
U. S. Department of State
Washington, D. C. 20523

Dear Mr. Printz:

NRDC Comments on the Draft Environmental Impact Statement on the Alexandria Waste Water Project

The Natural Resources Defense Council ("NRDC") has prepared these comments on the Draft Environmental Impact Statement ("DEIS") of the U. S. Agency for International Development ("AID") on its Alexandria Waste Water Project, following our participation at a June 22nd briefing at AID/Washington and a review of the document. While focussed upon this DEIS, these comments are generic in nature. We have left to other more expert commentators the consideration of the adequacy of the evaluation in the DEIS of impacts of and the alternatives to the proposed project. Our comments concern AID's environmental review process; in particular, the potential for conflict of interest in the preparation of the DEIS, the need to assure that recommended mitigation measures and monitoring are carried out, and the participation of host country officials and experts.

I. Potential for Conflict of Interest

There is clear potential for a conflict of interest where the contractor preparing an EIS has a financial or other interest in the implementation of the project. It has been generally recognized in the United States that such conflicts will reduce the objectivity and thoroughness of the environmental review. The new Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, 40 CFR Parts 1500-1508 (the "NEPA Regulations"), thus prevent an applicant from preparing an EIS on its own application (§1506) and require contractors to disclose that

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they have no financial or other interest in the outcome of the project (§1506.5(c)). These requirements apply to all EIS's, even where impacts to be analyzed occur outside the United States. There is no indication in Executive Order No. 12114 that environmental statements required thereby are subject to any less stringent precautions to assure full and fair consideration of environmental effects.

Here the DEIS was prepared by a division of Camp, Dresser & McKee, Inc. ("CDM"). CDM also drafted the Alexandria Waste Water Plan, in which the project proposed for AID funding was recommended. The DEIS confirmed the Master Plan's recommendation. Furthermore, CDM is bidding for the design of the waste water system. Under such circumstances, the objectivity and thoroughness of the environmental analyses may be subject to compromise.

AID must independently evaluate an EIS prior to its approval and must take responsibility for its content (§1602.5(c)). Thus, we are confident that AID will very closely scrutinize this DEIS. Even more important is that the agency take immediate steps to avoid such conflicts of interest in future environmental statements, assessments and other reviews.

II. Mitigation Measures and Monitoring

One central objective of the EIS process is to identify, discuss, and recommend, where appropriate, measures to minimize adverse environmental impacts. The effective implementation of mitigation measures may be essential to achieving success in some project and to avoiding significant environmental and economic costs in other AID has available and should utilize a number of means to insure that mitigation measures recommended in EIS's or environmental assessments are carried out. The NEPA Regulations suggest some and also encourag monitoring of project implementation by the agencies, particularly in important cases (§1505.3).

The DEIS on the Alexandria Waste Water Project recommends several mitigation measures for immediate inclusion in the Master Plan or for adoption after careful monitoring. The DEIS calls for pre-treatment of industrial waste, proposes the passage and enforcement of a sewer ordinance, and identifies the need for a system of rubbish collection. AID should condition disbursement of loan funds upon the adoption of a sewer ordinance and a rubbish collection system. AID should provide technical and financial assistance for their implementation and for the construction of temporary evaporation ponds and pr -treatment facilities.

The Master Plan should also detail a system for monitoring. The DEIS states that monitoring is necessary to determine the impact of sludge deposits at the end of the ocean outfalls, the extent to which organisms reach bathing areas, and the level of bacterial pollution from lagoon effluents (DEIS, Vol. I, at 51-52). AID should include in its assistance possible funding for new mitigation measures if monitoring detects problems in these areas. The monitoring also should be undertaken to determine the effectiveness of mitigation measures developed in project design and the actual environmental impact of the project. AID should provide help to host government agencies to develop their capability to take over monitoring of the project's implementation.

III. Participation of Host Country Officials and Experts

AID should strive for the full participation of host country officials, experts, and members of the public in the preparation of EIS's and environmental assessments. Their involvement is essential if the methods used and lessons learned are to be more widely appreciated and applied, particularly to other development activities which do not rely upon AID financing. Effective monitoring and full implementation of mitigation measures can only occur if there is close cooperation with host country officials.

CDM appears to have done an admirable job in drawing upon local expertise in the preparation of the DEIS. We suggest that the DEIS include the names of individual host country consultants and of governmental officials providing data, analysis or comments. This information would help AID to identify environmental expertise to be utilized in environmental reviews of its future projects in Egypt. The implementation plan should similarly specify those agencies and institutions which are to carry out mitigation measures and monitoring during project implementation and the assistance to be provided by AID.

NRDC would be pleased to provide any additional detail requested by AID concerning our comments about the DEIS. We ask that our comments be considered by AID in the preparation of the final EIS.

Sincerely yours,

S. Jacob Scherr
Staff Attorney

Lisa E. Simpson
Legal Intern

CC: Mr. Stephen F. Lintner

5.0 APPENDICES

In the course of project review the following materials were developed to supplement information provided in both the Alexandria Wastewater Master Plan Study and the Draft Environmental Impact Statement.

5.1 DIFFUSER DESIGN MODIFICATION ALTERNATIVE

5.2 TREATMENT LEVEL DESIGN ALTERNATIVES

5.2.A PRIMARY TREATMENT DESIGN ALTERNATIVE

5.2.B SECONDARY TREATMENT DESIGN ALTERNATIVE

5.3 PROPOSED MONITORING PROGRAM - OFFSHORE AND BEACHES

5.4 PROPOSED MONITORING PROGRAM - "SEWER USE LAW"

5.1 DIFFUSER DESIGN MODIFICATION ALTERNATIVE

Indicate how changes in diffuser design and location would effect changes in the probability of bacterial contamination of beaches, sludge bank development, and changes in overall far-field dispersion.

