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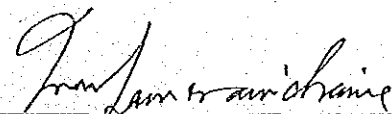
1) Scope of Work

SCOPE OF WORK
FOR
THE STUDY
ON
EXTENSION
OF
THE MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

AGREED UPON

BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE MINISTRY OF MAHAWELI DEVELOPMENT

Colombo, 28 October, 1987.



~~COE.~~ IVAN SAMABAWICKRAMA
SECRETARY
MINISTRY OF MAHAWELI
DEVELOPMENT



MASAMITSU AIHARA
LEADER OF THE PRELIMINARY
SURVEY TEAM,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan has decided to conduct a study on Extension of the Feasibility Study on The Moragahakanda Agricultural Development Project (hereinafter referred to as "the Study"), in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as JICA), the official agency responsible for the implementation of technical cooperation programmes of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Democratic Socialist Republic of Sri Lanka.

The present document sets forth the scope of work with regard to the Study.

II. Objectives of the study

The objectives of the study are to review and up-date the feasibility study on the Moragahakanda Agricultural Development Project as well as to formulate an overall agricultural development plan in the Amban Ganga Basin in consideration of (1) the most effective use of available water in the Mahaweli River System for irrigation development in the Amban Ganga basin and its adjacent areas, and (2) priority irrigation projects and proper implementation programme of these projects.

III. Scope of the study

III - 1 study area

The study area shall cover a net irrigation area of about 155,000ha, involving the Mahaweli Ganga, the Amban Ganga, and the Kalu Ganga as the major water resources for irrigation development.

III - 2 OUTLINE OF THE STUDY

The study consists of two Phases. Phase I study is to review and up-date the Feasibility Study on the Moragahakanda Agricultural Development Project in 1979. Phase II study is overall study on the Amban Ganga Basin Agricultural Development Project at master plan study level.

Phase I and Phase II Studies consist of the following work items.

1. Phase I Study

(Field Work)

- 1.1 To collect and review the data and information for up-dating the previous Feasibility Study including infrastructure and settlement cost.

(Home work)

- 1.2 To up-date the previous study.

2. Phase II Study

(Field work)

- 2.1 To collect and review the existing data and information relevant,
(a) to hydrological analyses on the Mahaweli River System,
(b) to exploration of available water for irrigation development in the study area, and (c) to preparation of an overall agricultural development plan.

- (1) Meteorology and hydrology
- (2) Irrigation and drainage conditions
- (3) Regional and national development plans relevant to the Mahaweli Development
- (4) Present water distribution system of the dams and tanks which exist or are under construction for irrigation.
- (5) The previous studies available on the Mahaweli Development Programme
- (6) Hydropower generation
- (7) Topography
- (8) Geology and soils
- (9) Vegetation
- (10) Agriculture
- (11) Land use and land classification
- (12) Agro-economy and institution
- (13) Infrastructure

- 2.2 To carry out field survey and investigations on the following items.

- (1) Topographic survey of proposed dam sites
- (2) Construction materials

- 2.3 To establish a basic overall agricultural development plan.
(Home work)

- 2.4 To analyse results of field work.

- 2.5 To carry out hydrological analyses on, and to explore available water in the Mahaweli River System.

2.6 To formulate an overall agricultural development plan that includes the following items.

- (1) Irrigation development
- (2) Dam and hydropower development

2.7 To estimate approximate cost for the projects.

2.8 To formulate implementation programme.

IV STUDY SCHEDULE

The Study will be executed in accordance with the attached tentative work schedule.

V REPORTS

JICA will prepare and submit the following reports in English to the Government of Sri Lanka.

- (1) Inception Report
Twenty (20) copies at the commencement of the field work in the Phase I.
- (2) Progress Report (I)
Twenty (20) copies at the end of the Home work in the Phase I.
- (3) Final Report (I)
Fifty (50) copies and twenty (20) copies of its summary within one (1) month after the Home work in the Phase I.
- (4) Interim Report
Twenty (20) copies at the end of the first Home work in the Phase II.
- (5) Progress Report (II)
Twenty (20) copies at the end of the second field work in the Phase (II)
- (6) Draft Final Report
Twenty (20) copies at the end of the Phase II.
The Government of Sri Lanka provides JICA with its comments on the Draft Final Report through the Embassy of Japan within one (1) month after the receipt of the Draft Final Report.
- (7) Final Report (II)
Fifty (50) copies and twenty (20) copies of its summary within two (2) months after receiving the comments on the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF SRI LANKA

