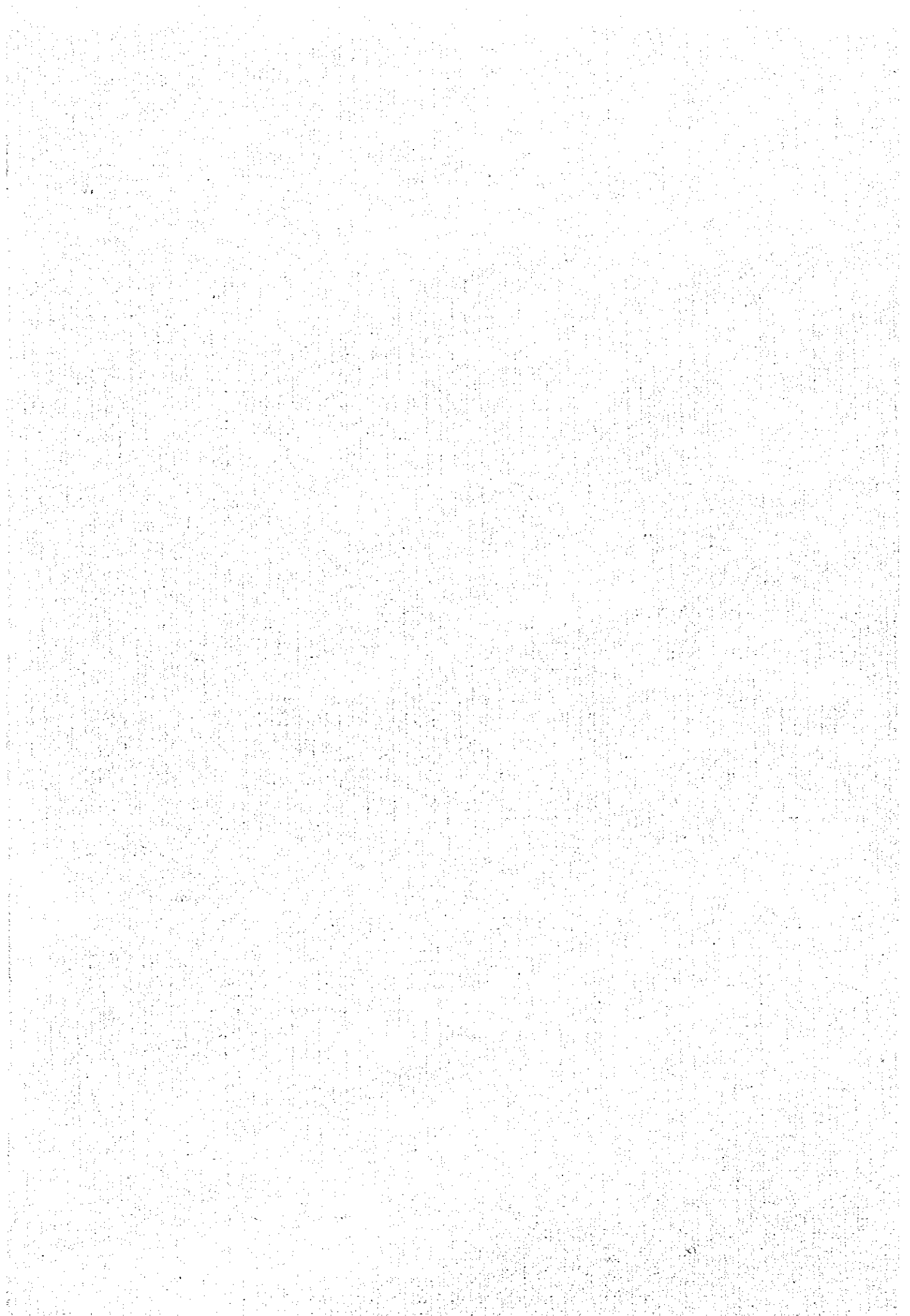


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1. 要請書



STANDARD MODEL OF TERMS OF REFERENCE

Application for the Technical Cooperation (Development Study) by the Government of Japan

1. Project Digest

- (1) Project Title - *Combined Cycle Power Project*
- (2) Location (Please attach a location map) - *Refer Figure 1*
- (3) Implementing Agency
- Name of the Agency - *Ceylon Electricity Board*
 - Number of the Staff of the Agency (on a category basis)
 - Budget allocated to the Agency - *Not Applicable*
 - Organization chart - *Refer Figure 2*
- (4) Justification of the Project
- *The project is one of the plant identified in the least cost development plan of the CEB*
- present conditions of the sector
- *CEB is the sole authority in generation transmission and most of the distribution of electrical energy in the country. It has a generation capacity of 1385 MW of which 1115 MW is composed of hydro electricity.*
- sectoral development policy of the national/local government
- *To install adequate generating capacity to meet the demand*
- problems to be solved in the sector
- outline of the Project
- *To carry out full scale feasibility study including environmental impact assessment report*
- purpose (long-term objective) of the Project
- *To meet the Long Term electricity demand*
- prospective beneficiaries
- *This is a national project with national socio-economic benefits*
- the Project's priority in the National Development Plan/Public Investment Programme
- *To be included once the feasibility study completed*
- (5) Desirable or schedule time of the commencement of the Project
- *1997 financial year*
- (6) Expected funding source and/or assistance (including external origin)
- *JICA*
- (7) Other relevant Project, if any

2. Terms of Reference of the Proposed Study

- (1) Necessity Justification of the Study - *To conduct Feasibility study in order to implement the project which will be most economical option for the Sri Lanka power sector*
- (2) Necessity/Justification of the Japanese Technical Cooperation - *Due to high expertise in the field of thermal plant design, construction and operation Japanese experts assistant will be beneficial to Sri Lanka*
- (3) Objectives of the Study - *To conduct full scale feasibility study*
- (4) Area to be covered by the Study - *Refer figure 1*
- (5) Scope of the Study - *carry out full scale feasibility study*
- *carry out EIA study as per requirement of the CEA*
- *Preparation of economic and financial analysis*
- (6) Study Schedule - *One year*
- (7) Expected Major Outputs of the Study - *Feasibility study report on the proposed power plant*
- (8) Request of the Study to other donor agencies, if any - *Not Applicable*
- (9) Other relevant information, if any

3. Facilities and Information for the Study Team, etc.

- (1) Assignment of counterpart personnel of the implementing agency for the Study (number, academic background etc.) - *Necessary counterpart staff will be assigned by CEB*
- (2) Available data, information, documents, maps etc. related to the Study (Please attach the list) - *Thermal Generation Option Study*
- (3) Information on the security conditions in the study Area - *Study area is closer to Colombo*

4. Global Issues (Environment, Women In Development, Poverty, etc.)

- (1) Environmental components (such as pollution control, water supply, sewage, environmental management, forestry, biodiversity) of the Project, if any
- *To be covered during the EIA study process*
- (2) Anticipated environmental impacts (both natural and social) by the Project, if any
- *To be studied in detail during the EIA study*
- (3) Women as main beneficiaries or not - *This is a national project*
- (4) Project components which requires special considerations for women (such as gender difference, women specific role, women's participation), if any
- *Not Applicable*
- (5) Anticipated impacts on women caused by the Project, if any - *Not Applicable*
- (6) Poverty reduction components of the Project, if any
- *The implementation of this project will lead to general socio-economic development in the country as well as it will contribute to the overall economic growth in the country*
- (7) Any constraints against the low income people caused by the Project

5. Undertakings of the Government of (the recipient country)

In order to facilitate a smooth and efficient conduct of the Study, the Government of (the recipient country) shall take necessary measures :

- (1) to secure the safety of the Study Team - *Yes*
- (2) to permit the members of the Study Team to enter, leave and sojourn in (the recipient country) in connection with their assignment therein, and exempt the from alien registration requirement and consular fees. - *Yes*
- (3) to exempt the Study Team from taxes, duties and any other charges on equipment, machinery and other materials brought into and out of (the recipient country) for the conduct of the Study - *Yes*
- (4) to exempt the Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Study Team for their services in connection with the implementation of the Study - *Yes*
- (5) to provide necessary facilities to the Study Team for remittance as well utilization of the funds introduced in (the recipient country) from Japan in connection with the implementation of the Study - *Yes*

- (6) to secure permission or entry into private properties or restricted areas for the conduct of the Study - *Yes*
- (7) to secure permission for the Study to take all data, documents and necessary materials related to the Study out of (the recipient country) to Japan - *Yes where relevant*
- (8) to provide medical services as needed. Its expenses will be chargeable to members of the Study Team. - *Yes*
6. The Government of (the recipient country) shall bear claims, if any arises against member(s) of the Japanese Study Team resulting from, occurring in the course of or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the member of the Study Team.
7. (The implementing agency) shall act as counterpart agency to the Japanese Study Team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

The Government of (the recipient country) assured that the matters referred in this form will be ensured for a smooth conduct of the Development Study by the Japanese Study Team

Signed :

Titled :

On behalf of the Government of

Date :

- 1. Name of Project** : **Combined Cycle Power Development Project**
- 2. Objective** : **To conduct feasibility study of the Combined Cycle Power Development Project at Kerawalapitiya**
- Activity** : **To obtain the services of a consulting firm to conduct a full scale feasibility study of 150 MW Combined Cycle Power Project at Kerawalapitiya. The Terms of Reference is attached.**
- Output** : **A complete feasibility study and Terms of Reference for consultancy to do detailed design and to prepare tender documents.**
- 3. Present Status** : **A Thermal Generation Options Study was conducted by Electrowatt Engineering Services Ltd. in 1995 second half to identify suitable sites for thermal projects in the Generation Expansion Plan. As the next best thermal plant, the consultants have recommended the implementation of 150 MW Combined Cycle Power Plant at a location close to Colombo. CEB has already arranged to procure approximately 30 ha of land at newly developed site at Kerawalapitiya in the Muthurajawela marsh North of Colombo. The site is available for the development of a 150 MW Combined Cycle Power Plant.**
- 4. Priority Rating** : **High**
- 5. Timing** : **The feasibility study should commence in 1997 so that plant will be available for commissioning in the year 2000 according to the least cost generation expansion plan**
- 6. Total Cost** : **Estimated total cost will be in the order of USS 750,000.**

Terms Of Reference For Feasibility Study Of Combined Cycle Power Development Project At Kerawalapitiya

1. Background

- 1.1 Ceylon Electricity Board (CEB) power system consists of 1135 MW of installed hydro capacity and 250 MW of thermal capacity at present. The thermal consists of 120 MW of gas turbines, 50 MW of oil fired steam turbines and 80 MW of diesel plants. A 40 MW extension of the existing Sapugaskanda diesel plant which is under construction is expected to be commissioned in 1997. Furthermore, 115 MW Gas Turbine is also being procured by CEB on a fast track basis to be implemented by early 1997. Action is also being taken to implement a 150 MW Combined Cycle Power Plant at the Kelanitissa power station premises with the assistance from OECF of Japan.
- 1.2 A Thermal Generation Options study has been conducted by Electrowatt Engineering Services Ltd. (EWI), Switzerland in 1995 to identify suitable sites for thermal projects in the generation expansion plan.
- 1.3 The Government of Sri Lanka (GOSL) now wishes to conduct a feasibility study of Kerawalapitiya site which is recommended by the consultants for a Combined Cycle power development.
- 1.4 The Proposed Combined Cycle Power Development Project is located at Kerawalapitiya in Gampaha District. The project location is at a distance of 12 km, North of Colombo, Sri Lanka.
- 1.5 On the request made by the Government of Sri Lanka the Japan International Cooperation Agency (JICA) is financing the feasibility study of the project.
- 1.6 The Executing Agency for the project is the Ceylon Electricity Board (CEB).

2. Objectives

The objectives of the Feasibility Study are;

1. Review previous studies and examine the feasibility of Combined Cycle Power Development Project and
2. Carry out the Environmental Impact Assessment.

3. Scope of Work

The consultant will undertake the feasibility level studies including detailed site investigations and the Environmental Impact Assessment with regard to the Combined Cycle Power Development.

3.1. Supplementary Studies for Feasibility Study

3.1.1. Review of the existing studies related to power system development in general and to this project in particular

- Review of the overall development plan of the project including selection of unit size
- Review of the overall implementation time schedule
- Review of the appropriate fuel to be used for the plant

3.1.2 The consultant shall finalise

- plant type and size including unit sizes
- fuel type, procurement aspects and delivery systems
- cooling water and feed water systems
- switchyard arrangements

3.1.3. Assist CEB in Power system integration analysis (Study of influence of the new power plant on the grid)

- Power flow analysis
- Fault analysis
- Steady-state stability analysis
- Transient stability analysis
- Optimisation study of hydro/thermal plant operation

3.1.4 Supplementary survey for civil works

- Topographic survey (land survey)
- Hydrographic survey
- Geotechnical investigation
- Oceanographic observation (ocean current and wave height measurement, etc.)
- Pipe line route survey for fuel and water supply

3.1.5. Environmental impact study for Power Plant, Transmission Lines etc.

- Existing environment-physical and biological systems
- Existing environment-human, economic and socio-economic aspects
- Construction impacts and mitigation measures
- Operational impacts and mitigation measures

Terms Of Reference for the EIA is annexed as appendix I. The consultants are required to examine the aspects of environmental impacts in accordance with the TOR in order to obtain clearance from the Project Approving Agency.

3.1.6. Preparation of detailed project cost estimates comprising construction, operation and maintenance cost.

The consultant will conduct detailed investigations on the power station option selected and develop optimized designs, layouts and separate cost estimates for all systems and demonstrate its financial and economic viability. Cost estimates should be based on Sri Lankan price levels and procurement through international competitive bidding (ICB). The systems should cover all aspects including the following

- fuel specifications, procurement aspects, fuel handling, transport, storage
- power station building
- cooling water and make-up water systems
- equipment for controlling and monitoring impacts on environment
- turbine and alternator or prime mover and alternator
- general auxiliaries, water treatment plant, air-conditioning, power line carrier and data transfer to system control center, instrumentation, protection and control equipment
- fire protection and fire-fighting equipment
- switching equipment, transformers, switchyard and transmission lines ;
- services as domestic water, drainage sewerage, housing for key staff, lighting, roads
- direct current (DC) system and DC lighting from station batteries, stand-by engine supply for emergency AC supply system
- black-start equipment
- supporting infrastructure including laboratory, training facilities, offices, workshop and stores, lift, cranes etc.

3.1.7. Preparation of detailed construction schedule.

3.1.8. Economic and financial analysis.

3.1.9. Preparation of Study Reports.

3.2 The final feasibility study report will include all the analysis carried out, with EIA report. The CEB will review the results. CEB will thereafter recommend to the GOSL, subject to the environmental clearance by the Project Approving Agency, whether to proceed with the project. The GOSL will thereafter make a decision on the implementation of the project.

3.3. General Items

3.3.1 Technology Transfer to Executing Agency and Local Consultant

Technology transfer will be made locally and at appropriate locations outside Sri Lanka for the counterpart staff of the executing agency.

3.3.2 Reports

The following reports and documents and other relevant reports, as requested by the executing agency will be prepared in English Language and submitted to the executing agency (CEB).

1. Inception report at commencement of feasibility study.
2. Environment Impact Assessment Study Report with mitigatory measures.
3. Field Survey Report (including data book)
4. Final feasibility study report at the end of study.
5. Monthly progress reports.

3.4. Tentative Time Schedule and Reports

1. Within one month after the commencement of the assignment the consultant shall submit 5 copies of the inception report, showing the proposals as to how the objectives of these services are to be achieved. The Consultant will receive comments from CEB within one (1) month of the submission of the Inception Report.

2. Within six (6) months after the commencement of the assignment, the consultant shall submit ten copies of EIA reports with mitigation measures to CEB.
3. Within six (6) months from the commencement of the assignment, the consultant shall submit ten copies of the final completion reports on feasibility study.
4. Monthly Progress Reports shall be submitted by the Consultant during the course of the Consultancy.

4. Language for communication

All the correspondence, documents, reports and other communications shall be in English. The consultant should be able to communicate (verbally and in writing) in English. In the case of those consultants whose native tongue is not English, CEB may request relevant certificate of English proficiency obtained from institutions acceptable to the CEB.

5. Facilities to be provided by the CEB

CEB will provide free of charge the following to the consultants for the duration of the project:

- (1) Office space
- (2) Local counterpart staff
- (3) Project vehicles
- (4) Office equipment such as computers, copy machines, furniture etc.
- (5) Office facilities including telephone, facsimile, telex and secretarial services

6. Responsibility of the Executing Agency

The executing agency (CEB) shall facilitate the smooth implementation of the services as follows :-

- (1) Assign suitable counterpart staff and field assistance to the consultants.
- (2) Provide available project data, information and documents required for the proposed work.
- (3) Permit transfer of relevant project data and documents overseas for further analysis and study.
- (4) Provide computers and software required for power system integration analysis.

- (5) Assist in obtaining permission from the relevant authorities in obtaining necessary Visa, in the clearance of necessary equipment and personal effects for expatriate staff.
- (6) Exempt payment of duty and tax on equipment and materials necessary for the services under existing Government Laws and Rules, or shall reimburse such tax and duty to the Consultants. Personal taxes on remuneration paid in Sri Lanka by expatriate personnel of the firm will be reimbursed by the executing agency. However, the remuneration that the Consulting firm receive from this contract will be subjected to normal tax liability, if any in Sri Lanka and will not be reimbursed by CEB.