Changing the diffuser design while keeping its general location constant does not appreciably affect cost, nor does it significantly affect the probability of bacterial contamination of the beaches or far-field dispersion. Lengthening a diffuser would increase initial dilution, roughly in direct proportion to diffuser length; and it may somewhat change the depositional pattern of settling solids.

Reducing the port diameter and spacing from those specified in Chapter 5 of the Alexandria Wastewater Master Plan Study, Volume IV may increase the possibility of plume submergence in the summer months. However, large port diameters (250 mm) are recommended to ensure that the ports will not clog with rags and other solids in the event that screening in the treatment process should fail. The final port diameters would be sized in the design phase.

The chief parameter of interest is distance of the diffuser from shore. In Table 5.1.1, the comparative capital costs, bacterial levels at beaches, and far-field dilutions are indicated as a function of outfall length. Lengths listed range from 4 to 14 kilometers. Lengths of less than 4 km were not considered, because of the low-salinity lens found near shore at certain times of summer. This lens is usually 3 to 4 km wide. Outfall discharges, with whatever degree of treatment, should be at least 4 km from shore to avoid being trapped within or under the lens.

By procedures described in Technical Appendix 8 of Chapter 10 of the Draft Environmental Impact Statement (DEIS), Volume II, and specifically from Section 5-1 therein, predicted fecal coliform levels at beaches are listed for each length, in terms of the percent of time that levels in seawater at the beaches is predicted to be less than 1000 per 100 ml and less than 100 per 100 ml. (Values for 4 km have been extrapolated.) This analysis is conservative in that: (1) plume submergence due to density stratification is not considered, although it may occur for a significant fraction of each popular bathing season; (2) the bacterial disappearance rates used, derived from tests in which sedimentation of some of the bacteria was not allowed to occur, are lower than in prototype cases in which sedimentation does, in fact, remove many bacteria from a wastewater plume approaching a beach; and (3) primary sedimentation will remove bacteria.

If the primary effluent suspended solids concentration is 300 mg/L, the load associated with 560 ML/day amounts to 61,000 tonnes/yr. Over an area perhaps 1 km wide by 10 km long, the settleable portion, reduced by volatilization, and regularly resuspended by currents and wave motion, would cause a deposit of several millimeters per year.

Possible development of a blanket of settled solids is discussed qualitatively as follows:

Ocean disposal of sludge is found to create the fewest problems when the bottom is a sandy plain flushed by an active current regime, rather than a rocky, jagged bottom, or rather than with weak currents. The same considerations apply to settling particles of primary treatment effluent. On a rocky bottom particles collecting in pockets and crevices may not be easily resuspended and dispersed; and thus could negatively impact the sessile biota attached to the rocky substrate. On a sandy bottom, there are usually fewer organisms per unit area to be impacted, and resuspension and dispersion is more likely, provided motion (whether unidirectional currents or oscillatory wave motion) is adequate.

The sites presently proposed are far from inshore areas and lagoon inlets, and in fact are beyond the rocky bottom regions which extend out several kilometers from shore. The Sidi Bishr outfall diffuser site is on a sandy plain. The Kait Bey diffuser site is on a sandy plateau. It is true that there is one more rocky ridge on the sea floor offshore of the Kait Bey site; however, predominant currents will not often carry the plume over this ridge.

For resuspension and dispersion, it is well to be in waters not so deep that wave action cannot aid in resuspension. At the proposed Sidi Bishr site, winter storm waves (typical period of 8.5 sec, typical height 5 m) can provide orbital motion at the bottom with speeds of up to 0.2 m/sec, which can initiate motion in unconsolidated calcareous sand grains as large as 0.2 mm diameter. Tests by Southern California Coastal Water Research Project (SCCWRP) scientists on sludge deposits in Santa Monica Bay (SCCWRP 1976 Annual Report) indicate that sediment motion is initiated when current speeds exceed about 0.06 m/sec.

To aid in dispersal of the particulate matter, it is well to have large water depth to provide large initial height of rise of the plume, so that particles settling may travel farther before falling to the sea bed.

Therefore, based upon our analysis of possible settled solids accumulation we conclude the following:

1. The proposed discharge sites are far enough from shore to be in sandy not rocky areas, yet not so deep that wave action cannot occasionally resuspend any deposits for further dispersal.

2. Changing the diffuser location would not substantially alter such a situation. Lengthening the diffuser would increase the areal distribution of deposits within 1 km of the diffuser, but not greatly alter conditions farther away.

A well engineered outfall system, designed with adequate knowledge of the marine environment, is one of the most technically reliable types of sewage facility available. The greatest liability is poorly diluted

nearshore discharge through a fracture in the pipeline. The line must, therefore, be properly designed and constructed in a conservative manner, giving consideration to all expected forces and construction conditions.

The impact of failure due to a fracture near the shoreline can be observed at the present Kait Bey outfall. Large areas of the sea near shore are discolored and aesthetically revolting; nearshore areas are subject to strong sewage odors and the beaches are unsafe for swimming.

Institutional support requirements associated with the outfalls include proper operation of the treatment facilities, particularly in the matter of screening, so that rags and other solids do not clog the diffuser ports; periodic inspection of the outfall by a diving team to check for problems; and a mechanism established so annual maintenance funds are available.

Navigational buoys should be placed at either end of the exposed portion of the pipe to warn shipping against anchoring on the pipe. Navigational charts should be marked, and at appropriate times, "Notices to Mariners" issued.