1. To facilitate smooth conduct of the Study, The Government of Sri Lanka will take necessary measures :

- (1) to secure the safety of the Japanese study team.
- (2) to permit the members of the Japanese study team to enter, leave and sojourn in Sri Lanka for the duration of their assignment therein, and arrange for alien registration requirements and consular fees.
- (3) not to require the Japanese study team to pay taxes, duties, fees and any other charges on equipment, machinery and other materials brought into Sri Lanka for the conduct of the Study.
- (4) not to require the Japanese study team to pay income tax, BTT and PAYE and any other charges imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study.
- (5) to provide necessary facilities to the Japanese study team for the remittance as well as utilization of funds introduced into Sri Lanka from Japan in connection with the implementation of the Study.
- (6) to secure permission for entry into private properties or restricted areas for the conduct of the Study.
- (7) to secure permission to take all data and documents related to the Study including photographs out of Sri Lanka to Japan by the Japanese study team.

2. The Government of Sri Lanka shall bear claims, if any arises, against the members 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 wilful misconduct on the part of the members of the Japanese study team.

B.T.T. - Business Turnover Tax

P.A.Y.E. - Pay As You Earn

3. The Mahaweli Authority of Sri Lanka (hereinafter referred as "MASL") 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.
4. MASL shall, at its own expense, provide the Japanese study team with the following, in cooperation with other agencies concerned, if necessary;
 - (1) available data and information related to the Study,
 - (2) additional survey related to the Study, if necessary,
 - (3) counterpart personnel to participate in the various activities for the Study,
 - (4) suitable office with necessary equipment in Colombo and the study area,
 - (5) appropriate number of vehicles with drivers in the study area, and
 - (6) credentials or identification cards to the members of the study team.

VII. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures;

1. to dispatch, at own expense, study teams to Sri Lanka,
2. to pursue technology transfer to the Sri Lankan counterpart personnel in the course of the Study,
3. to provide the necessary equipment for the implementation of the Study, which will remain the property of the Government of Japan unless otherwise agreed upon.

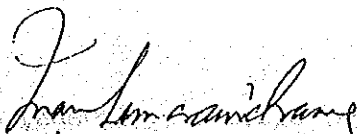
VIII. CONSULTATION

JICA and MASL will consult with each other in respect of any matter that may arise from or in connection with the Study.

2) Minutes of Meeting

MINUTES OF MEETING
OF
THE SCOPE OF WORK FOR THE STUDY
ON
EXTENSION OF THE MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

Colombo, 28 October, 1987



COL. IVAN SAMARAWICKRAMA
SECRETARY
MINISTRY OF MAHAWELI DEVELOPMENT



MASAMITSU AIHARA
LEADER OF THE PRELIMINARY
SURVEY TEAM,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY.

1. In response to the request of the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan has dispatched a Preliminary Survey Team for this study from 18th October to 31st October, 1987 through JICA.
2. The Preliminary Survey team, headed by Mr. Masamitsu AIHARA (JICA) and the Sri Lankan officials concerned headed by Col. Ivan Samarawickrema, Secretary, Ministry of Mahaweli Development had a series of discussions and exchanged their views regarding the Study. As a result of the discussion, both sides have agreed on the Scope of Work.
3. In this connection, both sides have agreed as follows :
 - (1) The study area will cover system D1, D2, F, G, H, IH, MH, I and the extensible areas in NWDZ (North West Dry Zone), see attached annex.
 - (2) The up-dating of Phase I will be conducted under the same condition as the previous study except unit price.
 - (3) The references concerning infrastructure and settlement cost will be provided by the Government of Sri Lanka.
 - (4) The Government of Sri Lanka will provide two jeeps with drivers.
 - (5) The office of the Study area will be scheduled to be located in Bakamuna.
4. List of participants at the above discussions were as follows :

MASL

- | | | |
|-----|-----------------------|-----------------------------------|
| (1) | Mr. K.H.S. Gunatilaka | Director-General, MASL |
| (2) | Mr. C.W.E. Rosa | Director Headworks Projects, MASL |
| (3) | Mr. P.T. Senaratne | Deputy Secretary-General, MASL |
| (4) | Dr. A. Attanayake | Director, PMU |
| (5) | Mr. H.B. Jayasekera | Addl. General Manager, CECB |
| (6) | Mr. Ananda Herath | Senior Asst. Secy., M/M.D. |
| (7) | Mr. L.U. Weerakoon | Director, WMS |