Figure 5.7
Kerawalapitiya Site

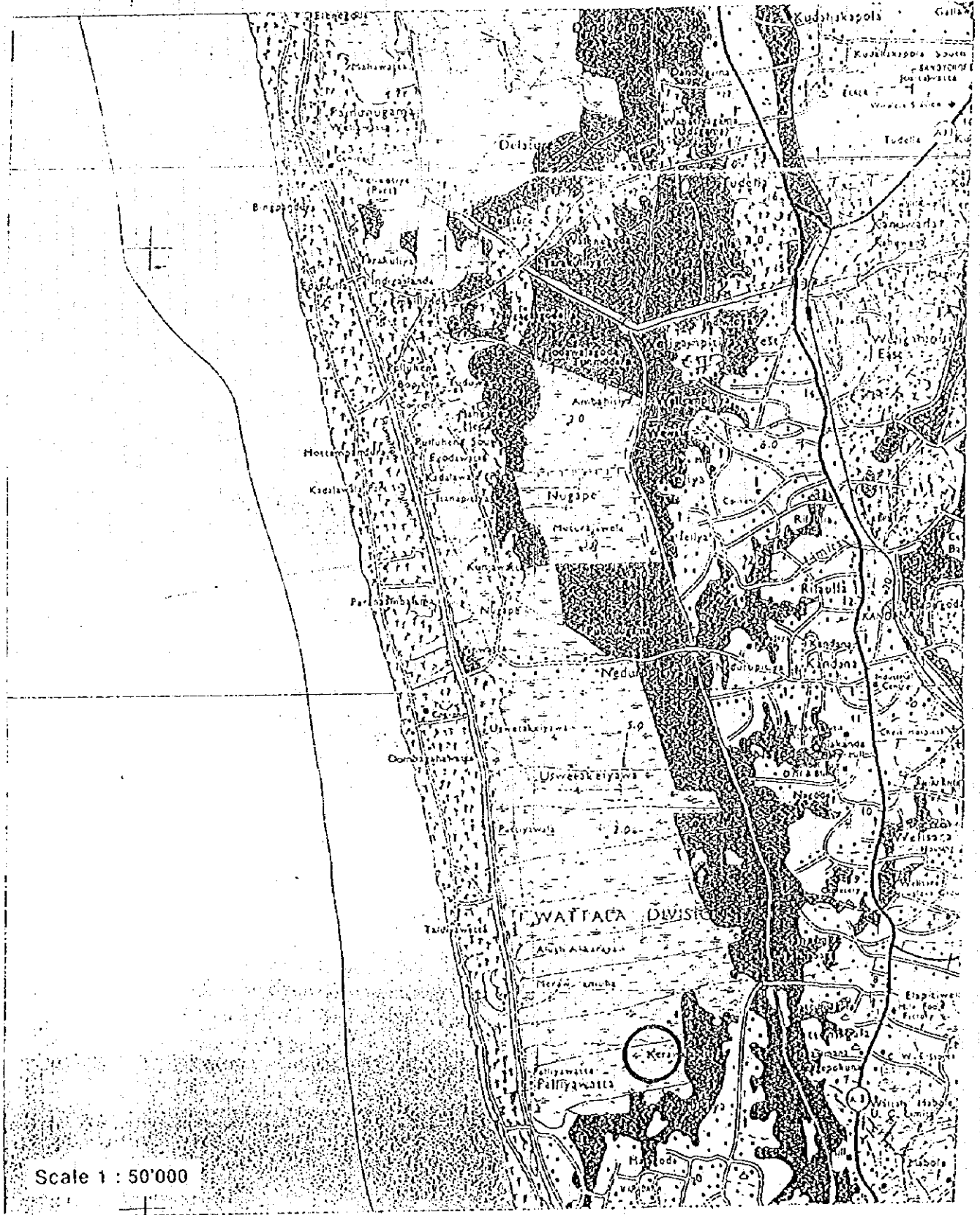
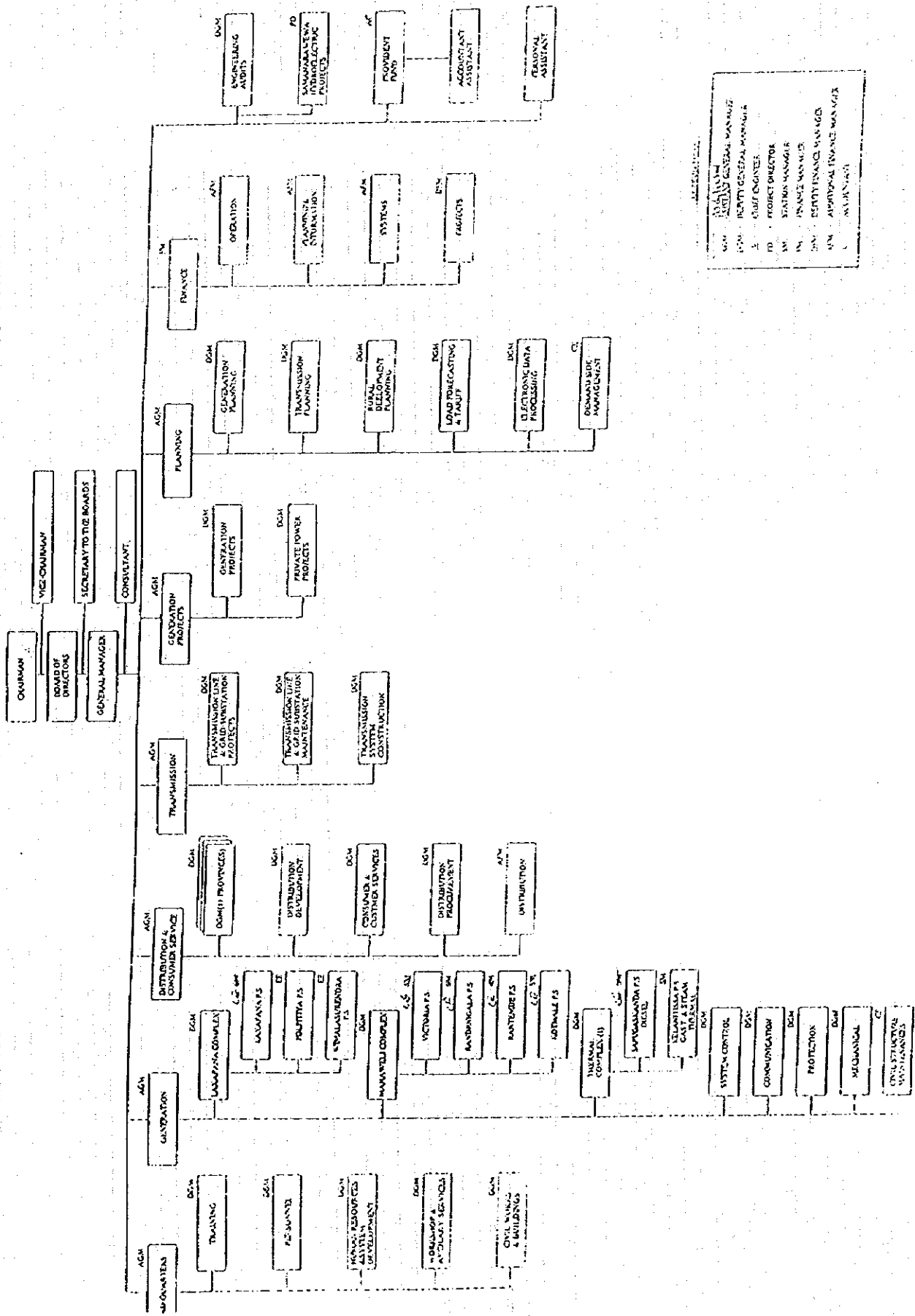


Figure 2



AGM - AREA GENERAL MANAGER
 DCM - DISTRICT CONTROL MANAGER
 PS - PROJECT DIRECTOR
 SM - STATUS MANAGER
 PM - PLANNING MANAGER
 DM - DEMAND SIDE MANAGER
 AM - AREA MANAGER

Organization Chart of CEB

**TERMS OF REFERENCE
FOR THE
ENVIRONMENTAL IMPACT ASSESSMENT STUDY**

PROJECT TITLE : 150 MW Combined Cycle power plant at Kerawalapitiya

PROJECT PROPONENT : Ceylon Electricity Board

PROJECT APPROVING AGENCY : Central Environmental Authority

OUTLINE OF THE EIA REPORT

Executive Summary

- Chapter 1 - Introduction
- Chapter 2 - Description of the Project
- Chapter 3 - Description of the existing environment
- Chapter 4 - Assessment of the anticipated Environmental Impacts
- Chapter 5 - Proposed Mitigatory Measures
- Chapter 6 - Monitoring Programme
- Chapter 7 - Recommendations/ Conclusions

Annex

- I** - Source of Data, Information & Computer printouts of atmospheric dispersion model
- II** - References
- III** - List of persons responsible for the study including their work allocations
- IV** - Comments made by the public, NGOs and other agencies.

STUDY AREA:

The study areas for the assessment will be considered to be 10 km from the boundaries of the project site for air quality appraisal and 2 km from the boundaries of the project site for other studies.

EXECUTIVE SUMMARY:

The summary should be a concise non-technical description of the salient features of the proposal, alternatives, existing environment, anticipated environmental impacts and mitigatory measures adequately and accurately covered. A one page summary table indicating main pollutants, their present levels, their accepted standards, the additions due to proposed project and the expected level of pollution in the environment should be presented in a matrix form. The summary should indicate in brief the responses to the issues raised by the public and other agencies. The summary should not normally exceed five pages.

CHAPTER 1: Introduction

This chapter should include the following;

- Objective of the project
- Objective of the EIA report
- Government policy regarding power development
- Extent and scope of the study
- Brief outline of the contents
- The approval necessary for this development
- The conditions laid down by Government Agencies in granting preliminary clearance for the project.

CHAPTER 2: The Description of the Project

2.1 Aim and Scope of the Project

The project's main objectives, main beneficiaries and the expected socio-economic effects should be stated.

2.2 Nature of Project

A description of the major features of the project including a location map indicating the project site, accessibility to the site, surrounding development activities & infrastructure (scale 1:50,000), drawings showing project layout plan including access roads (scale 1:5,000), components of the project etc. in order to give a clear picture of the project. This should include the brief description of the process of power generation, details of fuel Supply System, Fresh water Supply System, Cooling water usage and disposal system, Ash Disposal system, Air emission control system, Stack height and emissions, effluent discharge, Solid waste disposal, treatment systems, Noise Control measures and the description of transmission system and switchyard. If any phased development activities are envisaged give the details. Time schedule

should also be given. Surrounding development activities should be included.

2.3 Justification of the project

This section should consider justification of this project indicating phased developments, forecast power & energy requirement of the country, timing & size of plant.

2.4 Evaluation of Alternatives

This section should briefly state the basic environmental, engineering and economic parameters and criteria used in the investigation and evaluation of alternatives. The probable adverse impacts for each alternative including "no action" alternative should be summarized. Alternative fuels, use of land, site and technologies should be addressed.

2.5 Methodology of Construction and Operation

This section should include methods to be adopted for earth moving, rock blasting, waste disposal, operational maintenance of complex.

2.6 Work force

- Labour requirements (during construction and operation)
- Employment of local people during construction and operation
- Availability of labour
- Occupational health and safety
- Facilities required or provided

2.7 Financial commitments

Financial commitments to incorporate the mitigatory measures and compensation should be stated. Improvements to the social infrastructure in the vicinity if any and their financial allocations may also be indicated

CHAPTER 3: Description of the Existing Environment

This chapter should provide information on physical features, resources, socio - economic, archaeological and cultural considerations likely to be affected by any aspect of the proposal during its construction or operation phases.

The information should be presented in a comprehensive format using tables, maps, and diagrams. The methods used to collect data should be clearly stated under each category. Any technical terms used should be

clearly defined. The existing environment should be described under the following;

3.1 Physical features

3.1.1 Topography and Drainage

The most recent topographical data including reserve areas, waterbodies, rivers, streams.

3.1.2 Climatic & Meteorological conditions

Adequate data for the evaluation of any impacts should be given.

- rainfall data,
- relative humidity and temperature,
- wind speed, direction

3.1.3 Geology/Soil

- general geology of the area,
- soil type/s and distribution, land use capabilities, soil profile
- erosion trends

3.1.4 Hydrology

- surface drainage
- surface water availability, quality
- availability of ground water, safe extraction limits,

3.1.5 Air Quality

- Inventory of existing emission sources
- Ambient air quality measurements
SO₂ NO_x Suspended Particulate Matters (SPM)

3.1.6 Noise

- Inventory of existing noise sources
- Existing noise levels

3.1.7 Oceanography

- Data on tidal level, wave height and current characteristics

3.2 Ecological Resources

3.2.1 Terrestrial Ecology

- Identification, classification and mapping all existing habitats of fauna & and flora distribution and density in and around the project site.
- Identification of rare threatened and endemic plants and animal species, if any.

3.2.2 Aquatic Ecology

- identification of aquatic fauna and flora
- identification of endemic fresh water species, if any.
- distribution pattern of aquatic species

3.3 Human Settlement and Land Use

- Present land use pattern
- Population characteristics such as population distribution by age groups, education, health conditions, employment and income profiles.
- income generating sources,
- Existing infrastructure facilities
- transportation
- communication
- power
- housing and sanitation
- health care (hospitals)
- schools
- water supply
- main economic activities (Fisheries, Agriculture, Salt production etc.)
- archaeological, cultural components
- religious places

3.4 Environmental consideration/problems/issues in the area

- physical (water, air)
- ecological
- social & cultural
- economical

CHAPTER 4: Description of Environmental Impacts

This chapter should show the overall effects on the individual environmental components during construction and operation of the power plant. Impacts should include the foreseeable direct and indirect long and short term effects.

In all cases where an assessment is made it should be quite clear what criteria have been employed to assess impacts. Where possible effects should be quantified and uncertainties highlighted. Basis of predictions should be stated and justified, case studies/models/literature etc. Nature of impact should be considered in terms of magnitude, severity, duration, frequency, risk and indirect effects.

4.1 Construction Impacts

4.1.1 Solid waste

- Sources
- Impacts on the Environment

4.1.2 Transport

- Transport of materials and equipment
- Air quality impacts from traffic

4.1.3 Noise

- Noise from traffic
- Noise due to construction activities

4.1.4 Water & other liquid effluent

- Impacts of sewage, waste oils, oil spills, surface runoffs, waste water disposal on the environment

4.1.5 Ecological Resources

- Construction impacts on Flora and Fauna

4.1.6 Other Impacts

- Drainage
- Pipe lines
- Transmission lines

4.2 Operational Impacts

4.2.1 Physical Resources

4.2.1.1 Solid wastes

- Impacts due to oil sludge, sludge from waste water treatment plant, garbage including dyes used in operational equipment

4.2.1.2 Water and other liquid effluent

- Impacts of sewage, waste oils, oil spills, surface runoffs, waste water disposal on the environment

4.2.1.3 Thermal effluent impact

- Diffusion estimate and impact analysis of thermal effluent
- Impact analysis of intake and out let of cooling water

4.2.1.4 Air

- Stack emissions
- Dispersion model input data (in detail)
- Dispersion model results
- Atmospheric impact analysis

4.2.1.5 Noise

- Sources of noise generation
- Predicted noise levels
- Noise impacts

4.2.2 Ecological Resources

Human, Economic and Socio - Economic Impacts

- Population and communities
- Employment and income
- Land use and land use planning
- Agriculture
- Industrial development
- Road development
- Historical sites
- Health

At the end of this section an overview or synthesis should be made to show how the proposed project will interact with the total eco-system and its elements. This synthesis should also include an assessment of the significance of the various impacts identified.

CHAPTER 5: Proposed Mitigatory Measures

This chapter should set out the proposed measures to minimize the impacts identified in chapter 4. This should also outline the effectiveness of the proposed measures that are to be provided. The "mitigation" includes;

- Avoiding the impacts altogether by not taking certain action or parts of an action.

- Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifying the impacts by repairing, rehabilitating or restoring the environment.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

The mitigatory measures should be defined in specific practical terms and its effectiveness should be evaluated. This chapter should also present rationale for selection of chosen mitigatory measure.

CHAPTER 6: Monitoring Programme

A suitable monitoring programme should be evolved to monitor the changes, implementation of mitigatory measures. An effective reporting procedure should be outlined. Safety measures for employees against fire hazards, explosion, oil spills and other accidents should be outlined. An emergency action plan should be encompassed to execute this plan. Availability of funds, expertise, facilities should be stated. Any programme to improve general environmental conditions also can be here.