There must be effective marine monitoring and toxic control monitoring and regulation, as presented in the discussions of the Proposed Monitoring Programs contained in Sections 5.3 and 5.4.

TABLE 5.1.1

COMPARATIVE CAPITAL COST, BEACH COLIFORM LEVELS[a] AND FAR-FIELD DILUTION AS FUNCTIONS OF OUTFALL LENGTH

(1983 Basis)

Outfall Length	Comparative Capital Cost (millions of LE) Sidi Bishr	Kait Bey	Percent of Time Fecal Coliforms Are Less Than: 1000/100mL	100/100mL	Far-Field Dilution[b]
4 km	19.00	14.00	47	39	241
6 km	25.90	19.00	65	56	481
8 km	32.00	23.99	78	69	722
10 km	38.11	28.40	87	78	992
12 km	45.00	33.00	92	86	1265
14 km	51.30	37.60	95	92	1585

a Coliform levels indicated are based on primary treatment.

b For 11 m^3 sec, the projected year 2000 average combined discharge for both the Sidi Bishr and the Kait Bey Outfalls.

5.2 TREATMENT LEVEL DESIGN ALTERNATIVES

5.2.A: PRIMARY TREATMENT DESIGN ALTERNATIVE

Modify project design to include primary wastewater treatment prior to disposal through sea outfalls.

5.2.B: SECONDARY TREATMENT DESIGN ALTERNATIVE

Modify project design to include secondary wastewater treatment prior to disposal through sea outfalls.

To simplify presentation and ease comparisons, these two alternatives are discussed together in this section.

Alternative "A", consisting of subalternatives Aa and Ab, has been developed to allow an evaluation of a modification of the recommended plan which provides primary treatment in addition to preliminary treatment with sea outfall disposal. For this modification the treatment plants will include screening units, grease and oil removal, grit removal, and primary settling.

Screenings and grit would be disposed of to a sanitary landfill. Grease and oil would either be incinerated on site or hauled away to suitable disposal areas. Disposal of sludge would be by pumping to nearby landfill areas or by on-site dewatering and disposal to landfill areas. The costs developed in the present plan provide for minimal sludge processing. A final decision relative to sludge processing and alternate disposal would have to be evaluated at the facilities design stage. Subject to analysis of the sludge toxics, principally heavy metals, the residual sludge could be considered for soil conditioning agricultural application. Another consideration would be the use of sludge to generate gas to provide a portion of the energy needs for the treatment facility.

Treatment units would be covered as required for buffering and vector control, and ventilated with provisions for odor control. One such plant would be constructed at Kait Bey on land partially reclaimed from the sea. Another plant would be located at Ras el Soda (near Sidi Bishr). The existing West Treatment Plant would be modified and upgraded to provide a third plant.

For primary treatment, the length of the outfall could be decreased to an extent dependent on the degree of reliability predicted for the primary process. For an operation with low reliability, the outfall length should be not less than the length recommended for preliminary treatment; for high reliability, the length may be decreased by two kilometers at each outfall. Alternative "Aa" is based on primary treatment with the outfall lengths in accordance with the Master Plan Study recommendation; Alternative "Ab" is for primary treatment with outfalls shortened by two kilometers at each location.

Alternative "B" is similarly developed to allow evaluation of another modification of the recommended plan. This alternative provides secondary treatment with sea outfall disposal. For this modification it is assumed that three secondary treatment plants would be built; one to receive flows now planned to be treated at Kait Bay, one at the West Treatment Plant, and one at Ras el Soda. Each plant would include preliminary units (screenings, grease, oil and grit removal), primary sedimentation, biological treatment (either activated sludge or trickling filters) and secondary clarifiers. Processing and disposal of screenings, grit, grease and sludge would be as described in Alternative "A". One addition would be the provision of facilities for processing waste activated sludge if the activated sludge process should be selected.

The preliminary, primary and sludge treatment units would be housed and ventilated as required for buffering and vector control with provisions incorporated for odor control due to the close proximity of development at Kait Bey and the potential for development at the Ras el Soda site.

Preliminary analysis indicates that there is insufficient area for construction of the required secondary facilities at the Kait Bey site even considering land filling in the bay area. Therefore, for secondary treatment the entire facility would have to be located inland or a portion of the secondary facilities constructed at the Kait Bey site and the remainder at an inland site. Further evaluation of this alternative, if deemed appropriate, would be accomplished in the design stage subject to hydraulic considerations, cost, available land and selected treatment processes.

The outfalls could be shortened for Alternative "B" because dispersing currents need not be so great for secondary effluent. However, coliform counts in secondary effluents are not significantly lower than in preliminary and primary treatment effluents and, therefore, summer month chlorination for disinfection may be required.

The costs associated with these alternatives are presented in Tables 5.2.1, 5.2.2 and 5.2.3. Table 5.2.1 presents the total capital costs in a comparative fashion and is based on the level of detail available. As indicated the least cost alternative is the approach recommended in the Master Plan Study consisting of preliminary treatment and long outfalls. This alternative would provide for adequate protection of the shoreline and bathing beaches, as described in the Master Plan Study and the Draft Environmental Impact Statement.

As the degree of treatment increases, the cost of constructing the facilities increases. Alternative Aa, consisting of primary treatment and long (recommended plan) outfalls, increases the cost over the recommended plan by approximately 19%; Alternative Ab, consisting of primary treatment and shortened outfalls increases the cost over the recommended plan by approximately 11%; and Alternative B, consisting of secondary treatment and shortened outfalls increases the cost over the recommended plan by approximately 74%. Based upon satisfactory design, construction, and operation of these facilities, these increases in cost over the preliminary treatment alternative cost should be evaluated in terms of the increased measure of protection afforded by the alternative designs.