Embassy of Japan

- | | | |
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| (8) | Mr. K. Maruyama | 1st Secretary, Embassy of Japan |
|-----|-----------------|---------------------------------|

JICA

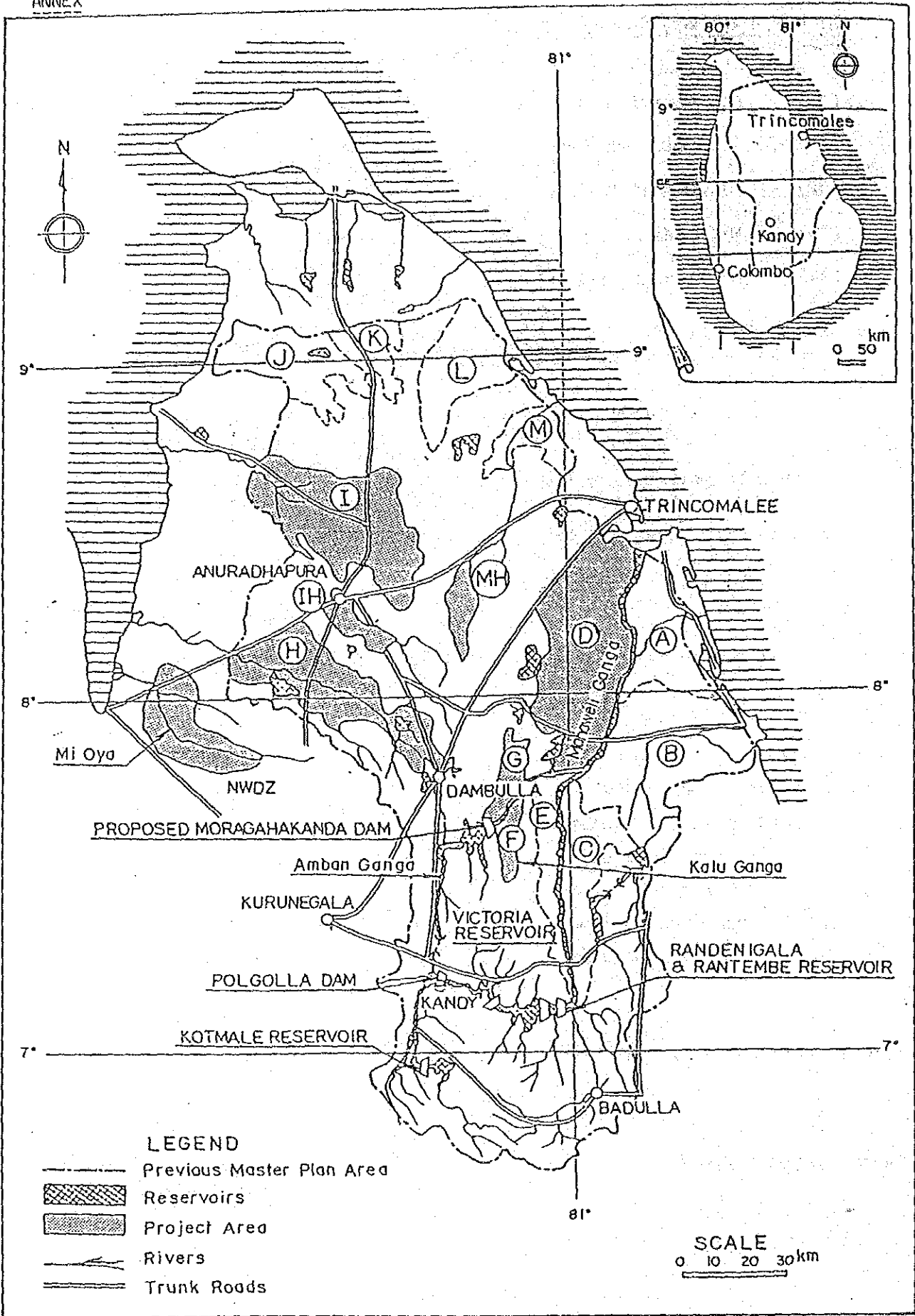
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| (9) | Mr. J. Hashiguchi | Resident Representative, JICA |
|-----|-------------------|-------------------------------|