CHAPTER 7: Recommendations/ Conclusions

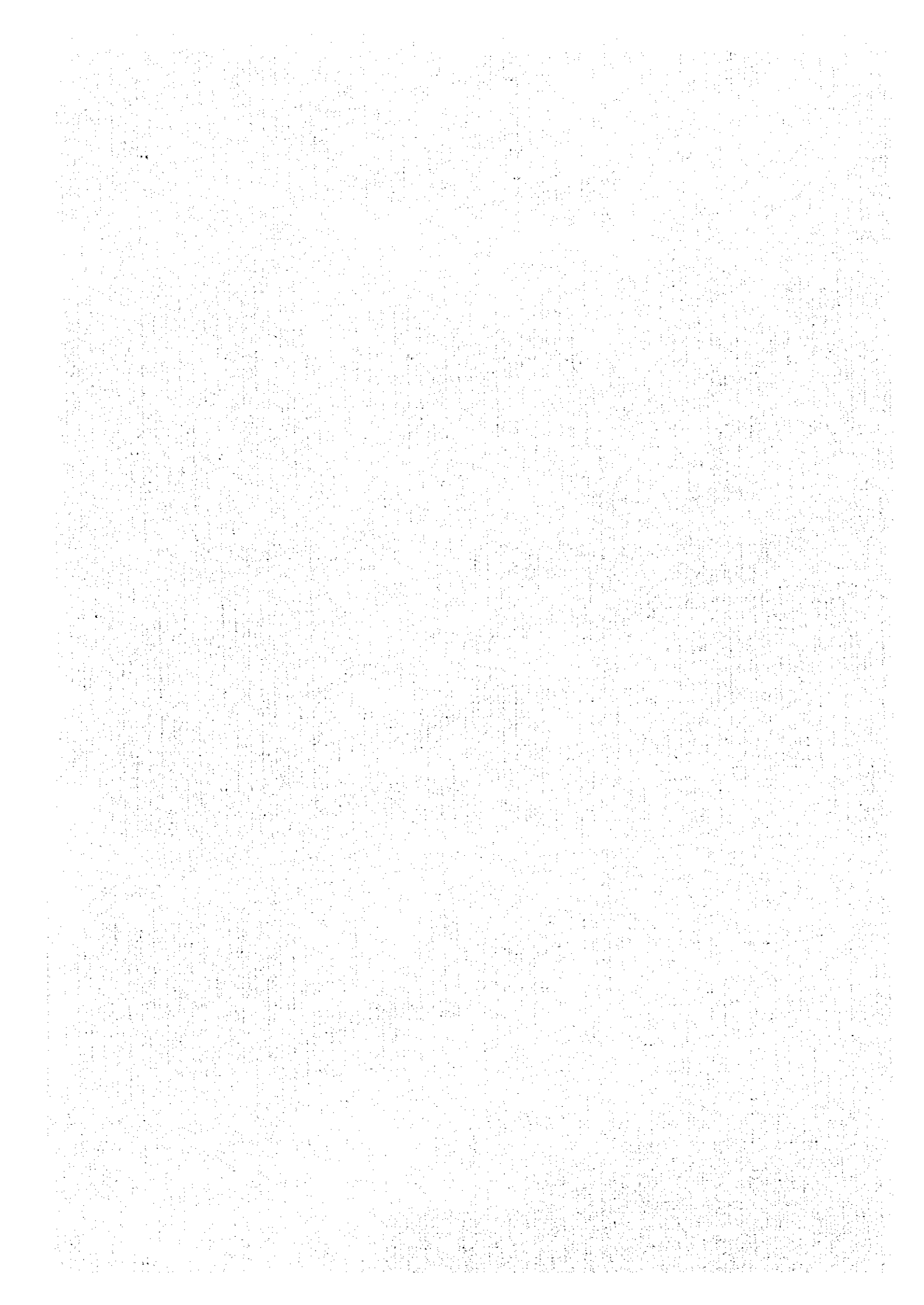
The acceptability of the proposed project and the alternatives to be analysed through an environmental cost/benefit analysis.

Further studies to analyse any long term effects should be indicated in this chapter.

GENERAL ITEMS

1. Consultants are to expected to coordinate the activities related to Environmental Impact Assessment study between Ceylon Electricity Board (CEB)).
2. The maximum number of pages of the report is expected to be within 50 pages.
3. The executive summary of the report should be translated into Sinhala and Tamil languages and 20 copies in each language should be submitted together with 20 copies of the EIA report.
4. The final report will be made available for public inspection for 30 days.
5. The 20 copies of the final report should submitted to the Project Approving Agency for decision making.

2. 質問状及び回答



Questions and Proposals

The following questions are made by the study team for the mission on Combined Cycle Project at Kerawalapitiya in order to clarify the points related to this project that have to be solved before getting an agreement on the Scope of Work.

The study team took a look at your application documents and TORs on this project submitted to Japanese Embassy in October last year.

Please answer the following questions and proposals or send your quick comments on them before 2nd of July if possible. We greatly appreciate your early reply.

1. Undertakings in the Scope of Work

According to your application document, you agreed with the most contents of the undertakings of the recipient country but two items.

If you have any problem with these items, please refer to the previous Scope of Work agreed between CEB and JICA on 11th of July 1995 on the project of making a master plan for the transmission system.

2. The Combined Cycle Power Project at Kerawalapitiya

There seems to be no description about the details of the technical specifications of the project in your application documents and also in the Thermal Generation Option Study. And we couldn't find any relevant power project apart from a simple gas turbine project at Kerawalapitiya in your power development plan in those documents.

Please make the following points clear and give us information.

- (1) You asked us to review the previous studies related to the project. Is the Thermal Generation Option Study only the document? Or do you have a Pre-F/S reports on the project?
- (2) The Thermal Generation Option Study used WASP for its analysis. Do you mean that reviewing existing studies includes re-run this program if necessary?
- (3) As far as we know, a power project at Kerawalapitiya in the Thermal Generation Option Study is a simple gas turbine cycle. What are the reason and story why a combined cycle project arises at Kerawalapitiya site?
- (4) We would like to have the latest version of Long Term Generation Expansion Planning. How important do you consider the project is in the plan mentioned above?
- (5) The power project at Kelanitissa loaned by OECF has 150MW combined cycle plant. Are the projects at Kelanitissa and Kerawalapitiya identical in terms of technical specifications?
- (6) Providing the Kelanitissa project that uses the same fuel as the Kerawalapitiya project uses is completed and in operation in the future, are there still enough fuel which is easily and cheaply procurable in domestic market at the moment? Please show us your future energy source plan.

3. Reporting

According to your requests, monthly reports are needed. But we are afraid to say that it is very difficult to take such way of reporting. However, we will take a standard way of reporting which is normally taken in our development study. Please refer to previous development study mentioned above.

4. Study Schedule

However you requested to have final reports within 6 months after commencement of study, we consider that, providing commencement of a full scale E.I.A. in particularly hydrological and meteorological field, the study has to have a period of 1.5 years at least.

5. Language

Our technical assistance aims both making good reports and technical transfer. In order to accomplish a technical transfer from Japan, apparently the consultants have to be selected in our nation. So consultants in this study will be Japanese in the most parts, although JICA will select a competent consultant team in terms of not only technical parts but also English proficiency.

6. Topographic Maps

In some nation, it is very restrictive and difficult to procure a topographic map even for a development study. Do you think the study team has any problem with getting maps? We think that the study requires 1/1,000 scale maps for instance.

7. Technical Transfer

Your nation has mainly developed hydropower so far. So you must have some experienced engineers in such field. But this time it is thermal generation plant which your engineers may not have any experience to get involved actual technical works.

It is very good opportunity to get some experience in making F/S of thermal power plant, so we would like to see clearly a planning of participation of your staff to the study.

8. Financial Source

Please give us an information about financial source of this project.

Questionnaire 1/2

0. background

- a) Please describe the energy and electricity supply policy of Sri Lanka?
- b) Please describe the situation of electricity demand, supply facilities (power plants and transmission line network), electricity price and generation cost.

1. Necessity and Justification of the project

According to the Thermal Generation Option Study Final Report, Kerawalapitiya site is recommended to build a gas turbine plants to commission in 98.

What is the reason to change the plant type from gas turbine to combined cycle and also what is the reason to change the commissioning year? Please explain the reasons based on the latest long term electricity demand forecast and generation plant development plan.

2. Fuel oil

What kind of fuel oil is available for this power plant from the viewpoint of refinery capacity in Sri Lanka? (including a future refinery expansion plan)

Is it possible to use imported naphtha for this power plant from the standpoint of energy policy?

3. Environmental Impact Assessment

1) legislation-Environmental Conservation

- a) Do you have the law/regulation/guidelines on environmental impact assessment?

What ministry or agency is responsible for the assessment?

- b) Do you have the environmental quality standard?

Please attach the details.

- c) Do you have any environmental impact assessment study of thermal power plants?

Please provide the summaries if any.

2) International Conventions on Environmental Conservation

Please give the names of the conventions of natural conservation and environmental protection affiliated or ratified, and the dates of affiliation or ratification.

3) The Social Environment

- a) Please provide the master plan of Kerawalapitiya land reclamation project and the latest situation of this project. (including land use plan, industrial development plan, water supply plan etc.)

- b) Is there any environmental impact assessment report on this reclamation project?

Please give the report.

- c) Is there any law or restriction for fishing rights? If so, please describe them. What is the procedure in case of changing such rights?

- d) Is there any fishing industries near the power station site (along the coast)?

e) Is there any law or restriction for compensating the fishing rights? Please provide any case which has compensation record.

f) Is there any landscape that is important from the point of tourism and /or religion?
If so, please describe them.

4) Natural Environment

(1)a. Is there any fragile nature such as mangroves, coral reefs, wetlands?
If so, please describe them.

b. Is there any district where national parks and natural parks are located?
If so, please describe them.

c. Is there any precious fauna and flora within or near the project area?
If so, please describe them.

(2)a. Do you have the geographical and geological data of and the surrounding area?

b. Do you have any biological map and data?

(3)a. Do you have any water resources data?

b. How the groundwater is used?

c. Do you have any restriction for using ground water?

(4) Do you have any data of sea condition including the sea current and sand flow?

(5)a. Is there any meteorological data of the area?

b. Is there any air pollution within the region?

c. Is there any emission standard of air pollution?

(6)a. Is there any data of water quality and temperature of the rivers and the sea around the area?

b. Is there any water pollution within the region?

c. Is there any emission standard of water pollution?

(7)a. Is there any soil contamination within the region?

b. Is there any emission standard of soil contamination?

(8)a. Is there any noise and/or vibration problem within the region?

b. Is there any standard for noise and/or vibration control ?

(9)a. Is there any offensive odor problem within the region?

b. Is there any standard for offensive odor control ?

5) environmental consultants

a) Please provide environmental consultant's name and contacts which can conduct environmental impact assessment.

Questionnaire 2/2

1. Please give us the figures of the following site conditions,

- (1) Maximum, Average and Minimum of the ambient temperatures
- (2) Maximum, Average and Minimum of the relative humidities
- (3) Elevation from the mean sea level

2. Providing the plant capacity of 150MW is figured out as the site rating, what are the following values used in the calculation ?

- (1) Ambient temperature
- (2) Relative humidity
- (3) Elevation

3. What is going to be the daily operational characteristics of the plant ?

Is it a peak-bottom type or a constant type for the base load ?

4. Do you have any preference in the configuration of the system of the combined cycle plant such as types of the gas turbines (GT), the heat recovery boilers (HRB), the steam turbines (ST) and so on ?

5. Do you want to have the plant operated as a complete combined cycle from the beginning ? What do you think about an alternative plan which is about that the plant should be started as a simple gas turbine cycle and then combined with HRB and ST.

6. Are the following data related to the cooling system available ?

- (1) Topographic maps which cover the area from the construction site down to the cost line.
- (2) Informations about the depth of the sea bed close to the site in order to estimate the length of the suction and drainage pipes of cooling system.
- (3) Informations about the quality of the seawater for the cooling system.

7. Have you ever implemented any subsurface explorations at the site for the project. Are there any data available ?

8. Is it possible to get naphtha as the fuel only in the domestic market ?

Are you going to import some of them overseas ?

If you are going to use imported naphtha as the fuel, what is the reason why you dare to use it ?

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 தந்தி } FORAID
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 செலக்ஸ் } FORAID
 Telex } Colombo
 } 21232
 ෆැක්ස් }
 பெக்ஸ் } 447633
 Fax }



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நிதி திட்டமிடல் அமைச்சு
DEPARTMENT OF EXTERNAL RESOURCES
Ministry of Finance and Planning

මහලේකම් භෞමිකාගාරය (3වැනි මහල)
செயலகம், (3ஆம் மாட)
The Secretariat, (3rd Floor)
 හැ. පෙ. 277, කොළඹ 01.
 அ. பெ. இல. 277, கொழும்பு 01.
 P. O. Box 277, Colombo 1.

19.....

CAJP/12ZA/B/412
 July 8, 1997

Mr. H. Suzuki
 Deputy Resident Representative
 JICA Office
 Colombo

Dear Mr. Suzuki

QUESTIONNAIRE & PROPOSALS FOR THE COMBINED CYCLE PROJECT AT KERAWALAPITIYA

This refers to your letter of June 30, 1997, addressed to us with copy to the Chairman, Ceylon Electricity Board regarding the above project.

I am enclosing the answers sent by the General Manager, Ceylon Electricity Board for your information and necessary action.

Yours sincerely

[Handwritten signature]

A.S.M.S. Mahanama
 Deputy Director
 for DG/BRD

QUESTIONS RAISED IN THE LETTER OF 30TH JUNE 1997

1. Undertaking in the scope of work

In the application drafted by CEB which is attached, items Nos. 2 and 3 in the "undertakings of the recipient country" has been completed in the affirmative.

2. Reporting

CEB agrees that formal monthly reports may not be needed. However periodic progress reports will be required which could be agreed with the study team upon commencement.

3. Study Schedule

CEB recognize that 6 months would be a short period for the study as originally envisaged. However in our application, we have tentatively indicated a study schedule of one year (please see attached application).

The answers to the questionnaire is attached.

**Answers to the JICA Questionnaire Regarding the proposed
Combined Cycle Plant at Kerawalapitiya**

A1:

The site had been identified during the Thermal Generation Options Study (TGOS) completed in July 1996. No additional studies were carried out subsequently up to now. As such the studies that need to be reviewed are TGOS carried out by Electrowatt Engineering Services (EWE), the Long Term Generation Planning study report (LTGEP) carried out by the CEB.

The site has been purchased by the CEB and is ready for development.

A2:

Electrowatts Engineering Services used a planning package similar to the WASP which is named As/Plan. These two methods have resulted in slightly different expansion planning sequences (Refer Annex). The review of existing studies may include re-running of WASP, if found necessary by the study team, for which the CEB counterpart staff will be provided for this task.

A3:

Kerawalapitiya site has been identified as suitable for both simple cycle gas turbines as well as for combined cycle power plants. In considering the plan drawn up by the CEB, there is provision to include a combined cycle power plant in the years 1999 (150 MW at Kelanitissa) in the year 2000 (150 MW at new site) or according to the plan drawn up under TGOS carried out by EWE, there is provision to include a combined cycle plant in the years 1999 (150 MW at Kelanitissa) and 2001 (300 MW at a new site). The establishment of 150 MW combined cycle power plant at Kelanitissa funded by the is underway. Further there is a proposal to establish another 150 MW plant at Kelanitissa possibly with the participation of the private sector. In the light of unforeseen difficulties encountered with the implementation of a 150 MW coal fired thermal plant to be completed by the year 2002 it has been now decided that the 150 MW power plant as proposed with TGOS is required to be installed. Since the Kerawalapitiya site has already been purchased by the CEB and there is a requirement to install a 150 MW combined cycle power plant, the

Kerawalapitiya site is now selected as the most feasible site for the combined cycle power plant. You may also please note that a gas turbine plant was installed at Kelanitissa and is ready for commissioning. Therefore there will not be a necessity to install a simple cycle gas turbine plant in immediate future.

A4:

A copy of the latest Long Term Generation Expansion Planning report is attached herewith. It is absolutely necessary to complete this project on schedule in order to meet the future demand without deficits.

A5:

The power plant proposed at Kerawalapitiya may be similar to the one proposed at Kelanitissa. However the study team is free to study all aspects and draw up its own technical specifications.

A6:

Kelanitissa and Kerawalapitiya plant may not necessarily use the same fuel. The quantities of fuel available and if any to be imported will be subjects for the feasibility study.

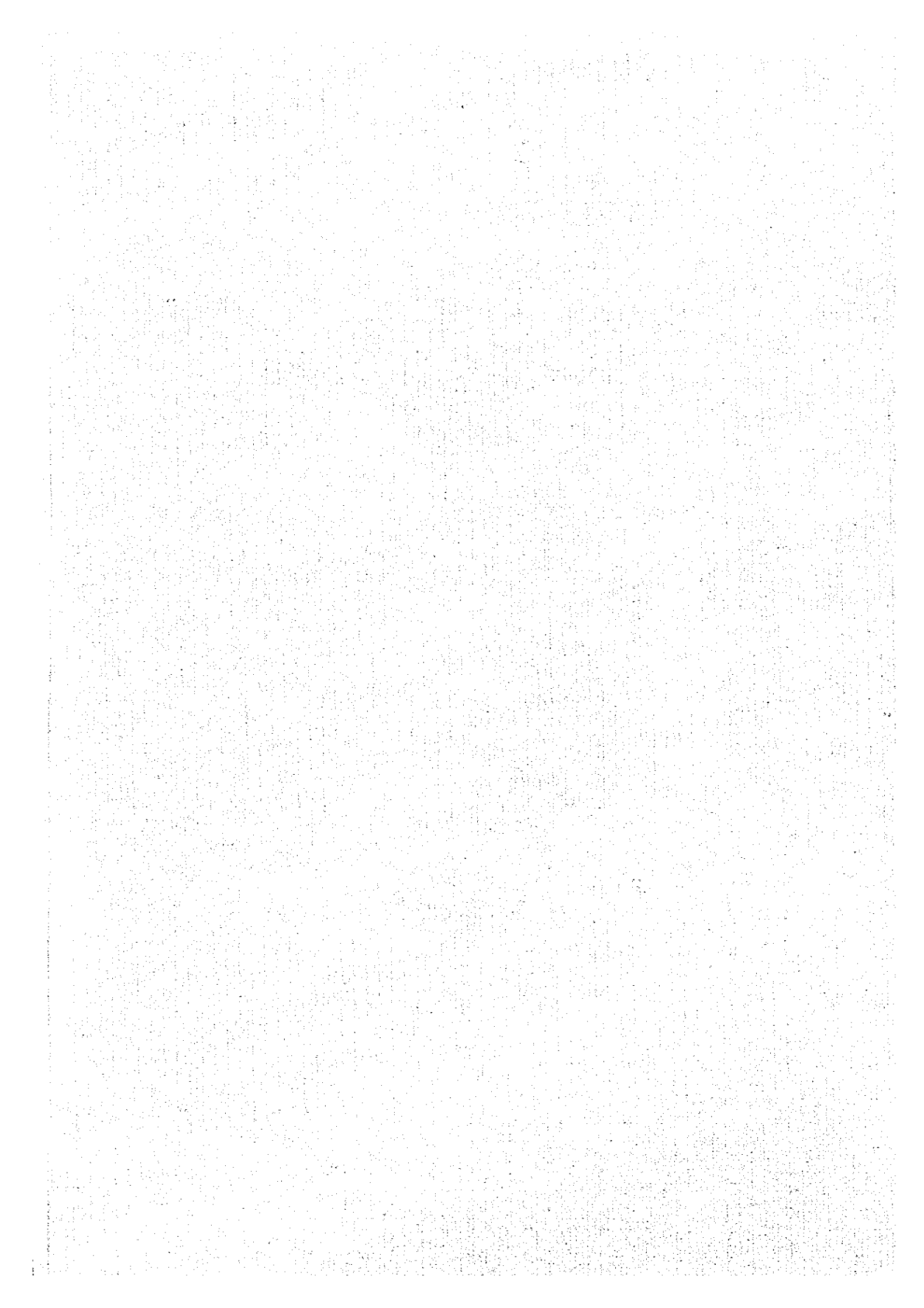
B:

Topographical maps in the relevant locality could be obtained without difficulty. However 1/1000 maps will have to be drawn under topographical survey enumerated in the Terms of Reference section 3.1.4 " supplementary survey for civil works - topographical survey"

C:

Financial Assistance is expected from OECF

3. 環境關係再委託調查見積資料



Noboru Yumoto Y. N. International
3-21-6-201, Yanaka, Taito-ku, Tokyo, Japan
Tel:81-3-3824-3912, Fax:81-3-3824-3913

To: Ceylon Electricity Board, Environmental Officer
Mr. R.K.W. Wijerathne
001-94-1-348587

Date

97/7/30

Page

1

Message

Dear Mr. Wijerathne

Thank you very much for all of your support to our JICA mission. We had a very successful meeting with you and your colleagues and now we are making an estimate of F/S 's cost in Tokyo. I think JICA could start F/S in coming October or November.