Table 5.2.2 presents the estimated land costs associated with each alternative. These have been reflected on Table 5.2.1.

Table 5.2.3 presents the estimated annual operation and maintenance costs associated with each alternative and is, again, based on the level of detail available. As indicated in the table primary treatment is almost twice as costly to operate and maintain as preliminary treatment and secondary treatment is over four and one-half times as costly as preliminary treatment to operate and maintain.

Parallel with the operational and cost evaluation, the reliablity of the treatment and disposal facilities is of prime concern. The recommended plan affords the highest degree of reliability of the alternatives presented, since the treatment units are simple, and require the least training to operate of the alternatives presented. There is little chance of process upset.

A relatively small amount of standby power will assure continuous operation of the recommended facility even in the event of power failure. Maintenance requirements and cost will be minimal. Reliability of Alternative "A" treatment is also good in respect to process upset except perhaps in the sludge dewatering units. Dewatering units require chemical supplies and are relatively high maintenance items. Effluent quality can be significantly degraded if dewatering units do not function effectively. System reliability of Alternative "B" is the lowest of all three alternatives considered here. Upset or operating problems in secondary and sludge treatment processes are traditionally more severe and frequent than in the plants affording a lower degree of treatment. Secondary sludges are significantly more difficult to dewater. The cost of providing standby power for the secondary treatment units would be prohibitive, so that during power outage these units would be out of service.

The concern properly associated with the reliability of the treatment facility is a function of the impacts associated with treatment failure. outfall disposal systems tend to decrease the short-term impacts of treatment plant failures when compared to impacts of failures where disposal is to land, lake, small stream or reuse. Generally, the overall impacts of treatment failure are consistent with the degree of treatment required; i.e., significant adverse impacts are felt when systems affording a high degree of treatment malfunction and vice versa. However, the effects of breakdown of either primary or secondary treatment units is not likely to have a serious short-term effect with an outfall longer than about 6 km. However, if repairs or recovery are not made within a few weeks, the effects may begin to become evident.

Personnel requirements to operate and maintain the system recommended in the Master Plan Study are relatively low compared to the Alternative "A" and "B" systems both as regards numbers and degree of training required. In addition, the level of parts and spare equipment needed to keep the plant running is relatively very low for the recommended plan and would be higher for the Alternative "B" system and significantly higher for the Alternative "B" plan. Similarly, the amount of sludge residual for disposal is significantly less for the recommended plan system.

Since power outages and escalating power costs are a concern, the energy requirements associated with each alternative were considered as a significant design factor. There is a wide variance in the energy requirements for the three alternatives considered in this comparison. All three alternatives involve the pumping of plant effluent to the sea. The energy involved in pumping effluent through the long outfall is only marginally greater than for the shorter outfalls, the principal difference being the increased friction head in the longer pipeline. This will amount to about 0.9 meters per km length at peak flow conditions.

The energy requirement for the recommended plan system will be low in comparison to Alternatives "A" and "B". Relatively small motors are needed to drive the treatment equipment. In addition, power will be required to ventilate the plant enclosures. The energy requirement for the Alternative "A" system will be similar to that of the recommended plan, except additional power will be required to drive the primary settlers (small motors) and the sludge handling and dewatering equipment. This could be significant or nominal depending upon the type of dewatering equipment selected. The energy requirement for the Alternative "B" system is estimated to be more than twice that required for Alternative "A".

TABLE 5.2.1

ESTIMATED COMPARATIVE CAPITAL COSTS (LE Millions)
(1983 Basis)

		Alternatives		
	Preliminary Treatment	Aa Primary[a] Long OF	Ab Primary[a] Shorter OF	B Secon Treat
Sidi Bishr Sea Outfall, km	10	10	8	6
Treatment Plant and Effluent Pump Station (560 ML/Day)	18.31	29.25	29.25	65.
Sea Outfall	38.11	38.11	32.00	25.
Kait Bey Sea Outfall, km	8	8	6	4
Treatment Plant (175 ML/Day) Effluent Pump Station (395 ML/Day)	15.54	24.00	24.00	55.
Sea Outfall	23.99	23.99	19.00	14.
West Treatment Plant - upgrading Pump Station and Force Main (220 ML/Day)	29.42	32.08	32.08	50.
Total Capital Costs	125.37	147.43	136.33	210.
Land Acquisition and Reclamation Costs	3.54	6.60	6.60	14.
Total Comparative Costs	128.91	154.03	142.93	224.

(a) Costs for the Primary Treatment Increment are based on minimal processing of sludge. During the design phase optimum processes for sludge disposal will be established.
(b) Estimated land reclamation and land acquisition costs for comparative purposes only.

TABLE 5.2.2

ESTIMATED LAND COSTS
(1983 Basis)

	Land Requirements		
	Preliminary Treatment	Primary Treatment	Secondary Treatment
Ras el Soda Site, ha. (Sidi Bishr Outfall)	5	7	12
Kait Bey Site, ha.	0.9	4	8*
West Treatment Plant Site, ha.	0	0	3
Total Land, ha.	5.9	11.0	23.0
Land Acquisition and Reclamation Costs, Assume 60 LE/sq. m.			
Total Land Costs - LE Million	3.54	6.6	14.0*

*At this site such an area is not available. Therefore an inland site will be required which will necessitate considerable modification to the extensive existing east zone collection system. Costs are presented for comparative purposes only.