JICA Preliminary Survey Team

- | | | |
|------|----------------------|-------------|
| (10) | Mr. Masamitsu Aihara | Team Leader |
| (11) | Mr. Masahiro Yagi | Member |
| (12) | Mr. Hitomi Nakada | Member |
| (13) | Mr. Isamu Ueda | Member |
| (14) | Mr. Takashi Shino | Member |

LOCATION MAP

ANNEX



3) Meeting 時に相手側提出又は作成資料

1. Tentative Terms of Reference
2. Terms of Reference (補足)
3. Minutes of Meeting Held on 20-10-87
4. Minutes of Meeting Held on 22-10-87

TENTATIVE TERMS OF REFERENCE FOR A PRE-FEASIBILITY
STUDY OF THE HYDROLOGICAL RESOURCES AND DEVELOPMENT
POSSIBILITIES OF THE AMBAN GANGA AND KALU GANGA
BASINS IN RELATION TO THE PREPARATION OF A DEVELOP-
MENT PLAN FOR AREAS IN THE NORTH CENTRAL PROVINCE
AND NORTH WESTERN PROVINCE.

1. OBJECTIVES OF THE STUDY

The objectives of the study are to formulate an overall agricultural plan for possible areas in the north central province and north western province, taking into consideration the hydrological resources from the diversion of the Mahaweli Ganga at Polgolla, the Amban Ganga and Kalu Ganga basins, which are the major water resources, and also utilizing the other possible minor rivers in the areas that will be studied.

2. OUTLINE OF THE STUDY

The study shall be basically divided into two parts, viz.

- (a) Stage I - which will consist of the identification of the available hydrological resources.
- (b) Stage II- the preparation of an overall agricultural development plan.

2.2 Stage I

Studies to be performed in the field

The collection and review of existing data and information relevant to hydrological analyses of the surplus water of the Mahaweli Ganga, the Amban Ganga and Kalu Ganga, including the exploration of other available water resources for irrigation development in the study areas. The following data and information will also be required to be obtained by the field study.

- (a) Meteorology and hydrology,
- (b) Existing vegetation conditions,
- (c) Irrigation and drainage conditions,
- (d) Existing agricultural conditions
- (e) Regional and national development plans that are relevant to the Mahaweli development programme.
- (f) Existing water distribution systems of anicuts and reservoirs and of those which are under design or construction for irrigation.

In order to assist in the above studies and review, the following studies done previously on the Mahaweli Development Programme are available.

- (a) UNDP/FAO Master Plan,
- (b) Accelerated Mahaweli Development Programme,
- (c) Implementation Strategy Study,
- (d) Mahaweli Water Resources Management Project,
- (e) Hydrological Crash Programme,
- (f) Transbasin Diversion Study,
- (g) Polgolla Diversion Study.

Following the above field studies, the basic concepts for hydrological analyses on the Mahaweli river systems should be established, and the available water for irrigation development in the study area, should be determined.

Home Study

The studies described below shall be performed in the home offices, using the basic concepts established and agreed upon as mentioned above.

- (1) Hydrological analyses of the Mahaweli Ganga, Amban Ganga, Kalu Ganga and other rivers, including the effect of the fixed diversion policy at Polgolla.
- (2) Explore and determine the available water resources for irrigation development in the study area, considering water regulations at the Moragahakanda reservoir and the reservoir proposed on the Kalu Ganga, and water requirements for existing irrigation and hydropower projects in the area.

2.3 Stage II - Studies to be performed in the field.

(1) Collection and review of existing data and information relevant for the preparation of an overall agricultural development plan. The data and studies referred to below, will be in respect of the proposed development areas.

- (a) Topographic conditions
- (b) Morphological studies in the proposed development areas.
- (c) Geological conditions and soil characteristics at probable hydraulic structure sites, for

example, dams, canals, tunnels etc.

- (d) Soil characteristics in relation to landuse.
- (e) Existing vegetation conditions.
- (f) Existing agricultural patterns.
- (g) Agro economic and institutional surveys
- (h) Irrigation and drainage conditions.
- (i) Existing infrastructure.
- (j) Available hydropower generation in relation to regional and national economy, including marketing.
- (k) Existing settlement patterns.

(2) The following field surveys and investigations will require to be performed under the following items.