In this context, I need the following information. I am very happy if you could provide us these information as soon as possible by fax or e-mail.

- 1) Environmental consultant's list in Sri Lanka and brief explanation on the capabilities of each consultant(if possible)
- 2) Price list of below samplings, measurements, and tests
 - 1) Water quality (sea and canal)
Number of samples: 6 stations, 3 depth, 3 times, Total samples: 54 samples
Measurement and Test items : Temperature, Salinity, T-SS, BOD, COD, Oil & Greases
 - 2) Noise
Number of sampling stations: 4 stations
Sampling interval : every 1 hour, 24 hours
 - 3) Ambient quality
Number of sampling stations : 10 stations
Measurement items : NOx, SOx, SPM
 - 4) Ecological environment
aquatic fauna and flora
fauna and flora around power station site and along transmission line

I am collecting materials on air pollution engineering and will send you those materials sometime soon.

Thank you for your cooperation. I am looking forward to hearing from you soon.



Noboru Yumoto
3-21-6-201, Yanaka, Taito-ku, Tokyo, Japan
Tel:81-3-3824-3912
Fax:81-3-3824-3913
E-mail: BZE01535@niftyserve.or.jp

Scope of subcontract

Environmental Study

a. Climate & Meteorology

collection of existing data (wind data of the Colombo Observatory etc.) and analyses

b. Oceanology

collection of existing data (wave, current, tide, sediment transport, shoreline)

bathymetric survey of water depth , 2~3 km along coast, from shore line to about 15 m depth

survey line interval: 100m

c. Environmental survey

air quality (NOx, SOx, SPM), 1 day, 10 stations

water quality (COD, BOD, SS, Temperature, pH, Oil & greases, Salinity, Transparency)

1day, canal: 2 stations, sea : 2~4 stations

sea water temperature 1 station, 3~ 6 month (including the hottest season)

noise 1day (every 1 hour, 24hours), 4 stations

inventory of existing emission sources (air quality, noise)

d. Socio-environmental survey

population , land use, industry (fishery, agriculture etc.) , transportation , water supply etc.

e. Ecological environmental survey

supplementary survey to the Environmental Profile of Muthurajawela and Negonbo Lagoon

land: 2 km area around site, fauna and flora (vegetation, birds, animal, insect, fish etc)

sea : 2~4 stations, aquatic fauna and flora (plankton, benthos etc)

interview of fishermen/women

f. Pollutant dispersion simulation

Air pollutant (NOx, SOx)

Noise

Effluent of heated cooling water (temperature)

g. monitoring plan

Fuel Transportation Plan / Transmission line

a. topographic map from SPMB at the Port of Colombo to the site

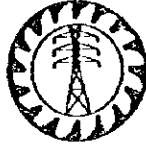
b. land use between Kelanitissa power station and the site

c. safety regulation on oil pipeline

d. geological survey

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இலங்கை மின்சாரக் கலைய
(1969ம் ஆண்டின் 17 ஆம் இல. பாராளுமன்ற அதிசாயச் சட்டத்தின் பிரகாரம் தاسீக்கப்பட்டது)



CEYLON ELECTRICITY BOARD
(Established by Act of Parliament No. 17 of 1969)

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නැ. පෙ. 540, කොළඹ 2, ශ්‍රී ලංකාව.

50, சேர் சிற்றம்பலம் ஏ. காடினர் மாலத்தை,
த. பெ. 540, கொழும்பு 2, ஸ்ரீ லங்கா.

50, Sir Chittampalam A. Gardiner Mawatha,
P. O. Box 540, Colombo 2, Sri Lanka.

පැවැත්වීම: "කිලෝවොට්ස්" අක්ෂර: "කිලෝවොට්ස්" TELEFAX: 04-1-449572 Telegrams: "KILOWATTS" Telex: 321368 CE

පාලක Chairman	329894 329108	විකල්ප Vice Chairman	422297	ප්‍රධාන General Manager	325340 320953	ප්‍රධාන Head Office	324471-8	කොළඹ විදුලි සැපයීම Colombo Electricity Supply	575923
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Mr. Noboru Yumoto
Y.N. International
3-21-6-201, Yaneka, Taito-ku
Tokyo, Japan.

Dear Mr. Yumoto

Thank you very much for your fax dated 30th July 1997. I wrote to two of the Accredited Laboratories in Sri Lanka, National Building Research Organisation (NBRO) and Ceylon Institute of Scientific & Industrial research Institute (CISIR) asking their prices for sampling measurement and testing as specified in your fax. The approximate prices for are as follows.

- a) Water Quality - Rs. 146,500.00 (NBRO)
- b) Noise - Rs. 85,000.00 (CISIR)
- c) Ambient air Quality - Rs. 1,000,000.00 (NBRO)
- d) Ecological - Rs.65,000.00 per man month

These prices were obtained over the telephone. As soon as I received their quotations, will be sent to you. The specifications for required sampling and testing should be written with the consultation of consultants and after examination of available data.

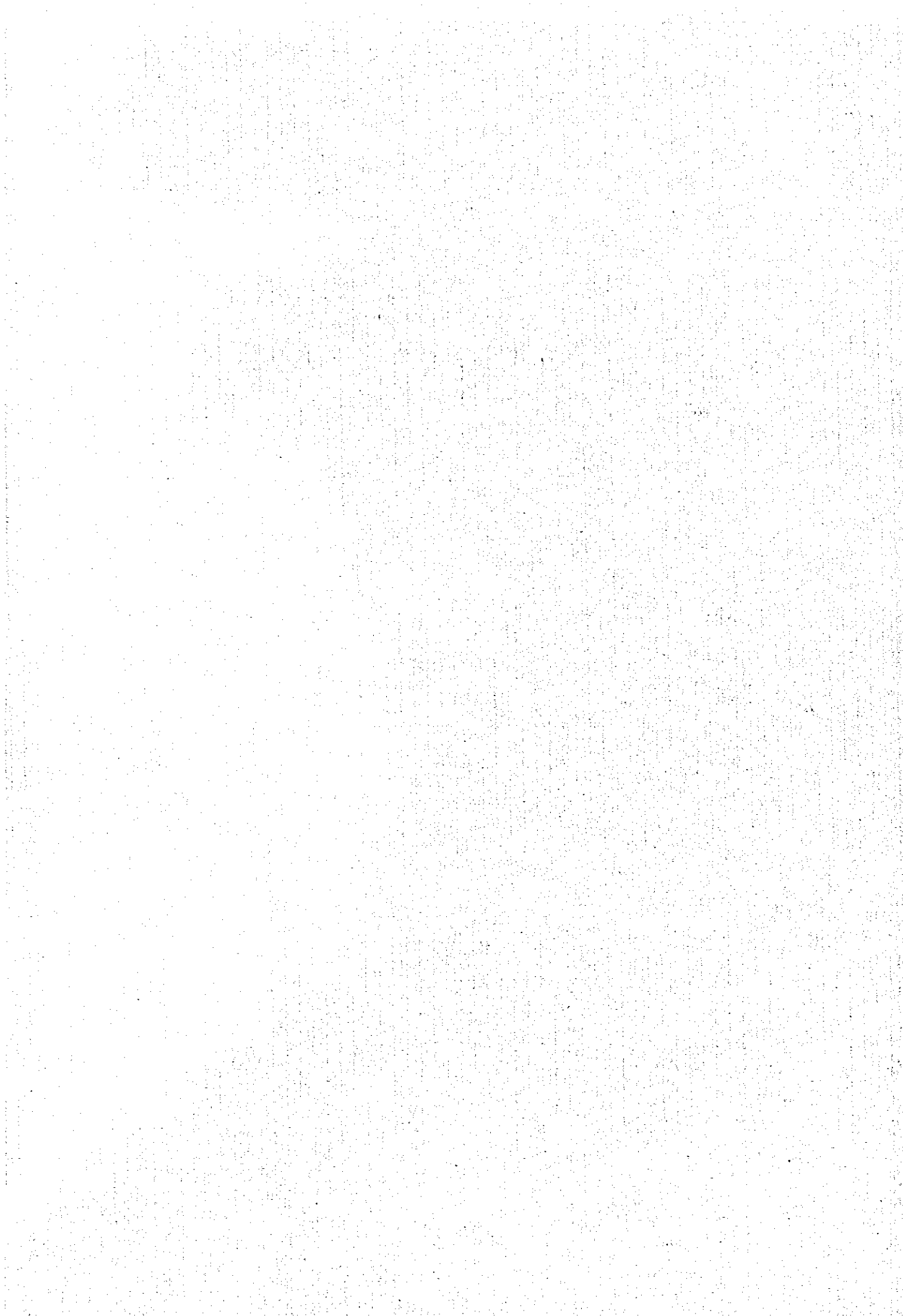
I handed over the following documents to JICA Office at Colombo for mailing to you.

1. List of Environmental Consultants. Capabilities of these consultants will be notified later.
2. Copy of Conservation Management Plan Muthurajawela Marsh and Negombo Lagoon.
3. Copy of EIA Report for proposed LPG import terminal at Kerawalapitiya. This contains most of the data required to carry out the EIA study this project.

Best regards

Yours sincerely
R.V. Wijerathne
R.V. Wijerathne
Environmental Officer

4. ローカルコンサルタントリスト



To MR. Shams
Uthaya Rao

Annexure 2

LIST OF SUGGESTED SPECIALISTS/CONSULTANTS
FOR TECHNOLOGICAL GUIDANCE
ON POLLUTION CONTROL

	Name of Organization	Designation	T. Phone No:
1	National Water Supply & Drainage Board, Galle Road, Ratmalana	General Manager	716449
2	47A, Indrajothi Mawatha, Ratmalana	Mr. K.A. . Wijeratne	734269 725224
3	M/S. Samuel & Sons Ltd, 164, Messenger Street, Colombo 12.	Mr N A Jayasuriya Manager Mechanical Engineering Dept Mr Clude Devidpulle Mechanical Engineer Mechanical Eng. Dept	432341 -4 Fax 434764
4	M/S. Engineering Consultants Ltd, 60, Dharmapala Mawatha, Colombo 3	Mr. G.E.M. Gomez Managing Director	573737 574154
5	Ranimpex Environment Engineering Services Division, 24, Temple Road, Maharagama	Mr. Ravi Jayananda, Management Consultant	550724
6	Hydro Systems International, 121B, Madiwela Road, Udahamulla, Nugegoda, 17, Lauries Road, Colombo 4.	Mr. Tissa Meepe	554827
7	Dept. of Civil Engineering, University of Moratuwa, Katubedda	Dr (Ms) N. Ratnayake, Senior Lecturer	505/30 1 505/34 0
8	Dept of Buildings Sethsiripaya Battaramulla	Ms. S. A. Gunasekera (CE, Sewerage)	562588
9	Energy and Environment Consult (Pvt) Ltd, 196 A, Sirima Bandaranayake Mawatha, Mahara, Kadawatha.	Ms W Seneviratne Mr. T. Daranagama Mr. M. Seniviratne Mr E M K M Ekanayake	078- 63623 520635

10	Rubber Research Institute, Telewala Road, Ratmalana ----- Rubber Research institute Dartonfield, Agalawatte	Dr Gamini Seneviratne Head, Raw Rubber Process Development & Che. Eng. Dept ----- - Mr Thurul Warnakula Asst Biochemist	01- 635851 01- 633351 ----- 034- 71426 034- 71383
11	Ceylon Institute of Scientific & Industrial Research, 363, Baudhaloka Mawatha, Colombo 7	Dr. A M Mubarak Head, Evt. Science & Tech. Unit (Water + Air Tech) Mr H P N J Gunasekera, Head Calibraion & Measurement Unit (Noise & Vibration) Attn: Mr A S Pannila	698622 691516
12	Sunpower Systems (Pvt) Ltd, 7, Braybrooke Place, Colombo 2	Mr. F.M. Zahir, Sales Manager	26351- 4
13	National Building Research Organization, 99/1, Jawatta Road, Colombo 5.	Director General,	588946
14	Environmental Engineering Consultants, 5, Council Lane, Dehiwala	Mr. K. Suntheralingam	714846
15	National Engineering & Development Centre of Sri Lanka. 2P/178, I D B Industrial Estate, Ekala, Ja Ela	General Manager	536- 434
16	Agronomist, No.2.J.Block Government Flats Colombo 04.	S.P Emmanuel	585506
17	Environmental Laboratories Ltd, 135/1, Old Kottawa Road, Navinna, Maharagama	Managing Director	551070 - 1 551069

18	55, Barnes Place, Colombo 7	Dr. S. A. Abeysekera Eng. Consultant	695929
19	Associated Environmental Consultants, 30, 1/1, First Floor, Sri Saranankara Road, Dehiwela	Mr. D. P. T. Munasinghe	727275
20	K W S Contractors, 82, New Bullers Road, Colombo 4	Mr. K. W. Wijepala	589351
21	Lankamerica Manufacturing (Pvt) Ltd, 10A, Gangadara Mawatha, Templers Road, Mt. Lavinia	Mr. Ranjith Ranadeera, Director	716605
22	Nihal Rajapakse Consulting Engineers, No. 29, Milagiriya Avenue, Colombo 4	Mr. R. K. N. L. Rajapakse, Managing Director	585458
23	United Tractor & Equipment Ltd, P.O. Box 343, 447, Union Place, Colombo 2.	Mr. Raja Molligoda, General Manager	695461
24	Tech Waters (Pvt) Ltd 303, Highlevel Road, Colombo 5.	Mr. Nalin Kamaragoda Managing Director	553752
25	Waterman Engineering (Pvt) Ltd, No. 124/5, Dudley Senanayake Avenue, Dehiwela	Mr. B. M. A. P. Balasooriya, Technical & Process Engineer	716810
26	Lanka Asia Managements Systems Co., (Pvt) Ltd, No. 341, Hotel Lanka Oberoi, P. O. Box 252, 77, Steuart Place, Colombo 3.	Mr. Malwila Dissanayake Managing Director	20001/ 437437 /42117 1
27	Aqua Resource Systems (Pte) Ltd, 357, Peradeniya Road, Kandy	Mr. P.M.V.P. De Silva, Managing Director	08- 22664
28	Polyfil Pvt., Ltd., 172/4, Polhengoda Road, Colombo 5	Mr. C. D. Bandaranayake, Managing Director	510756
29	Consultants on Environmental Aspects, 4/155, Dolalanda Gardens, Talawathugoda.	Mr. N. Abeysinghe	687288
30	Dr. K. Gauthamadasa, 65, Chapel Road, Nugéoda	Dr. K. Gauthamadasa	