TABLE 5.2.3

ESTIMATED COMPARATIVE ANNUAL OPERATION AND MAINTENANCE COSTS
(1983 Basis)

	Average Flow Ml/Day	LE Millions/Year		
		Preliminary Treatment	Primary Treatment	Secondary Treatment
Ras el Soda Plants	560	1.68	4.20	12.39
Ras el Soda Effluent Pump Station	560	0.84	0.84	0.84
Kait Bey Plants	175	0.74	1.89	4.41
Kait Bey Effluent Pump Station	395	0.63	0.63	0.63
West Treatment Plants	220	0.84	2.10	5.46
West Pump Station	220	0.63	0.63	0.63
Total		5.36	10.29	24.36

5.3 PROPOSED MONITORING PROGRAM - OFFSHORE AND BEACHES

Develop a program to insure the proper monitoring of aquatic systems in the vicinity of the sea outfalls and the beaches of Alexandria.

The proposed monitoring program for the impacts of sea outfalls on aquatic systems and beaches is outlined below. The institutional arrangements are suggestions only, based on acquaintance with local conditions and institutions. Steps to confirm the arrangements must, of course, be taken in concert with the Egyptian organizations involved, within the outfall design phase.

Monitoring of bacterial levels shall continue at up to 25 beaches along the Alexandria coast, much as in past seasons (Table 5.3.1). Each week during the bathing season (June through September) and each month out of season (October through May), samples of seawater shall be taken from the surf zone, both in the early morning (5 to 7 am) and in early afternoon (1 to 3 pm). These shall be cultured for those bacteria that have been found to best indicate health effects among bathers. The High Institute of Public Health of Alexandria University has done such work in the past, and is the logical institution to continue the work. Sampling, culturing, identification, and counting techniques shall be those used in the recent High Institute of Public Health/United States Environmental Protection Agency (HIPH/EPA) study that have proved to be the most satisfactory. Continuing liaison with members of the HIPH/EPA team involved may be advantageous, as may be the importation of equipment such as millipore filters.

Monitoring of ecological conditions shall be undertaken annually at up to 50 stations distributed about the Sidi Bishr and Kait Bey discharge sites (see Figure 5.3.1). The monitoring program should be started three years before discharge through the new system begins to permit observation of changes resulting from the discharge.

Monitoring should be done four times (Winter, Spring, Summer, Autumn) during the first year to see if there are significant seasonal changes. On the basis of the results, seasonal sampling frequency may be reduced.

Similarly, while monitoring should be undertaken at up to 50 stations in the early years before and just after discharge begins, the data may then be analyzed to determine whether essentially the same information can be obtained with a smaller number of stations, perhaps 25 to 30.

Water quality surveys should include dissolved oxygen (DO), Biological Oxygen Demand (BOD), suspended solids (SS), nitrogen as nitrate and ammonia, phosphorus as orthophosphate, chlorophyll-a (an indication of whether or not there is a stimulation of phytoplankton by discharged nutrients), and water transparency. Water quality surveys should also include enumeration of the same kinds of enteric bacteria that are examined in the beach monitoring program, and the two surveys should be coordinated so that effects from the two main discharges (Sidi Bishr and

Kait Bey outfalls) may be separated from those resulting from local discharges and runoff at or near the beach areas. Samples for water quality analyses should be taken from just below the surface and just above the bottom at each station.

Temperature and salinity vertical profiles should be taken in the course of the water quality surveys to indicate the extent of thermal and density stratification, and thereby help explain the distribution of the discharge plume and other natural water quality characteristics.

Sediment samples should be taken from each station. Sample analyses should include conventional grain size analyses, and chemical analyses for PCB, pesticides, toxic heavy metals (e.g., Pb, Hg, Cd, Cu, Zn), sediment oxygen demand and percent organic content. The list of toxic materials sought in analyses should be based in part on a list of those materials suspected of being generated by Alexandrian industry and subject to control at their source.

For biological analysis of the sediments, it is strongly suggested that a biological analysis technique such as the Infaunal Trophic Index recently developed and reported by the Southern California Coastal Water Research Project (SCCWRP, 1978 Annual Report) be adopted for Alexandria marine conditions. The SCCWRP Infaual Trophic Index was developed in response to the very common need to identify specific areas of pollution, and to be able to distinguish unambiguously between "normal" and "changed" conditions on the sea bed. The virtues of such an index are numerous. Each sample analyzed can be assigned an index value in a few hours; replicates are not needed; all species in a sample need not be identified; equal results can be obtained by different biologists using a wide variety of equipment; old data can often be compared with new data; and the results can be readily plotted on a chart. Furthermore, there is a clear relationship between the Index animals and organic materials in the sediments.

In addition to sediment samples, there should be samples taken at each station by benthic grab (sieved through 0.1 mm mesh screen for collection of infaunal benthic organisms), and by bottom trawl for epibenthic fishes and invertebrates. Organisms should be identified and counted and diversity determined by conventional methods, to make survey results comparable t other, similar studies, as well as using an index such as the SCCRP Infaunal Trophic Index. Benthic fishes, particularly flatfish, should be examined for incidence of fin rot and other diseases or malformations.

Specimens of commercial food organisms (i.e., penaeid shrimp, molluscs if they are eaten and caught in significant quantity, and one or more important benthic fin fish) should be collected during each survey and the edible portion analyzed for PCB, pesticides, and toxic heavy metals (e.g., Pb, Hg, Cd, Cu, Zn).

The Institute of Oceanography and Fisheries is the logical choice of organization to undertake this field samplings and identification; the Alexandria branch has a vessel, the "Faras al Bahr," which is suitable for such field work.