- (a) Morphological surveys on the rivers and irrigation areas by field reconnaissance.
- (b) Existing irrigation and drainage facilities, including possible streams and rivers that could be used as alternatives to the NCP Canal.
- (c) Present conditions of agriculture, including agriculture support services in the study area.
- (d) Soils and land classification surveys
- (e) Landuse surveys
- (f) Hydropower demand surveys
- (g) Regional economic and marketing surveys
- (h) Agro economic and institutional surveys.
- (i) Topographic surveys of proposed damsites.
- (j) Survey of available construction materials.
- (k) Survey of existing cost prices for the different Works and Services.
- (l) Environmental survey.

Resulting from the above studies, establish basic concepts for the preparation of an overall agricultural development plan for the proposed areas.

Home Study

Utilizing the basic concepts established as outlined above, the following studies shall be performed in the Home offices.

- (1) Analyses of results of field surveys and investigations, including alternative studies for the following sectors :
 - (a) Irrigation development.
 - (b) Agricultural development.
 - (c) Dams and hydropower development
- (2) Analyses of results of surveys and investigations on inter-sector basis
 - (a) Multipurpose reservoir planning
 - (b) Water distribution planning
 - (c) Environmental assessments.
- (3) Formulation of priority projects for irrigation development, considering the results of intersector analyses.
- (4) Evaluation of the projects from the economic and social aspects.
- (5) Formulation of an overall agricultural development plan, including short term and long term implementation programmes.
- (6) Approximate cost estimates for different components of the projects.

2.4 Work Schedule

The tentative Work Schedule is shown in Fig. 1-1. It is presumed that all works will be completed within about 22 months.

It is expected that the hydrological and other studies will require about 9.5 months, and the preparation of the overall agricultural development plan about 12.5 months.

The preparation of the draft final report will be completed within the 22 months, and the final report will be submitted within two months after the receipt of comments on the draft final report from the government of Sri Lanka.