31	Pride International (Pvt) Ltd., No. 229, Castle Street, Colombo 8	Mr. Anura Kumarasinghe, Managing Director	687195 Fax: 687195
32	Enviro System (Pvt) Ltd 151, Buddhist Institute Avenue, Kotte	Mr. D. H. Wijeratne, Chairman/Managing Director	864723 Fax: 867346
33	Confifi Engineering (Pvt) Ltd, 207/2, Dharmapala Mawatha, Colombo 7	Mr. S. S. Miththapala, Director	697996 692325 698534
34	Ceywater Consultants (Pvt) Ltd, 142 2/1, Hill Street Dehiwala.	Mr A U Gammulle Managing Director	727512 Fax: 722738
35	Nalco South East Asia (Pte) Ltd, Water Treatment Section, Chemical Industries (Colombo) Ltd, P O Box 352, Colombo.	Mr M J M Fouz, Manager	284216 540278
36	Soil & Water Engineers G1, NHDA Building Complex Sri Vipulasena Mawatha Colombo 10	Mr K. W. Upasena Managing Director	564596 072/45 770/ 685013
37	Watertech (Pvt) Ltd 532/8A, Siebel Place Kandy	Mr. R. M. Wijetunge Managing Director	08- 23156
38	Environmental Lanka Ltd 20 1/1, Galhena Road Gangodawila, Nugegoda	Mr. Premendralal Wijayasurendra, Chartered Civil Engineer Mr. Tissa Liyanage Environmental Engineer	581776
39	Engineering Consultants Ltd 60, Dharmapala Mawatha Colombo 3.	Ms Manel S Gunawardena Head Business Development	574154 4 5755 125734 51 573737
40	Wengs System Engineering (Pvt) Ltd 16/1 A, Averihena Road, Colombo 5	Mr Rohan Dharmaratnam Manager (Marketing & Services)	821789 Fax: 821789

41	LAN Management Development Service 3rd Floor, 91, Galle Road, Colombo 5.	Mr P Mervyn Gunasekera Managing Director	501584
42.	Powater (Pvt) Ltd 303, High Level Road Colombo 5.		853752 824287
43.	Design Consortium Ltd 83, kynsey Road Colombo.	Mr Nalin Wijekoon Managing Director	698088 698089 696247
44.	Biotech Corpotion Lanka (Pvt) Ltd 303/1, R A de Mel Mawatha Colombo 3.	Mr A M K Perumal Managing Director	575772 Fax:59 1220
45	Bamber & Bruce 56 1/1, Vajira Road Colombo 5.	Dr C S S de Silva Managing Director	500254 Fax: 508813
46	Engineering Solutions (Pvt) Ltd Chartered Engineers 3/5, Church Street Nugegoda.	Mr D S Jayawardena Director	941- 826087 821459
47	Walker Sons & Company Engineers (Pvt) Ltd 250, Sri Ramanathan Mawatha Colombo 15.	Mr Susantha Fernando	434365 436221
48	Resource Recovery & Aqua Services Asia (Pvt) Ltd (ReRasa) No 1, 6th Lane Colombo 3.	Mr Saliya Rajakaruna Marketing Manager	575233 577691 -2 Fax: 575233
49	CMS-Pan Lanka Joint Venture Co (Pvt) Ltd 22/1, Auburn Side, Dehiwala	Milton Manmperi Chairman/Managing Director	685783 724008 724027 Fax; 737542
50	Enviro Tech Lanka Limited 303/1, R A De Mel Mawatha, Colombo 3. (Speciality: Petrol & Oil Service Stations)	Mr Tikiri Kobbekaduwa General Manager	Tel/ Fax 575772

51.	Small & Medium Enterprise Developers 29, Gregory's Road Colombo 7.	Mr A N P Wickremasooriya Project Director	Tel/ 697020 699559 Fax 695035
52.	Pollution Engineering Lanka Pvt Ltd 446/15, Thimbirigasyaya Road, Colombo 5.	Mr Russell Baptiste Executive Director	Tel 071- 38022 Fax 826009
53	Modern Environmental Technology 427/1, Galle Road, Rawathawatte, Moratuwa.	Mr K G K Perera	
54	pyramid Agencies Development (Pvt) Ltd Suite 2-227, B M I C H Colombo 7.	Mr S Murugadasan Managing Director	699706 686132 824320 Fax- 699706
55	S C Consultants 43/9, Issipathana Avenue Off Anderson Road, Kalubowila, Dehiwala.	Dr Shahane de Costa	826100
56	Environmental Resources Management Lanka (Pvt) Ltd 1st Floor, Keels Realters Bldg, 80, Navam Mawatha, Colombo 2.	Mr Adam J Slee Resident Project Manager Mr B m Karunaratne Senior Consultant	072- 78467 332514 Fax; 332513
57	Development Consultants & Technologies (Pvt) Ltd 7, C M Fernando Mawatha 2nd Kurana, Negombo	J Fernando B.Sc Eng., C.Eng Managing Director	031- 4313 031- 8295 Fax: 9431 8270 94 145 3088
58	Small & Medium Enterprise Developers 29, Gregory's Road, Colombo 7	A N P Wickremasuriya Project Director	697020 699559 Fax 695035
59	Lalan Engineering (Pvt) Ltd 344, Grandpass Road, Colombo 14.	Mr Lalith Hapangama Director	329566 325997 Fax: 447060

60	International Projects Consortium Ltd 273/5, Vauxhall Street P O Box 612 Colombo 02.	Mr Ajith Fernando Managing Director	334980 325411 Hotline 072- 68415 Fax : 334980 325411
61	Metech Engineering (Pte) Ltd 233, Vauxhall Street Colombo 02.	Mr Mahendra Wijeratna Engineering Manager/Executive Director	071- 32986 Fax: 439571
62	Environmental Standards (Pvt) Limited 39/5, Chapal Road Nugegoda	Mr Ravi Randeniya Managing Director	Tel/ Fax 826643 078- 79600
63	Professional MET Consultancy Services 85-2/1, Ground Floor Ward Place Colombo 07.	Mr M A Justin Chief Consulting Engineer/Managing Director	Tel. 692573 071- 32039 Fax : 692573
64	Link Intertrade (Pvt) Ltd 338, T B Jayah Mawatha, Colombo 10.	Mr L R Goonetilleke Director	Tel. 592999 Fax : 592998
65		Mr Jayamanne Mohottige Don Augustian Athula Mechanical Engineer (Pollution control for Farms, Service Station, Distilleries and Breweries - Specially in Biogas Technology)	Tel. 032- 54966

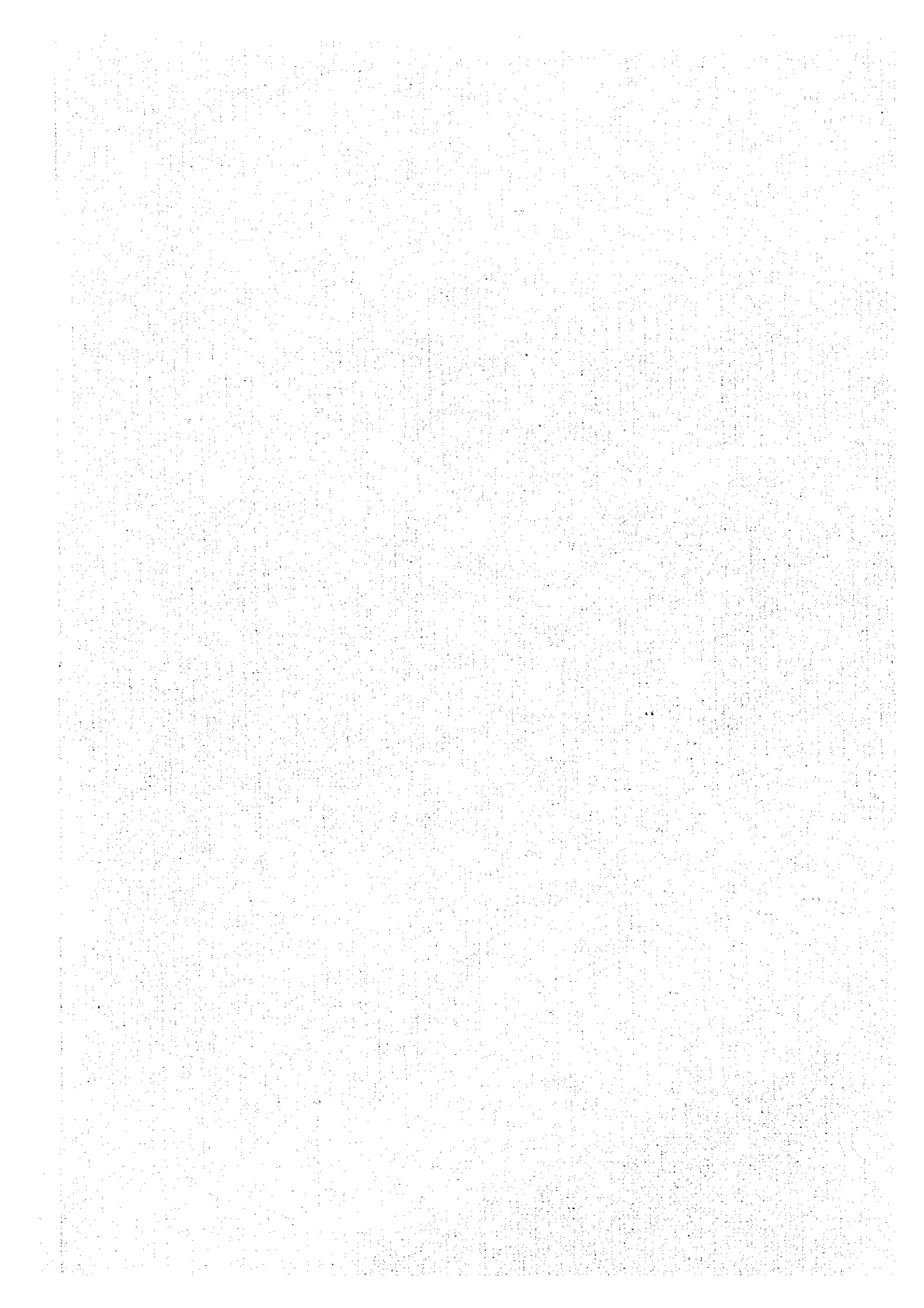
GEOTECHNICAL INVESTIGATION			
<i>Name</i>	<i>Address</i>	<i>Tel:</i>	<i>Fax</i>
<i>Engineering & Laboratory Services</i>	<i>62/3, Neelammahara Rd., Katuwawala, Boralesgamuwa.</i>	<i>509806</i>	<i>509806</i>
<i>Group Engineering Laboratory Ltd.</i>	<i>Level 4, Majestic City Complex, Colombo 4.</i>	<i>582179</i>	<i>589837</i>
<i>Geotec Ltd.,</i>	<i>8/3, Vijayamangalarama Rd., Kohuwala, Nugegoda.</i>	<i>828864 071-35745</i>	<i>828864</i>
<i>Foundation & Waterwell Engineering (Pvt.) Ltd.</i>	<i>142/47, Jenson Gardens, Anderson Rd., Dehiwala</i>	<i>722895</i>	<i>725834</i>
<i>National Building Research Organisation (NBRO)</i>	<i>99/1, Jawatta Rd., Colombo 05.</i>	<i>588946 501834</i>	<i>439246</i>
<i>Samitar Limited.</i>	<i>103, Siri Dhamma Rd., Colombo 10.</i>	<i>6977985 698817</i>	<i>697801</i>
<i>Soil & Foundation (Pvt.) Ltd.</i>	<i>232a, Weliwala Rd., Kotikawatta.</i>	<i>578239</i>	<i>580721</i>

Topographical Surveyors			
<i>Name</i>	<i>Address</i>	<i>Tel:</i>	<i>Fax</i>
<i>The Surveyors' Institute of Sri Lanka</i>	<i>275/75, Baudhaloka Mw., Colombo</i>	<i>580669</i>	<i>580669</i>
<i>Jayasundara Associates</i>	<i>No. 85, Queen Mary Rd., Gampaha.</i>	<i>033-22458</i>	<i>033-26879</i>
<i>AMS Attanayake</i>	<i>1A, Duplication Rd., Colombo 05.</i>	<i>580997</i>	<i>593232</i>
<i>Land N Resources Survey Co. (Pvt.) Ltd.</i>	<i>11 A/1, School Avenue, Kalubowila, Dehiwala.</i>	<i>725047</i>	
<i>Survey and Computing Services (Pvt.) Ltd.</i>	<i>A. Jayanthi Mawatha, Pelawatta, Battaramulla.</i>	<i>865932</i>	<i>865932</i>
<i>Survey Engineering Company Ltd.</i>	<i>45/1, 1st Lane, Medawelikada Rd., Rajagiriya.</i>	<i>874483</i>	<i>873148</i>

Unit Rates for Geological Investigation		
No.	Description	Unit price Rs.
01	Drilling and Sampling in soils with SPT N<50, depth 0-40 m.	1000 - 2000
02	--- Do ---- depth > 40 m	1200 - 2800
03	Drilling and Sampling in hard soil with SPT N > 50, depth 0-40 m	5000 - 8000
04	--- Do ---- depth > 40 m	6000 - 8750
05	Addition to items 02 & 03 for Undisturbed Samples	500 - 800
06	Standard Penetrometer Tests	150 - 450
07	Taking and storing in core boxes, labeling etc.	100 - 300

Unit Rates for Topographical Survey	
Description	Unit Rate Rs.
Control point survey <i>per km</i>	10,000 - 15,000
Topographic survey <i>per m2</i>	0.20 - 0.80
Mapping <i>per m2</i>	0.05 - 0.10

5 . CEB TARIFF 1996



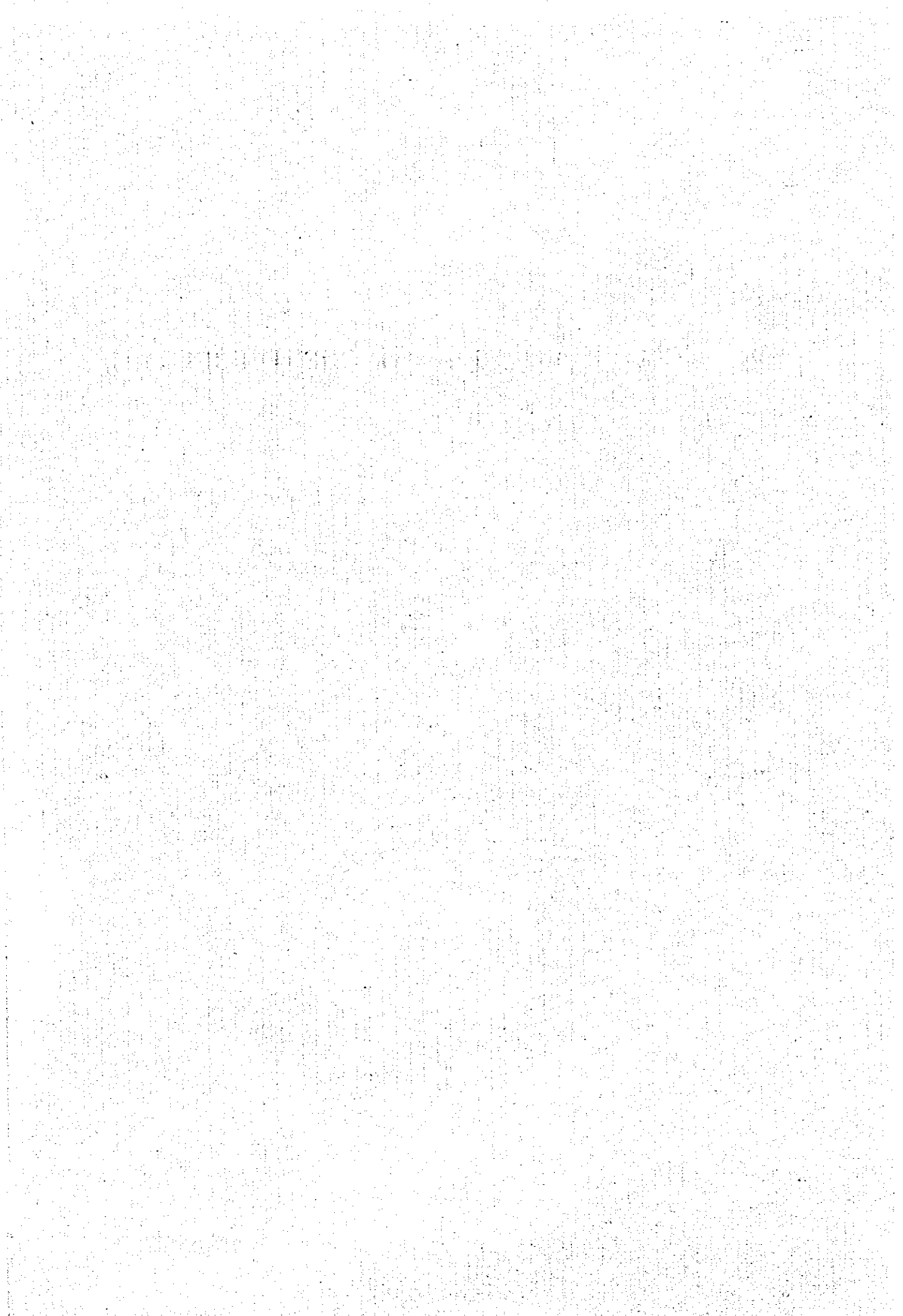
CEYLON ELECTRICITY BOARD

TARIFF

Effective from January 01, 1996

Domestic			
Block 1 - First 30 units		@ Rs. 1.20 per unit	
Block 2 - 31 - 90 units		@ Rs. 2.40 per unit	
Block 3 - 91 - 180 units		@ Rs. 4.50 per unit	
Block 4 - Above 180 units		@ Rs. 5.60 per unit	
Monthly Fixed Charge -		Rs. 15.00	
Religious Purpose			
Block 1 - First 90 units		@ Rs. 1.20 per unit	
Block 2 - 91 - 150 units		@ Rs. 2.40 per unit	
Block 3 - Above 150 units		@ Rs. 4.50 per unit	
Monthly Fixed Charge -		Rs. 15.00	
	General Purpose	Industrial	Industrial (Time of Day)
Supply at 400/230V			
Contract Demand < 50kVA			
Unit Charge (Rs/unit)	5.60	4.30	8.90 (peak) 3.20(off peak)
Fixed Charge (Rs/month)			
upto 10 kVA	15.0	15.00	15.00
above 10 kVA	205.0	205.00	205.00
Supply at 400/230V			
Contract Demand >=50kVA			
Unit Charge (Rs/unit)	5.50	4.10	9.00 (peak) 3.80(off peak)
Demand Charge (Rs/kVA)	270.00	235.00	110.00
Fixed Charge (Rs/month)	435.00	435.00	435.00
Supply at 11/33/132 kV			
Unit Charge (Rs/unit)	5.40	3.90	8.60 (peak) 3.60(offpeak)
Demand Charge (Rs/kVA)	250.00	210.00	100.00
Fixed Charge (Rs/month)	435.00	435.00	435.00
Bulk Supplies to LECO/LA			
		Unit charge	Demand Charge
		Rs/unit	Rs/kVA
L1 - Supply at 400/230V		2.60	65.00
L2 - Supply at 11kV & above		2.25	47.50
Street Lighting		@ Rs. 4.30 per unit	

6 . CERTIFICATE OF ANALYSIS (DIESEL OIL)



RCVD JULY 14
CEB Staff

ලංකා විද්‍යාත්මක හා කාර්මික පර්යේෂණ ආයතනය
இலங்கை விஞ்ஞான கைத்தொழில் ஆராய்ச்சி நிலையம்
CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH

த. பெ. 787
1. பௌத்தலோக மாவத்த, கோழும்பு 7, ஸ்ரீ லங்கா.