To develop an index such as the Infaunal Tropic Index for local conditions, there should be an initial visit to Alexandria by SCCWRP scientists and visits to the SCCWRP laboratory by appropriate Egyptian marine biologists, before the monitoring program is started, with continuing liaison thereafter.

Final technical arrangements for the monitoring program should conform with the Guidelines for Health Monitoring of Coastal Water Quality, Mediterranean Pollution Monitoring and Research Programme (MED POL), World Health Organization (WHO), 1977. Key personnel from the High Institute of Public Health, the Institute of Oceanography and Fisheries and Alexandria University have participated in MED-POL proceedings to date. It is strongly suggested that arrangements be made to archive the data with MED-POL in accordance with United Nations Environmental Programme (UNEP) policy of coordinating environmental data world-wide and the provisions of the "Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-based Sources."

Further technical support of both beach and marine monitoring in matters of personnel and equipment may be found in several departments of Alexandria University, such as the Oceanography Department in the Faculty of Science; the Sanitary Engineering Department in the Faculty of Engineering; and the Faculty of Agriculture. As noted above, final institutional arrangements must be negotiated with the parties involved.

The monitoring agencies shall be responsible not only for gathering and analyzing data, but for integrating and archiving the data as well and for deciding when and where there may be violation of standards or environmental stress. Should a monitoring agency determine that discharges from the ocean outfalls are causing unacceptable impacts on the part of the environment within the agency's responsibility, there must be an effective administrative procedure established to require the operating agency to take proper mitigating measures.

The Government of Egypt will have to provide a procedure whereby monitoring results, properly interpreted, may influence outfall operation as is appropriate. Adoption of discharge and water quality standards will contribute to this end. Furthermore, it would be most advisable to update Egyptian Law No. 92 of 1962, by adding quality standards for Marine waters.

Personnel arrangements and estimated costs are given in Tables 5.3.2 and 5.3.3. Final institutional arrangements must await the outfall design phase.

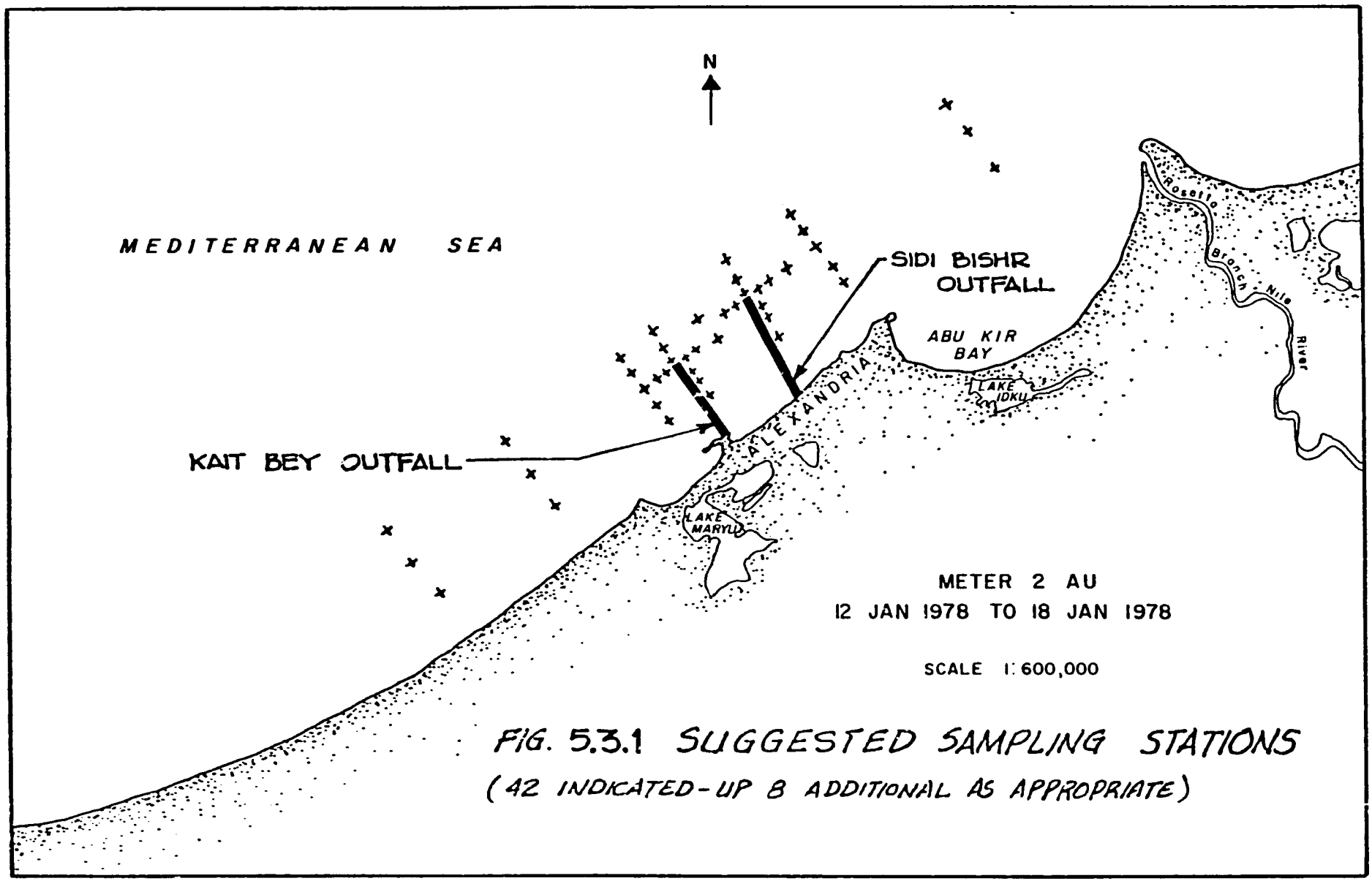


FIG. 5.3.1 SUGGESTED SAMPLING STATIONS
(42 INDICATED-UP 8 ADDITIONAL AS APPROPRIATE)