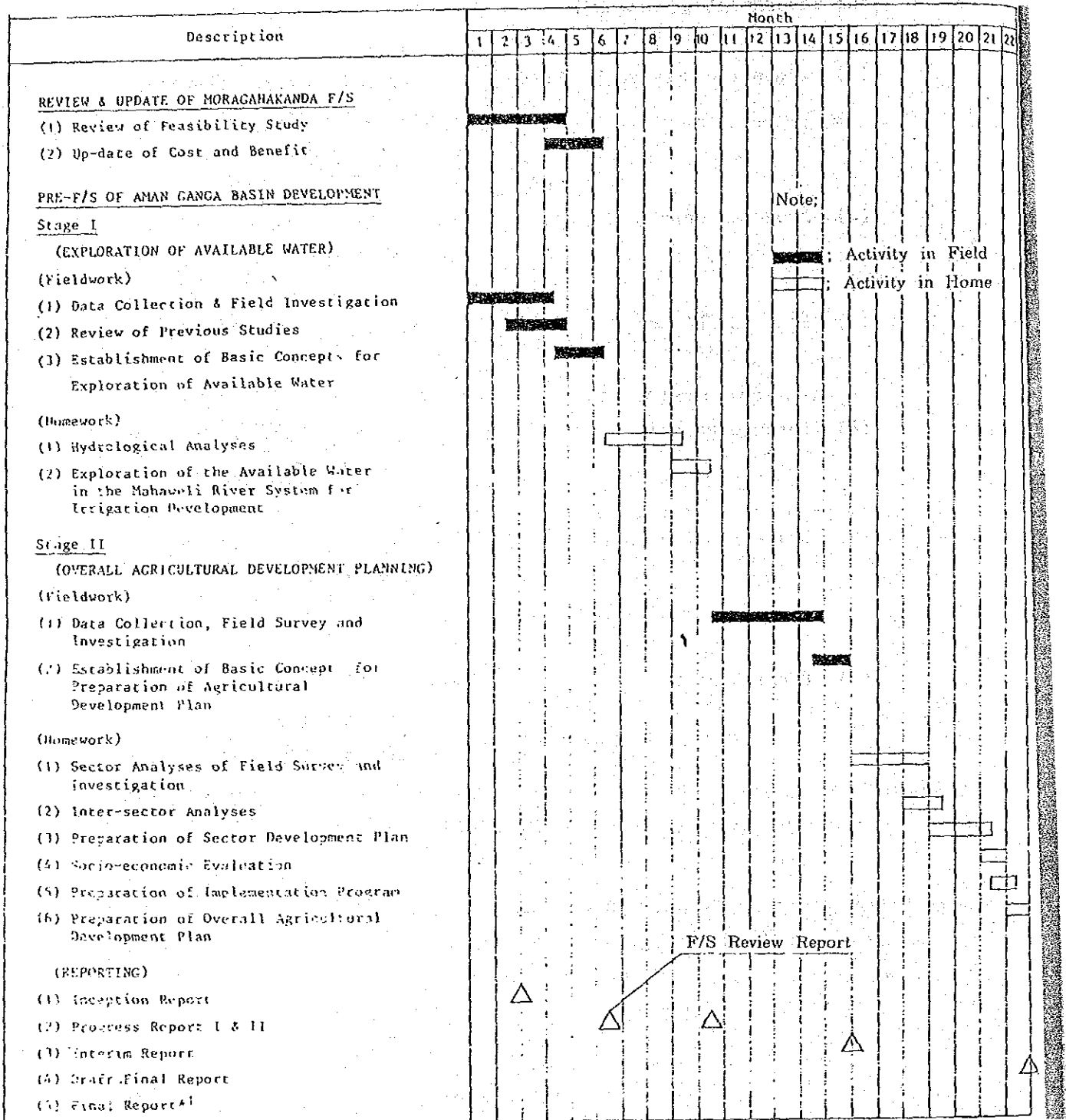
2.5 Reports

The following reports will be prepared in English and submitted to the Government of Sri Lanka :

- (1) Inception Report : Twenty (20) copies at the end of 2nd month after commencement of the work.
- (2) Progress Report I : Thirty (30) copies at the end of the Stage I, Field Works.
- (3) Progress Report II : Thirty (30) copies at the end of Stage I.
- (4) Interim Report : Thirty (30) copies at the end of Stage II, Field Works.
- (5) Draft Final Report : Thirty (30) copies at the end of Stage II,
and
- (6) Final Report : Fifty (50) copies within 2 months after receiving the comments on the Draft Final Report from the Government of Sri Lanka.