பெ. பெ. 787
363, பௌத்தலோக மாவத்த, கோழும்பு 7, ஸ்ரீ லங்கா.

P. O. Box 787
363, Bauddhaloka Mawatha,
Colombo 7, Sri Lanka

பெட்டி } பெட்டிப் பெயர்
p } 21208 - HPT - CE
les } CISIR
x } 22151 - HPT - CE
Attention CISIR



දුරකථන } 693807 - 9
தொலைபேசி }
Telephone } 698620 - 3

CERTIFICATE OF ANALYSIS

Certificate Reference No. SS 7237

To: Ceylon Electricity Board
50, Sir Chittampalam A Gardiner Mawatha
COLOMBO 02

13 May, 1996

Page 01 of 03 pages

This report is issued for the information of the client. It shall not be published in total or in part without the written authority of the Director, CISIR.

The specimen/s tested was/were submitted by the client. It was/They were NOT sampled by CISIR officers. The report is therefore limited specifically to this/these specimen/s.

While the Institute exercises every care in respect of work entrusted to it by clients, the Institute is not liable for any loss or damage howsoever caused to person or property, including property entrusted by clients to the Institute whether such loss, damage or delay may have been caused by the negligence or dishonesty of the employees of the Institute or otherwise.

Any person or any party who alters or adds or deletes or interpolates any provisions or words or letters or figures shall be liable to legal action.

“பெட்டி ஓடு கப்பல் இறங்கும் வரை பெட்டி கட்டுப்பாடு”
“தொலைத் தொட்புகளுக்கெல்லாம் பெட்டிச் செய்தலும்”
“PLEASE ADDRESS ALL ENVELOPES TO THE DIRECTOR”

ලංකා විද්‍යාත්මක හා කර්මික පර්යේෂණ ආයතනය
 இலங்கை விஞ்ஞான கைத்தொழில் ஆராய்ச்சி நிலையம்
 CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH

ප. බ. 787
 පෞද්ගලික මාවතලය,
 මුම්පු 7, ශ්‍රී ලංකා

ප. බ. 787
 363, බෞද්ධලොක මාවත,
 කොළඹ-7, ශ්‍රී ලංකා

P. O. Box 787
 363, Bauddhaloka Mawatha,
 Colombo 7, Sri Lanka.

දුරකථන }
 විද්‍යුත් තැපෑල }
 C I S I R }

දුරකථන } 93807
 විද්‍යුත් තැපෑල }
 Telephone } 598620

21248 MIN'ND CE Attention C. I. S. I. R.

CERTIFICATE OF ANALYSIS

CERTIFICATE REFERENCE NO. SS 7237

CLIENT : Ceylon Electricity Board
 50, Sir Chittampalam A Gardiner Mawatha
 COLOMBO 02

SPRCIMEN : DIESEL OIL

Two samples were collected from Kalanitissa Power Station. One sample was submitted to the Ceylon Electricity Board and one was brought to the CISIR laboratory for analysis.

Sampling were done by Mr. S K D Sarath Kumara, Technical Assistant of CISIR in the presence of Mr. Ravi Silva, Generation Planning Division of Ceylon Electricity Board on 09 May, 1996 at 12.15 p.m.

TESTED FOR : Sodium, Potassium, Vanadium, Calcium, Magnesium and Lead

Reference client's letter dated 08 May, 1996

TEST METHOD : Atomic Absorption Spectroscopy

Date of analysis - 10-12 May, 1996

Page 02 of 03 pages

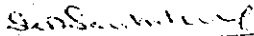
The specimen/s tested was/were submitted by the client. It was/They were NOT sampled by C. I. S. I. R. officers. The report is therefore limited specifically to this/these specimen/s.

"සියලුම ලිපි කවර දිවැස්ස වෙත ආවේණික කර යැවීම."
 "கன தயார்ப்பெறும் அலுவல் பெயரில் எழுதவும்"
 "PLEASE ADDRESS ALL ENVELOPES TO THE DIRECTOR"


SS 7237

RESULTS :

*Parameter	Test values
Sodium (as Na), mg/kg	1.6
Potassium (as K), mg/kg	1.3
Vanadium (as V), mg/kg	Less than 1
Calcium (as Ca), mg/kg	0.5
Magnesium (as Mg), mg/kg	0.1
Lead (as Pb), mg/kg	0.1



 S K D Sarath Kumara
 TECHNICAL ASSISTANT



 Dr. P M Jayatissa
 DIRECTOR

AMM:nsk

13 May, 1996

Page 03 of 03 pages

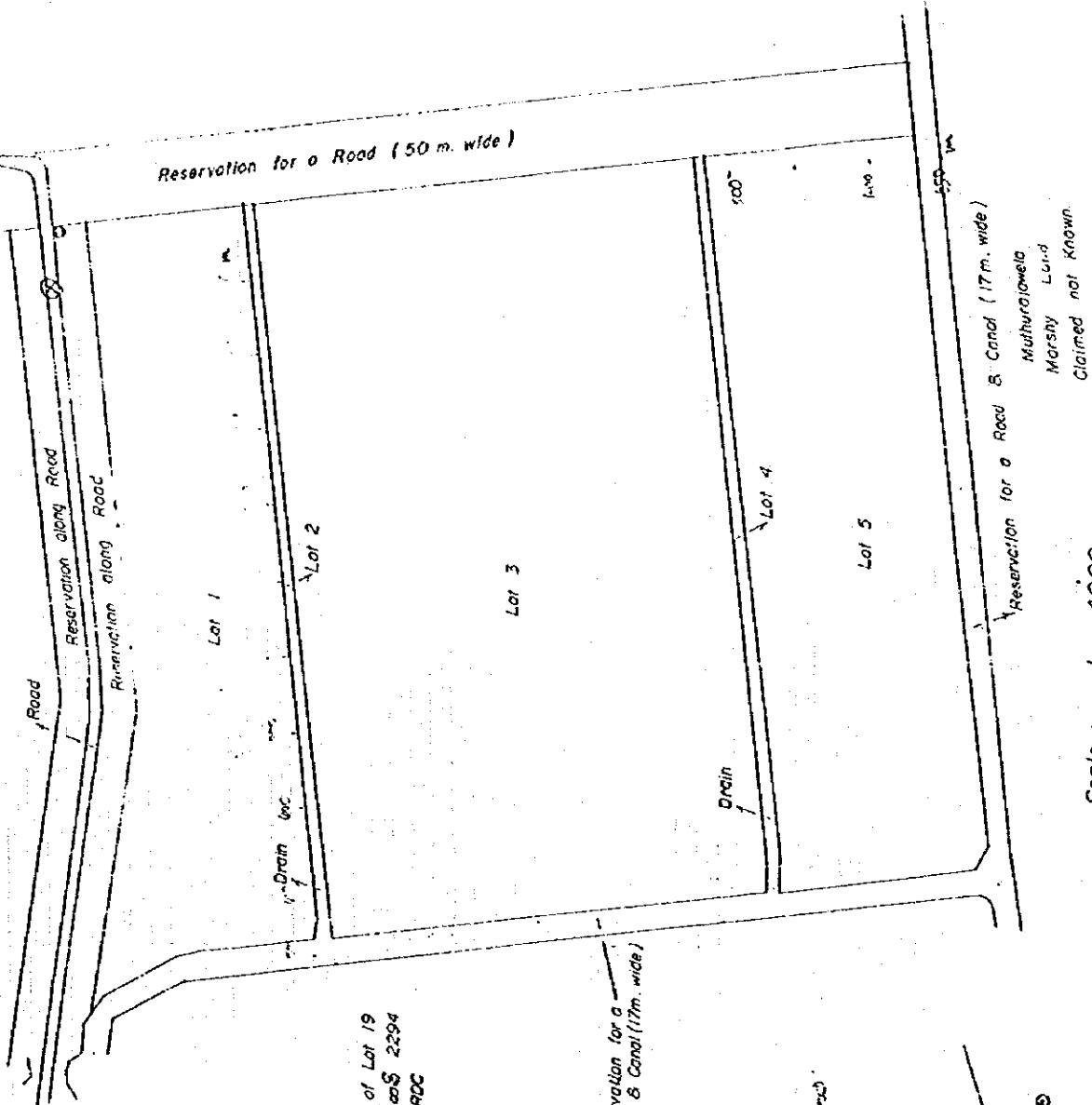
N.B:

The specimen/s tested was/were submitted by the client. It was/They were NOT sampled by C. I. S. I. R. officers. The report is therefore limited specifically to this/these specimen/s.

7. 建設予定地関連図

L. P. A. Shanika Perera, M.S.I.
 Licensed Surveyor & Leveller,
 Court Commissioner & Valuer,
 351, Welikada,
 Rajagiriya.
 Tel. 662436

Balance portion of Lot 19 depicted in
 PP 05 2294 claimed by SLLRDC



Balance portion of Lot 19
 depicted in PP 05 2294
 claimed by SLLRDC

Reference - Sri Lanka Land Reclamation &
 SLLRDC - Development Corporation

Reservation for a
 Road & Canal (17m. wide)

මහලාචාරිකා විද්‍යාලය

[Signature]
 27.04.1996
 76.09.06

Scale :- 1 : 4000

PLAN

of five (05) allotments of land marked lot 1-5 (being a portion of Lot 2 depicted in my Plan No. 75/SLLRDC and originally being a portion of Lot 19 depicted in Plan No. PP 05 2294 authenticated by Surveyor General) of the land called Muthurajawela situated at Matagoda Village in Rogam Pattu of Aluth Kuru Korale

GAMPAHA DISTRICT
 WESTERN PROVINCE

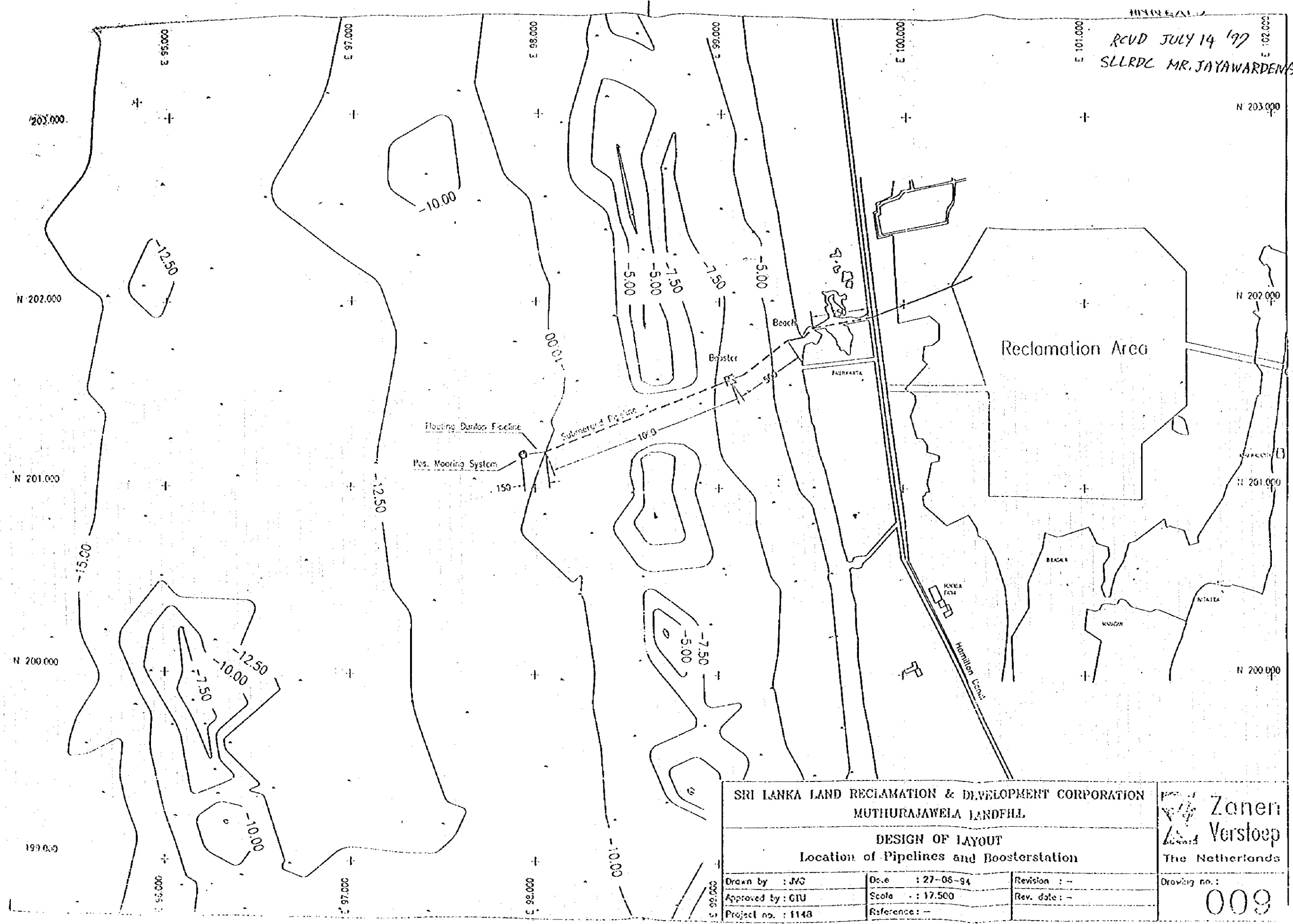
Schedule of Boundaries :-

Lot No.	North	East	South	West	Extent		
					Hac.	A.	R. P.
1	Reservation along Road	Reservation for a Road (50m. wide)	Lot 2	Reservation along Canal	5.6175	15	3 20.7
2	Lot 1	do	Lot 3	do	0.5024	1	0 38.6
3	Lot 2	do	Lot 4	do	14.5613	35	3 37.0
4	Lot 3	do	Lot 5	do	0.5090	1	0 39.2
5	Lot 4	do	Reservation along Canal	do	6.8212	16	3 15.8
Total					28.0084	69	0 37.3

Surveyed on 27th April 1996

[Signature]
 L. P. A. Shanika Perera,
 Licensed Surveyor & Leveller,
 Surveyor SLLRDC,
 25. 06. 1996

RCVD JULY 14 '97
SLLRDC MR. JAYAWARDENA



SRI LANKA LAND RECLAMATION & DEVELOPMENT CORPORATION
MUTHURAJAWELA LANDFILL

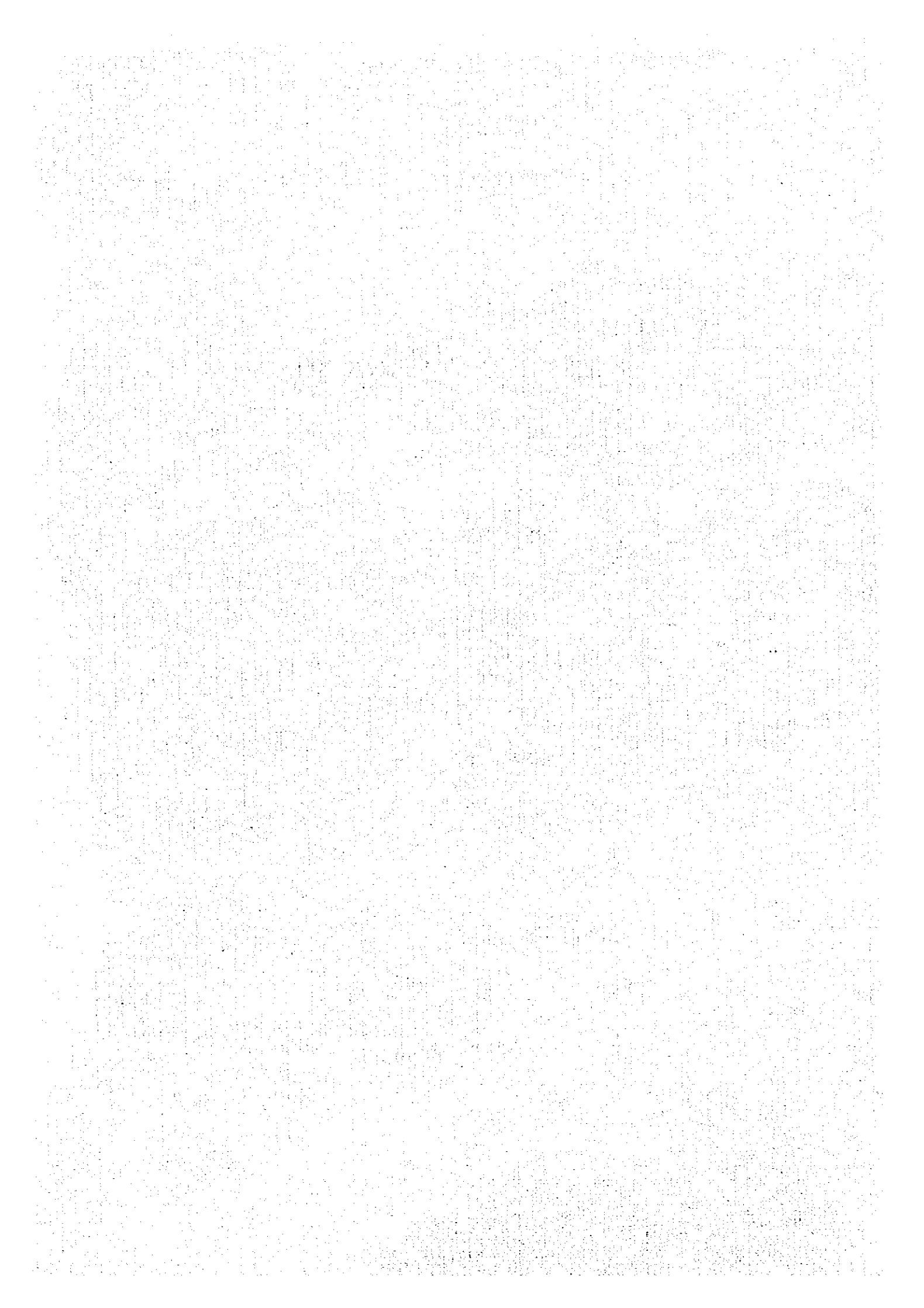
DESIGN OF LAYOUT
Location of Pipelines and Boosterstation

Zaneri
Verstoep
The Netherlands

Drawn by : JVG	Date : 27-05-94	Revision : -
Approved by : GIU	Scale : 1:17,500	Rev. date : -
Project no. : 1143	Reference : -	

Drawing no. :
009

8 . SOIL INVESTIGATION



RCVD July 14 1997

SLLRDC MR. JAYAWARDENA

CLOUGH ENGINEERING GROUP

251 St. George's Terrace,

Perth,

Western Australia 6000.