TABLE 5.3.1

BEACH LOCATIONS FOR BACTERIAL SAMPLING

1. Anfushi
2. Halka
3. Yacht Club, E. Harbor
4. Kashafa, E. Harbor
5. Mahkama, E. Harbor
6. Chatby
7. Camp Ceasar
8. Ibrahimiya
9. Sporting
10. Sidi Gaber
11. Police Club
12. Stanley Bay
13. Glym, Pump Station
14. Glym, Beach
15. San Stefano
16. Saray
17. Abu Hief
18. Sidi Bishr
19. Miami
20. Mandara
21. Montaza
22. Maamura

(Up to three other locations may be specified as deemed appropriate.)

TABLE 5.3.2

PERSONNEL AND COSTS FOR BEACH SAMPLING PROGRAM
(1983 Basis)

Personnel (all on HIPH* Staff)

Supervisor (2 days per month)

2 Scientists

2 Technicians

Costs

Per sample, including personnel collecting and analyzing sample; equipment; transportation	$16
No. of Stations	25
No. of visits per sampling day	2
No. of sampling days: 8 in off season 17 in bathing season	25

Total cost per year:

50 samples/day x 25 days x $16/sample = $20,000

*High Institute of Public Health
Alexandria University

5.4 PROPOSED MONITORING PROGRAM - "SEWER USE LAW"

Develop a program to insure the proper implementation of the monitoring program for the existing "Sewer Use Law" and the proposed "Ordinance Regulating Sewer Construction, Sewer Use and Industrial Waste Discharge."

The Agency to implement and enforce the "Sewer Use Law" (SUL) would be the General Organization for Sewerage and Sanitary Drainage (GOSSD). GOSSD should be reorganized as needed to establish a separate department, which might be named the Department of Sewer Use Control, with responsibility to implement all aspects of the SUL, including the levy of penalties and fines. The Department of Sewer Use Control should be divided into four sections with further divisions or subsections as shown on the Table of Organization (Table 5.4.1).

5.4.1 Department Head, Department of Sewer Use Control

The Department Head would be responsible to the General Director GOSSD for all aspects of the SUL, its implementation and enforcement. Administration of the Department would be his principal duty but he should also serve on any permanent advisory committee set up by the General Director. He should be an administrator (first priority) but preferably with municipal engineering experience.

5.4.2 Residential and Commercial Section

Residential and Commercial Section would be responsible for all aspects of application for and issuance of permits as well as inspection of installations and connections for residences and commercial establishments. The section should be administered by a Section Head and should contain two subsections, one to handle the office work and the other to handle the field inspections. The office staff should include one or more technicians experienced in the work of making connections to assist in the preparation of the applications and permits. Typists and filing clerks would complete the office administration staff. Inspectors would make field visits to the sites and assure that the work is done properly. The Department would not make any connections.

5.4.3 Industrial Section

Industrial Section would be responsible for all aspects of application for and issuance of permits as well as inspection of installations and connections for industrial establishments. This section would not be involved in monitoring of effluents for SUL compliance. The functions of the Applications and Permits and Inspection Subsections would be similar to those described above for the Residential and Commercial Section. There would be, in addition, a Design and Operations Assistance Subsection to advise industries and/or their consultants on the design and operation of metering and treatment facilities. The staff of this Subsection would include engineers and technicians experienced in the design and especially operation, of industrial treatment facilities. The staff of this Subsection would make periodic visits to the various industrial

TABLE 5.3.3

PERSONNEL AND COSTS FOR MARINE SAMPLING PROGRAM

(1983 Basis)

Personnel

Supervisor (2 days per month)

Scientist in charge of chemical analysis

Scientist in charge of biological analysis

4 Technicians

Costs

Vessel with crew, fully found $300/day for 2 days	$ 600
Per biological sample, $100 x 50 samples	5,000
Per water quality sample, $20 x 50 samples	1,000
Per sediment sample, chemical analysis $100 x 50 samples	5,000
Miscellaneous costs	3,000
Cost per year	$14,600

SCCWRP* Participation	
Initial Involvement	$50,000
Annual Thereafter	2,000

*Southern California Coastal Water Research Project

facilities independently of the Monitoring Section personnel (described in Section 5.4.4 below) to keep abreast of the functioning of industrial facilities. They would maintain liaison with the Industrial Subsection of the Monitoring Section to advise them of problem plants and to obtain information about problem treatment facilities and wastes. This information would also be utilized in this Subsection's function of assistance to industries.