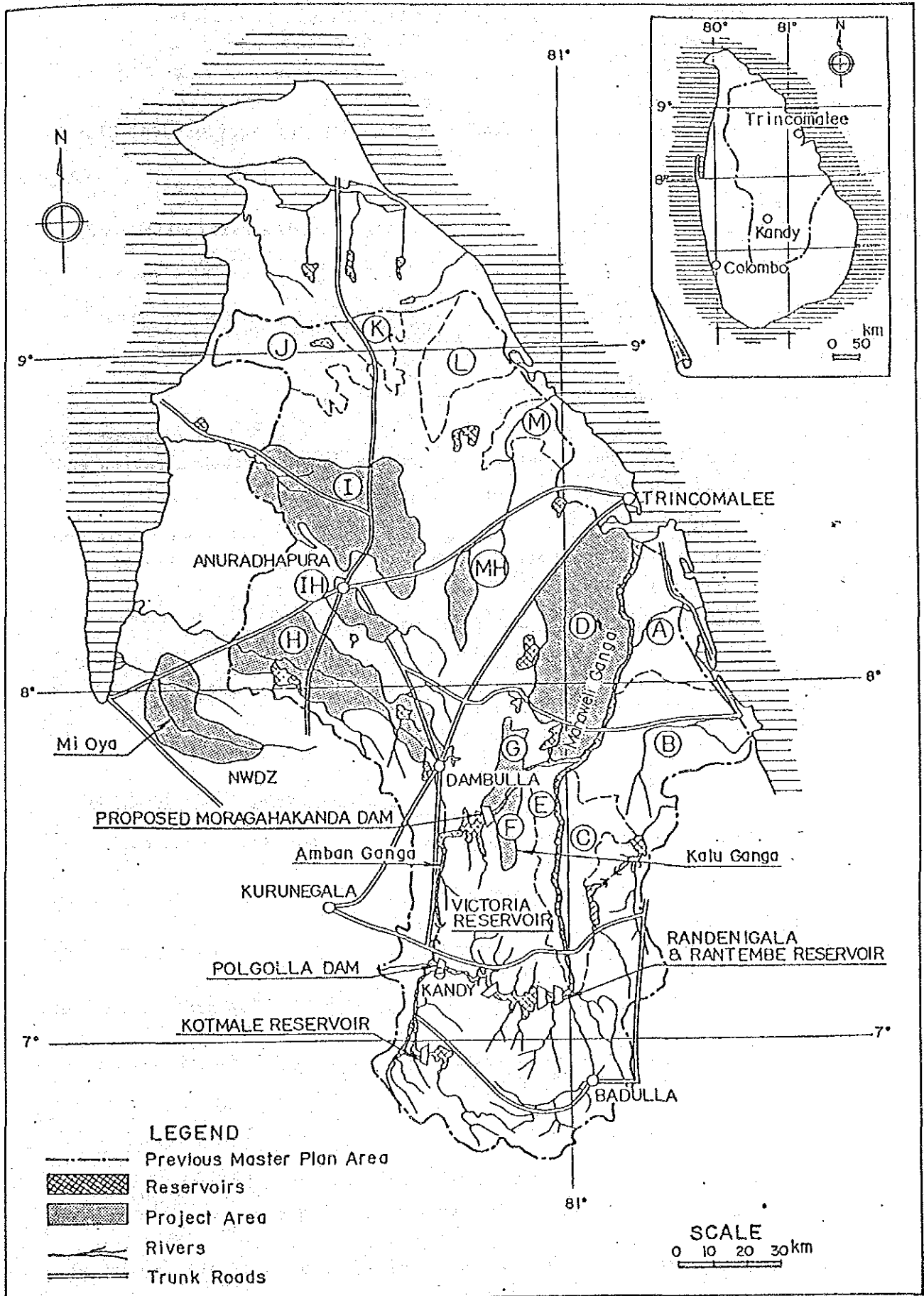
TENTATIVE WORK SCHEDULE

Fig. 1-1



Note: *1 : 2 months after receiving comments on Draft Final Report.

LOCATION MAP



TERMS OF REFERENCE FOR UP-DATING FEASIBILITY
STUDY ON THE MORAGAHAKANDA AGRICULTURAL
DEVELOPMENT PROJECT

1. Review of the Previous Studies on Irrigation and Agricultural Plan
 - a) Review of agricultural plan including crop diversification and irrigation and drainage plan, and
 - b) Data collection for up-dating costs and benefits.
2. Up-dating of Construction Costs and Benefits
 - a) Up-dating of construction cost for the dam and rehabilitation and improvement of the existing irrigation facilities including Elahera-Minneriya Yoda Ela,
 - b) Up-dating of project benefits based on the agricultural plan to be reviewed, and.
 - c) Up-dating of economic and financial evaluation.

MINUTES OF MEETING HELD ON 20-10-87 WITH THE
JICA FEASIBILITY STUDY TEAM IN REGARD TO THE
MORAGAHAKANDE AGRICULTURAL DEVELOPMENT PROJECT,
PRESIDED OVER BY SECRETARY/MINISTRY OF MAHA-
WELI DEVELOPMENT.

Present

Delegation

- Mr. Masamitsu Aihara .. Director/Land Improvement Engineering Service Center, Chugoku Shikoku Regional Agricultural Administration Office, Ministry of Agriculture, Forestry and Fisheries (MAFF)/Leader.
- Mr. Masahiro Yagi .. Official, Development Co-operation Division, Economic Co-operation Bureau, Ministry of Foreign Affairs/Co-operation Policy.
- Mr. Hitomi Nakada .. Section Chief, Crop Production Division, Agricultural Production Bureau, (MAFF)/Agriculture.
- Mr. Isamu Ueda .. Section Chief, Regional Planning Division, Planning Department (MAFF)/Irrigation & Drainage.
- Mr. Takashi Shino .. Official, Technical Affairs Division, Agricultural, Forestry & Fisheries Planning and Survey Department/JICA/Co-ordination.

Officers of the Mahaweli Project

- Col. Ivan Samarawickrama .. Secretary/Ministry of Mahaweli Development.
- Mr. K.H.S. Gunatilaka .. Director-General/Mahaweli Authority of Sri-Lanka.
- Mr. L.K.B. Godamunne .. Secretary-General/Mahaweli Authority of Sri-Lanka.
- Mr. C.W.E. Rosa .. *Consultant for World Bank Project*
- Mr. Ananda Herath .. Senior Assistant Secretary/Ministry of Mahaweli Development.

Secretary explained the position of Moragahakande and the importance of that project from the point of view of the Mahaweli Development Programme.

The Team submitted a brief paper on the scope of work for the Study on the up-dating and extension of the Moragahakande Agricultural Development Project.

Secretary said that a detailed discussion could take place on 22nd October '87, after the officers of the Mahaweli Project study the note submitted by the JICA Team.