Report on Preliminary Soil Investigation

At

MUTHURAJAWELA - KERAWALAPITIYA

SRI LANKA

July 1995

by

**SOIL ENGINEERING
and
DEEPWELLS (PVT) LIMITED**

Tel: 94-1-581283 / 94-78-62177 / 94-1-531458
Fax: 94-1-581283

CONTENTS

I	LOCALITY PLAN	FIGURE I
II	LOCATION OF BORE HOLES	FIGURE II
1	REPORT	1 - 4
2	VERTICAL SOIL PROFILES	5 - 9

FIGURE 1

LOCALITY PLAN

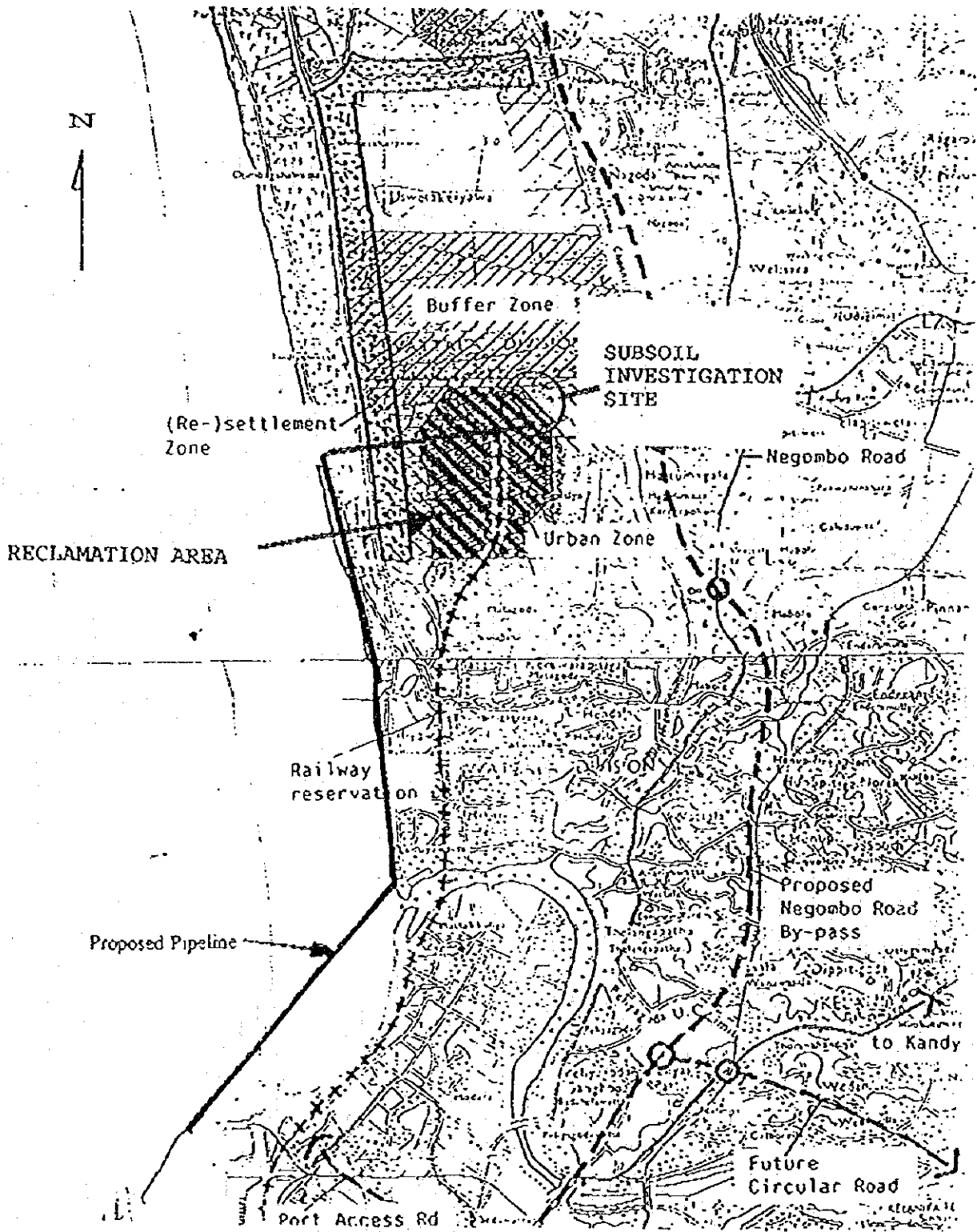
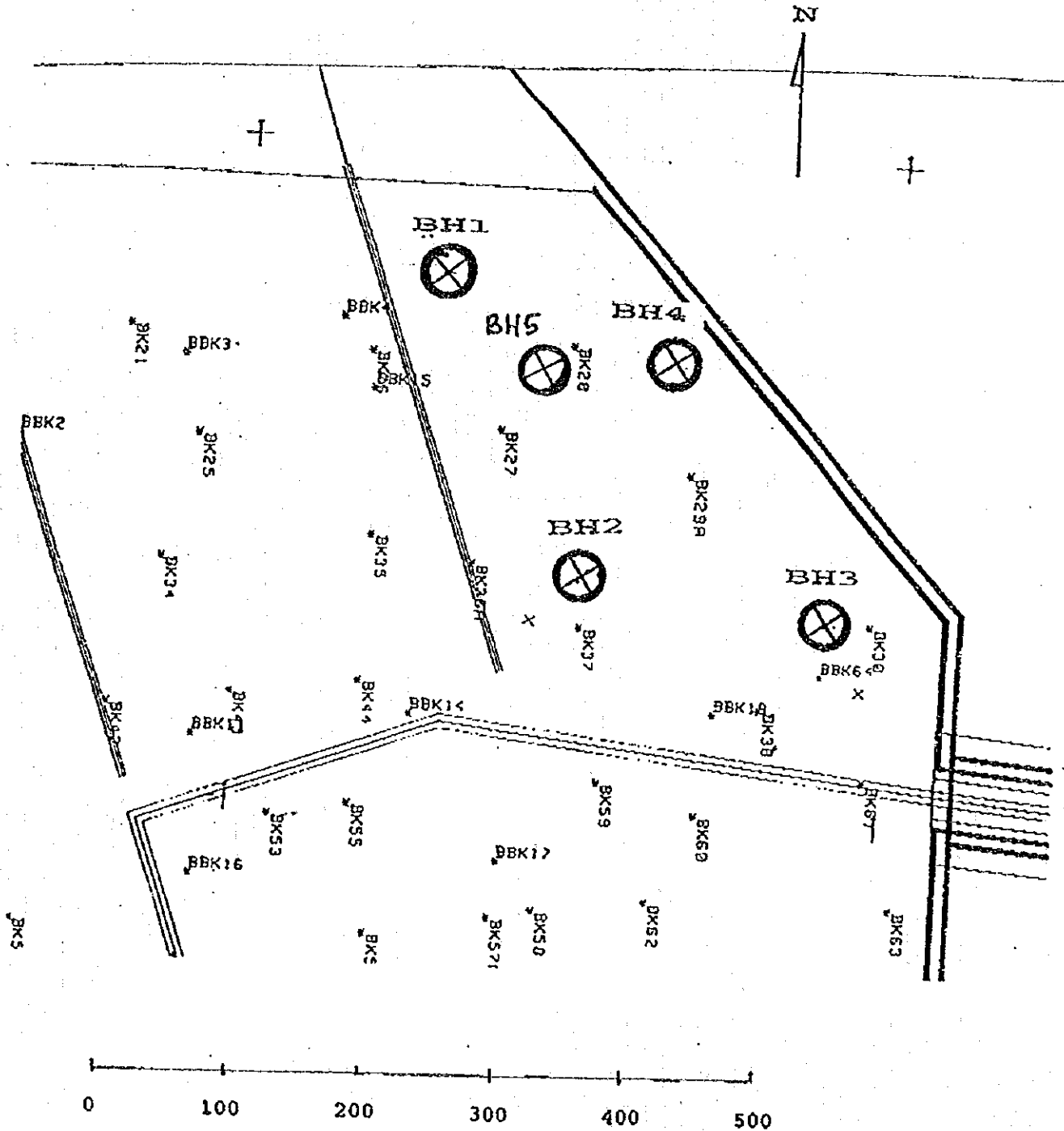


FIGURE II

APPROXIMATE BORE HOLE LOCATIONS

(NOT TO SCALE)



1 : 4000

REPORT

REPORT ON THE PRELIMINARY SOIL INVESTIGATION

AT

MUTHURAJAWELA - KERAWALAPITIYA

FOR

CLOUGH ENGINEERING GROUP

PERTH

WESTERN AUSTRALIA

1. ORIGIN

This soil investigation has been entrusted to M/S SOIL ENGINEERING AND DEEPWELLS (PVT) LIMITED by Mr. Ken Blake of Clough Engineering Group, 251 St. George's Tce., Perth, Western Australia, vide his letter dated 4th July 1995.

2. SCOPE

The scope of work was to drill four bore holes at the locations proposed by the Client and set-out by M/S Boskalis International bv. Co-ordinates of the bore hole locations were to be given by M/S Boskalis International bv.

All four bore holes were to be terminated on a load bearing hard stratum. Standard Penetration Tests were to be conducted at almost every 1.0 metre to 1.5 metres depth. It has been proposed to collect undisturbed soil samples if highly compressible soft clay or peat layers were encountered in order to conduct laboratory tests at a later stage.

The objective of the preliminary soil investigation was ;

- to identify the foundation level for heavily loaded driven or bored piles,
- to identify soil types in order to infer likely ground settlement behaviour.

After completion of the four bores, it has been requested by the Client to advance another bore hole at least 3 to 5 metres into bed rock in order to determine the quality of bed rock.

3. LOCATION

The site is located at the north-western corner of the recent reclamation at Kerawalapitiya, Hendala, within Hendala-Wattala Pradeshiya Sabha, in the Gampaha District, Western Province of Sri Lanka. Locality plan is shown in Figure I.

The bore holes are labelled BH 1, BH 2, BH 3, BH 4 & BH 5, and the co-ordinates of the bore hole locations with respect to the National Grid as furnished by Boskalis International by are as follows;

BH 1 :	202400.00 N	101148.00 E	+2.682 MSL
BH 2 :	202180.00 N	101260.00 E	+2.299 MSL
BH 3 :	202154.00 N	101454.00 E	+1.920 MSL
BH 4 :	202340.00 N	101332.00 E	+1.454 MSL
BH 5 :	202359.50 N	101244.60 E	+2.380 MSL

Approximate locations of the bore holes are shown in Figure II.

4. WORK DONE

4.1 GENERAL

A Nenzi rotary core drilling machine and an XY-01 rotary core drilling machine together with two drilling teams have been mobilized for this work on the 07th of July 1995. Assistance had to be sought from M S Boskalis International by to haul the machinery and equipment to bore hole locations as even farm tractors failed to travel on this surface.

Drilling could be commenced only on the 10th & 11th of July 1995 and drilling of four bore holes could be completed by the 16th of July. After receiving the order for the 5th bore hole on the 18th of July drilling of BH 5 was commenced only on the 21st of July. The field work was completed on the 28th of July and the machines were demobilised on the 29th of July 1995.

The bore holes BH 1 , BH 2 , BH 3 and BH 4 have been terminated on highly weathered rock beyond which depth no further penetration was possible with a Tungsten Carbide casing shoe.

The bore hole BH 5 has been terminated after coring 3.15 metres into highly weathered to fresh bed rock.

The depths at which the bore holes were terminated are as follows;

BH 1 : 16.40 m (highly weathered rock at 16.40m)
BH 2 : 14.25 m (highly weathered rock at 14.25m)
BH 3 : 14.60 m (highly weathered rock at 14.60m)
BH 4 : 17.25 m (highly weathered rock at 17.25m)
BH 5 : 21.00 m (highly weathered rock at 17.85m)

Standard Penetration Tests were conducted at almost every 1.0 metre depth down to 5.0 metres below ground level and at every 1.5 metres there-onwards, except where undisturbed soil samples were collected.

4.2 SAMPLING AND CLASSIFICATION

The subsoil strata were recovered using a split spoon sampler, by other dry blocking methods and sometimes by washing. Representative samples were collected at every change of soil type and at least at every 1.0 metre to 1.5 metres depth.

The soils were examined visually using a 10 X 1 magnifying lens and classified under the Unified Soil Classification System.

4.3 STANDARD PENETRATION TEST (SPT)

Standard Penetration Tests (SPT) were conducted inside the bore holes in accordance with ASTM D 1586 at every 1.0 metre depth down to 5.0 metres below ground level and at every 1.5 metres there onwards.

'N'-values are reported in Pages 5 to 9 in the vertical soil profiles.

4.4 WATER TABLE

The water table inside the bore holes has been observed and is reported in the vertical soil profiles in Pages 5 to 9.

BH 1	:	1.20 m	GL
BH 2	:	0.70 m	GL
BH 3	:	0.90 m	GL
BH 4	:	0.70 m	GL
BH 5	:	0.95 m	GL

4.5 SOIL PROFILE

Vertical soil profiles of bore holes BH 1, BH 2 , BH 3
BH 4 and BH 5 are reported in Pages 5 to 9.

4.6 UNDISTURBED SOIL SAMPLING

Undisturbed soil samples have been collected using
75mm diameter thin walled open tubes, in BH 1 from
5.00m to 6.00m, in BH 3 between 3.20m and 5.40m, in BH
4 from 2.00 m to 3.00m and in BH 5 from 3.00m to
4.00m.

Date:.....31-07-95.....Signature:.....*Sunil de Silva*.....
Dr. Sunil de Silva
B.Sc. (Eng) Hons., M. Eng., Ph.D.

VERTICAL SOIL PROFILE

GEOLOGICAL RECORD OF BORING						HOLE No. BH-1			
PROJECT			CLOUGH ENGINEERING GROUP		LOCATION		MUTHURAJAWELA		
GROUND ELEVATION		+2.682 MSL	DEPTH OF HOLE		16.40M		ANGLE FROM VERTICAL	0	
DIAMETER OF HOLE		100mm	MACHINE		NENZ1		DATE OF DRILLING		13/07/95 to 16/07/95
CORE RECOVERY			DEPTH TO GROUND WATER LEVEL IN HOLE			1.20M BELOW GROUND LEVEL			
DRILLED BY S.K.P. JAYASUNDARA						LOGGED BY B.S. YAPA			

ELEVATION (m)	DEPTH (m)	THICKNESS (m)	FIELD OBSERVATION				CORE RECOVERY		STANDARD PENETRATION TEST								
			COLUMN SECTION	SOIL OR ROCK CLASSIFICATION	COLOUR	DESCRIPTION	%	cm	DEPTH (m)	NUMBER OF BLOWS N							
									(N)	0	10	20	30	40	50	60	
				SP	Yellowish Brown Greyish Brown Blackish Brown	DENSE TO MEDIUM DENSE POORLY GRADED SANDS + SEA SHELLS			1.0	19		▲					
	3.65	3.65							2.0	18		▲					
									3.0	14		▲					
									4.0	01	▲						
			5.00 U/D 6.00	Pt		VERY SOFT PEAT			6.50	01	▲						
									8.0	01	▲						
	10.31	6.66							9.50	01	▲						
				ML	Greyish Brown	STIFF TO VERY STIFF CLAYEY SILTY + MICA (COMPLETELY DECOMPOSED ROCK)			11.0	13		▲					
									12.50	39			▲				
									14.0	29			▲				
	16.40	6.09							15.50	27			▲				
						HIGHLY WEATHERED ROCK ?											
						BORE HOLE TERMINATED AT 16.40M BELOW GROUND LEVEL.											