5.4.4 Monitoring Section

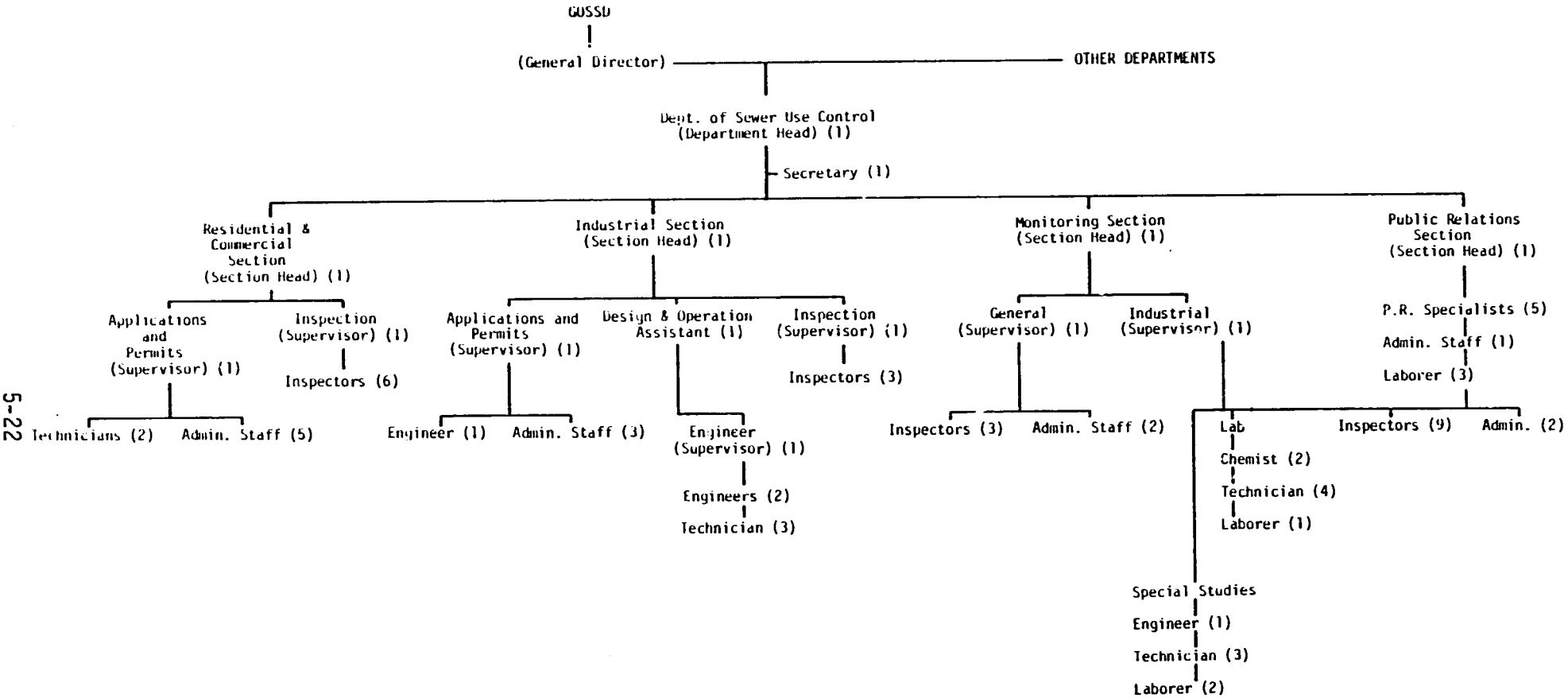
The Monitoring Section would be responsible for the field inspection or monitoring of all operating connections. Two Subsections would be provided, one designated the General Subsection to monitor for general violations of the SUL and the other, the Industrial Subsection to perform the monitoring necessary to control industrial wastes discharges. The General Subsection would make spot checks and generally patrol the service area for violations. The personnel of this Subsection would be trained sanitary technicians and a secretary to handle office paperwork and coordination. The Industrial Subsection would make routine and periodic investigations (through metering and sampling) of the various industries, perhaps a week at each plant per year. The Subsection would be provided experienced junior engineers or technicians to do the metering and sampling and a staffed laboratory to make the necessary chemical analyses. A special studies group would be provided for special, non-routine studies and investigations. A small administrative group would handle the Section paperwork and coordination.

5.4.5 Public Relations Section

A fourth section, Public Relations Section, would be responsible for the education of the public and industries to the SUL and its requirements. Because the existing law has not been enforced, it is considered necessary to start fresh to make the public and industries aware of the SUL and why it is essential that it be enforced. The activities of this Section should start as soon as possible and may be curtailed or even eliminated later when the public and industries become accustomed to the SUL and its provisions. The personnel of this Section should be public relations trained and oriented and should be equipped with the necessary visual aids, public address equipment, etc. to carry out the program.

5.4.6 Effectiveness

The successful implementation and enforcement of the SUL are totally necessary for the effective operation of the wastewater collection, treatment and disposal system. The task of implementation is formidable and will require not only support by the various levels of government but full acceptance and cooperation by the people and industries. The public relations effort must be simple, direct and stress communication. It will be the key, initially, to the effectiveness of implementation. The organization setup (Table 5.4.1) should prove adequate to handle the initial implementation of the SUL and bringing up to date the permits, applications and records for the existing connections.



Note:
(4) indicates number of staff by position

TABLE OF ORGANIZATION
Department of Sewer Use Control

TABLE 5.4.1

TABLE 5.4.2

ESTIMATED CAPITAL AND ANNUAL COSTS
FOR PROPOSED DEPARTMENT OF SEWER USE CONTROL
(1983 Basis)

Estimated Costs

Initial Costs - (one-time costs to establish)		LE	$
Vehicles	26 @ 4,000	104,000	
	6 @ 10,000		60,000
Office Furniture		10,000	
Laboratory Facility		50,000	50,000
PR Equipment		5,000	6,000
Monitoring Equipment, Meters		5,000	15,000
	LE	174,000	$131,000

Annual Costs			
Personnel		122,000	
Vehicles, Operation, Maint., Repl.		90,000	
Laboratory Supplies		2,000	10,000
Office Supplies		5,000	
Misc Supplies & Equip.		10,000	5,000
	LE	229,000	$ 15,000