GEOLOGICAL RECORD OF BORING						HOLE No. BH 2		
PROJECT	CIVIL ENGINEERING GROUP			LOCATION	MUTHURAJAMELA			
GROUND ELEVATION	+2.299 NSL		DEPTH OF HOLE	14.25M		ANGLE FROM VERTICAL	0	
DIAMETER OF HOLE	100mm		MACHINE	XY - 01		DATE OF DRILLING	11/07/95 TO 12/07/95	
CORE RECOVERY				DEPTH TO GROUND WATER LEVEL IN HOLE	0.70M BELOW GROUND LEVEL			
				DRILLED BY	G.B.M. EKANAYAKE		LOGGED BY	B.S. YAPA

ELEVATION (m)	DEPTH (m)	THICKNESS (m)	FIELD OBSERVATION				CORE RECOVERY		STANDARD PENETRATION TEST								
			COLUMN SECTION	SOIL OR ROCK CLASSIFICATION	COLOR	DESCRIPTION	%	cm	SPT (bl)	NUMBER OF BLOWS N							
									(N)	0	10	20	30	40	50	60	
	2.00	2.00		SP	Yellowish Brown	LOOSE POORLY GRADED SANDS + SEA SHELLS			1.0	07	▲						
	3.00	1.00		SP/SW	Yellowish Brown	LOOSE POORLY GRADED SANDS / WELL GRADED SANDS			2.0	06	▲						
	3.61	0.61		Pt	Blackish Brown	VERY SOFT DECOMPOSED ORGANIC MATTER			3.0	01	▲						
	6.71	3.10		SP	Greyish Brown	VERY LOOSE POORLY GRADED SANDS			5.0	02	▲						
					Greyish Brown				6.0	04	▲						
	11.69	4.98		CL	Reddish Brown	STIFF TO VERY STIFF SANDY CLAYS			7.50	13	▲						
					Greyish Brown				9.0	09	▲						
	14.25	2.56		ML	Yellowish Brown	HARD TO STIFF CLAYEY SILTS (DECOMPOSED ROCK)			10.50	16	▲						
						HIGHLY WEATHERED ROCK ?			12.0	60							
						BORE HOLE TERMINATED AT 14.25M BELOW GROUND LEVEL			13.50	11	▲						

GEOLOGICAL RECORD OF BORING						HOLE No. BH 3	
PROJECT			CLOUGH ENGINEERING GROUP		LOCATION		MUJIBURAJAWELA
GROUND ELEVATION		+1.920 MSL		DEPTH OF HOLE		14.60M	
DIAMETER OF HOLE		100mm		MACHINE		NENZI	
CORE RECOVERY				DEPTH TO GROUND WATER LEVEL IN HOLE		0.90M BELOW GROUND LEVEL	
				DRILLED BY		S.K.P. JAYASUNDERA	
				LOGGED BY		B.S. YAPA	

ELEVATION (m)	DEPTH (m)	THICKNESS (m)	FIELD OBSERVATION				CORE RECOVERY		STANDARD PENETRATION TEST								
			COLUMN SECTION	SOIL OR ROCK CLASSIFICATION	COLOUR	DESCRIPTION	%	cm	DEPTH (m)	0	10	20	30	40	50	60	
				SP	Yellowish Brown	VERY DENSE TO DENSE POORLY GRADED SANDS + SFA SHELLS			1.0	43							
	2.91	2.91							2.0	18							
	3.20	0.29		SP/PL	Blackish Brown	LOOSE TO SOFT POORLY GRADED SANDS/PEAT VERY SOFT PEAT											
	5.40	2.20		U/D													
				SC/GC	Yellowish Brown	MEDIUM DENSE CLAYEY SANDS/CLAYEY GRAVELS			5.50	10							
	7.73	2.33							6.50	12							
	9.50	1.77		CL	Greyish Brown	VERY STIFF SANDY CLAYS			8.0	18							
	10.85	1.35		SW	Greyish Brown	EXTREMELY DENSE WELL GRADED SANDS			9.50	56							
	12.0	1.19		SC/GC	Greyish Brown	EXTREMELY DENSE CLAYEY SANDS/CLAYEY GRAVELS			11.0	58							
	13.76	1.76		ML	Whitish Brown	VERY STIFF TO HARD CLAYEY SILTS			12.50	30							
	14.60	0.84		SM	Dark Greyish Brown	DENSE SILTY SANDS MICA + TRACK IRON MINERALS HIGHLY WEATHERED ROCK											
BORE HOLE TERMINATED AT 14.60M BELOW GROUND LEVEL.																	

GEOLOGICAL RECORD OF BORING						HOLE No. BH-4		
PROJECT	CLOUGH ENGINEERING GROUP			LOCATION	MUSHURAJAWELA			
GROUND ELEVATION				DEPTH OF HOLE	17.25M		ANGLE FROM VERTICAL	0
DIAMETER OF HOLE	100mm		MACHINE	XY-01		DATE OF DRILLING	13/07/95 TO 14/07/95	
CORE RECOVERY				DEPTH TO GROUND WATER LEVEL IN HOLE	0.70M BELOW GROUND LEVEL			
				DRILLED BY	G.B.M. EKANAYAKE		LOGGED BY	B.S. YAPA

ELEVATION (m)	DEPTH (m)	THICKNESS (m)	FIELD OBSERVATION				CORE RECOVERY %	CORE DEPTH (m)	STANDARD PENETRATION TEST							
			COLUMN SECTION	SOIL OR ROCK CLASSIFICATION	COLOUR	DESCRIPTION			(N)	0	10	20	30	40	50	60
	1.80	1.80	2-00	SP	Yellowish Brown	VERY LOOSE POORLY GRADED SANDS + SEA SILTS		1.0	04	▲						
	4.0	2.20	U/D 3.00			U.D. SAMPLE VERY SOFT PEAT		4.0	<1							
	5.30	1.30		SP	Greyish Brown	VERY LOOSE TO LOOSE POORLY GRADED SANDS		5.0	06	▲						
	8.0	2.70		CL	Yellowish Brown	STIFF SANDY CLAYS		6.50	09	▲						
	11.91	3.91		CL/ML	Greyish Brown	VERY STIFF SANDY CLAYS + SILTS		8.0	21		▲					
	17.25	5.34		SP	Whitish Brown	VERY DENSE POORLY GRADED SANDS		9.50	14		▲					
								11.0	16		▲					
								12.50	34			▲				
								14.0	38				▲			
								15.50	42					▲		
						HIGHLY WEATHERED ROCK										
						BORE HOLE TERMINATED AT 17.25M BELOW GROUND LEVEL.										

GEOLOGICAL RECORD OF BORING					HOLE No. BH 5		
PROJECT	CLOUGH ENGINEERING GROUP			LOCATION	MUTHURAJAWELA		
GROUND ELEVATION	+2.380 MSL		DEPTH OF HOLE	21.00 metres		ANGLE FROM VERTICAL	0
DIAMETER OF HOLE	100mm		MACHINE	XY-01		DATE OF DRILLING	21st to 28th July '95
CORE RECOVERY	DEPTH TO GROUND WATER LEVEL IN HOLE			0.95m below ground level			
DRILLED BY G.B.M. EKANAYAKE				LOGGED BY B.S. YAPA			

ELEVATION (m)	DEPTH (m)	THICKNESS (m)	FIELD OBSERVATION			CORE RECOVERY (%)	DEPTH (m)	STANDARD PENETRATION TEST								
			COLUMN SECTION	SOIL OR ROCK CLASSIFICATION	COLOR			DESCRIPTION	(N)	0	10	20	30	40	50	60
				SP	Yellowish Brown	MEDIUM DENSE TO VERY DENSE POORLY GRADED SANDS MIXED WITH SEA SHELLS		1.00	35				▲			
	2.91	2.91						2.00	35				▲			
			3:00 U/D	Pt	Blackish Brown	MEDIUM STIFF DECOMPOSED ORGANIC MATTER		4.00	08	▲						
	4.70	1.79	4:00					5.00	02	▲						
				SP	Yellowish Brown	VERY LOOSE TO DENSE POORLY GRADED SANDS		6.50	02	▲						
	8.00	3.30						8.00	17		▲					
				SP	Whitish Brown	DENSE TO VERY DENSE POORLY GRADED SANDS		9.50	37				▲			
	12.00	4.00						11.0	39					▲		
				SP	Whitish Brown	EXTREMELY DENSE POORLY GRADED SANDS		12.5	50/23cm						▲	
	14.92	2.92						14.0	50/20cm						▲	
				ML	Greyish Brown	VERY STIFF CLAYEY SILTS (COMPLETELY DECOMPOSED ROCK)		15.5	20				▲			
	17.73	2.81						17.0	23					▲		
	17.55	0.12		SM		EXTREMELY DENSE SILTY SANDS										
	18.85	1.00			HIGHLY TO MODERATELY WEATHERED ROCK	Core Recovery = 22.0% R.Q.D. = 12.0%										
	19.85				SLIGHTLY WEATHERED TO FRESH ROCK	Core Recovery = 83.6% R.Q.D. = 73.27%										
	21.00					Core Recovery = 91.42% R.Q.D. = 91.42%										
						FRESH ROCK										
						BORE HOLE TERMINATED AT 21.00 M BELOW GROUND LEVEL.										

(V2)

RCVD JULY 14 '97
SLLRDC MR. JAYAWARDENA

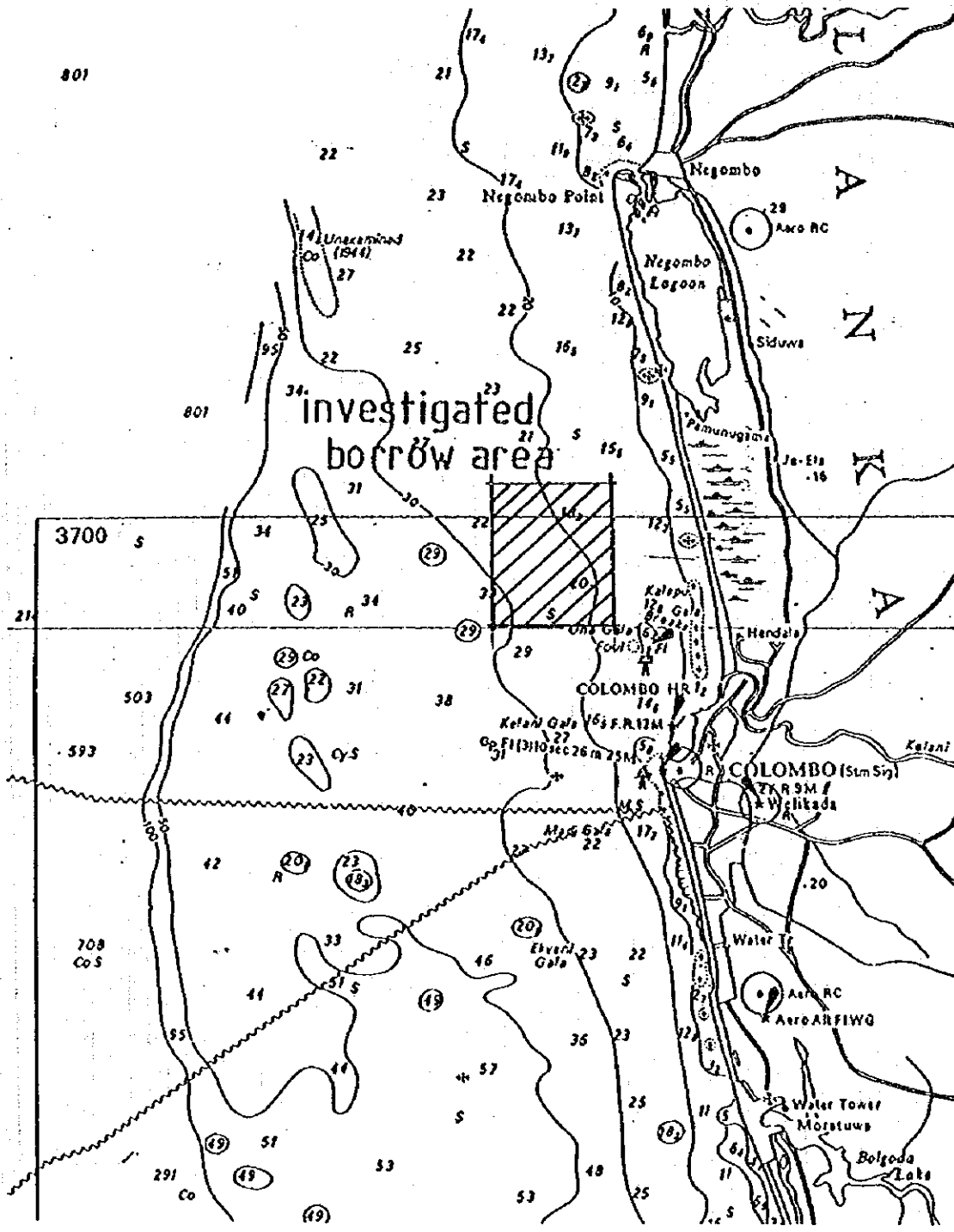
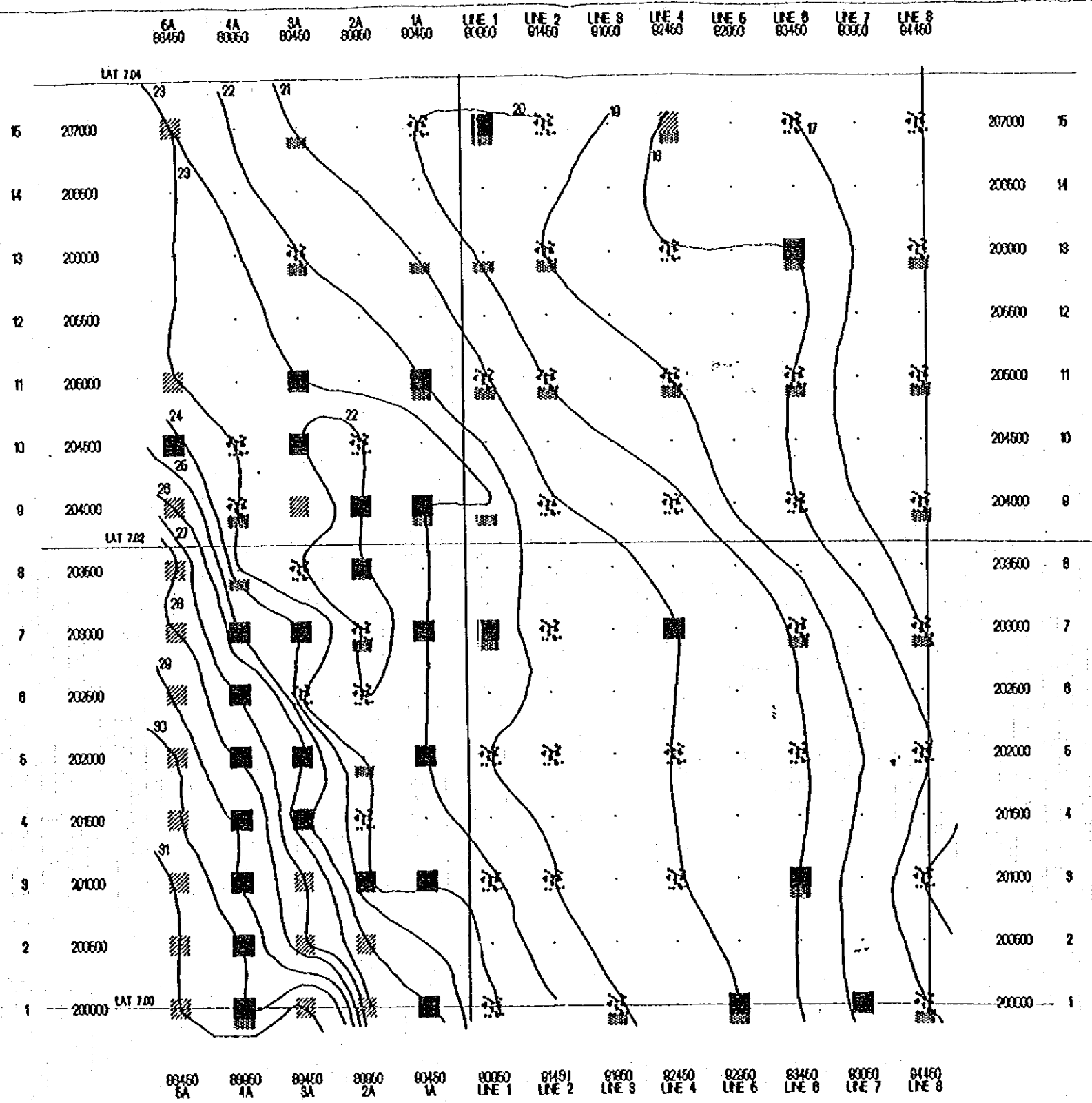


Figure 1: Area of Investigation

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MATERIAL FOUND

- FINE SAND
- FINE/COARSE SAND
- COARSE SAND
- CLAY (No penetration)

SRI LANKA LAND RECLAMATION & DEVELOPMENT CORPORATION
MUTHURAJAWELA LANDFILL

BORROW AREA INVESTIGATIONS
BOTTOM MATERIAL IN AREA OF INVESTIGATION



Drawn by : JBEM	Date : 01-04-84	Revision : .
Approved by : .	Scale : 1 : 4000	Rev. date : .
Project no. : 23028	Reference : .	

Figure no. :
002