It was further stated that the detailed recommendation in regard to the Feasibility Study, including the amendments to the Terms of Reference, will be indicated to them at that Meeting.

He further stated that matters needing the attention of the Ministry of Finance & Planning will be taken up with them by the Ministry of Mahaweli Development and the Mahaweli Authority of Sri-Lanka.

Rgt/-

20/10

MINUTES OF MEETING IN REGARD TO MORAGAHAKANDA
AGRICULTURAL DEVELOPMENT PROJECT HELD ON 22ND
OCTOBER 1987, PRESIDED OVER BY DIRECTOR-GENERAL
OF THE MAHAWELI AUTHORITY OF SRI LANKA

PRESENT :

DELEGATION

- Mr. Masamitsu Aihara : Director/Land Improvement Engineering Service Center, Chugoku Shikoku Regional Agricultural Administration Office, Ministry of Agriculture, Forestry and Fisheries (MAFF) - Leader
- Mr. Masahiro Yagi : Official/Development Cooperation Division, Economic Cooperation Bureau, Ministry of Foreign Affairs - Cooperation Policy.
- Mr. Hitomi Nakada : Section Chief/Crop Production Division Agricultural Production Bureau (MAFF)- Agriculture
- Mr. Isamu Ueda : Section Chief/Regional Planning Division Planning Department (MAFF) - Irrigation & Drainage.
- Mr. Takashi Shino : Official/Technical Affairs Division, Agricultural, Forestry & Fisheries Planning and Survey Dept., JICA - Coordination.
- Mr. K.H.S Gunatilaka ; Director-General/MASL
- Mr. C.W.E. Rosa ; Director/Headworks
- Mr. P.T. Senaratne : Deputy Secretary-General/MASL
- Mr. Abhaya Attanayake : Director/P.M.U.
- Mr. H.B. Jayasekara : Actg. G.M./C.E.C.B.
- Mr. P. Samaraweera ;
- Mr. L.U. Weerakoon : Director/Water Management Secretariat
- Mr. N.G.R. De Silva : Chairman/MECA

Mr. Ananda Herath : Senior Asst. Secretary/M.D.

The following decisions were taken:-

- (1) The JICA Assistance will be in the form of a Grant for the Feasibility study.
- (2) The Feasibility Study will be carried out in two phases:-
 - (a) Phase I - Will deal with the updating of the previous Study, including infrastructure and settlement costs, and will be completed in April 1988 to enable the Sri Lanka Government to contact the O.E.C.F. in time to make assistance available for the year, 1989, and to have the Project, included in the PIP of the Sri Lanka Government.
 - (b) Phase II - This Study will be completed within 15 months from January, 1988
- (3) Field Studies, in this connection, will commence from January '88. However, JICA will explore the possibility of doing pre-feasibility studies by that date, once the Consultants are identified and the work assigned. Further, every effort will be made by JICA to commence the Phase II Field Study also immediately after the completion of Phase-1 field studies.

In the Phase-1 Study, cropping patterns of the previous Study will be used, with necessary modifications in regard to the possible new crops. However, Phase - II of the Study will explore the possibility of diversified agricultural strategy.

The Progress Monitoring Unit, together with the Mahaweli Economic Agency and the Mahaweli Engineering & Construction Agency, will make available the information on social infrastructure and

Conti... (3)

settlement costs.

A note submitted by the Leader of the JICA Team of Study dated 28.10.87, was examined, and the following amendments were made:-

- (1) Deletion of Section 1.2
- (2) Inclusion of the phrase 'of new areas' at the end of section 2.3.
- (3) Mahaweli Authority to make available 2 Jeeps to the Study Team from January '88' and for the JICA to obtain necessary Cars for their mobility.

4) 要 請 文 書

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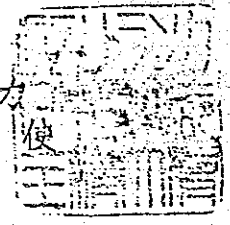
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國際協力課長

第 213 号
昭和 6 / 年 3 月 5 日

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大使 大 蔵 大 使



國際協力事業団宛

件名
モウガハカンタ農業開發計畫 F/S (正式要請)

引用公・電信
日付・番号 佐電 米/2/1号 (総協用)

5月4日付大蔵企画省發寄館宛本件要請書簡
別添の通り送付申し上げます。

(3)

經協局
61.3.11
國際協力

61.3.11

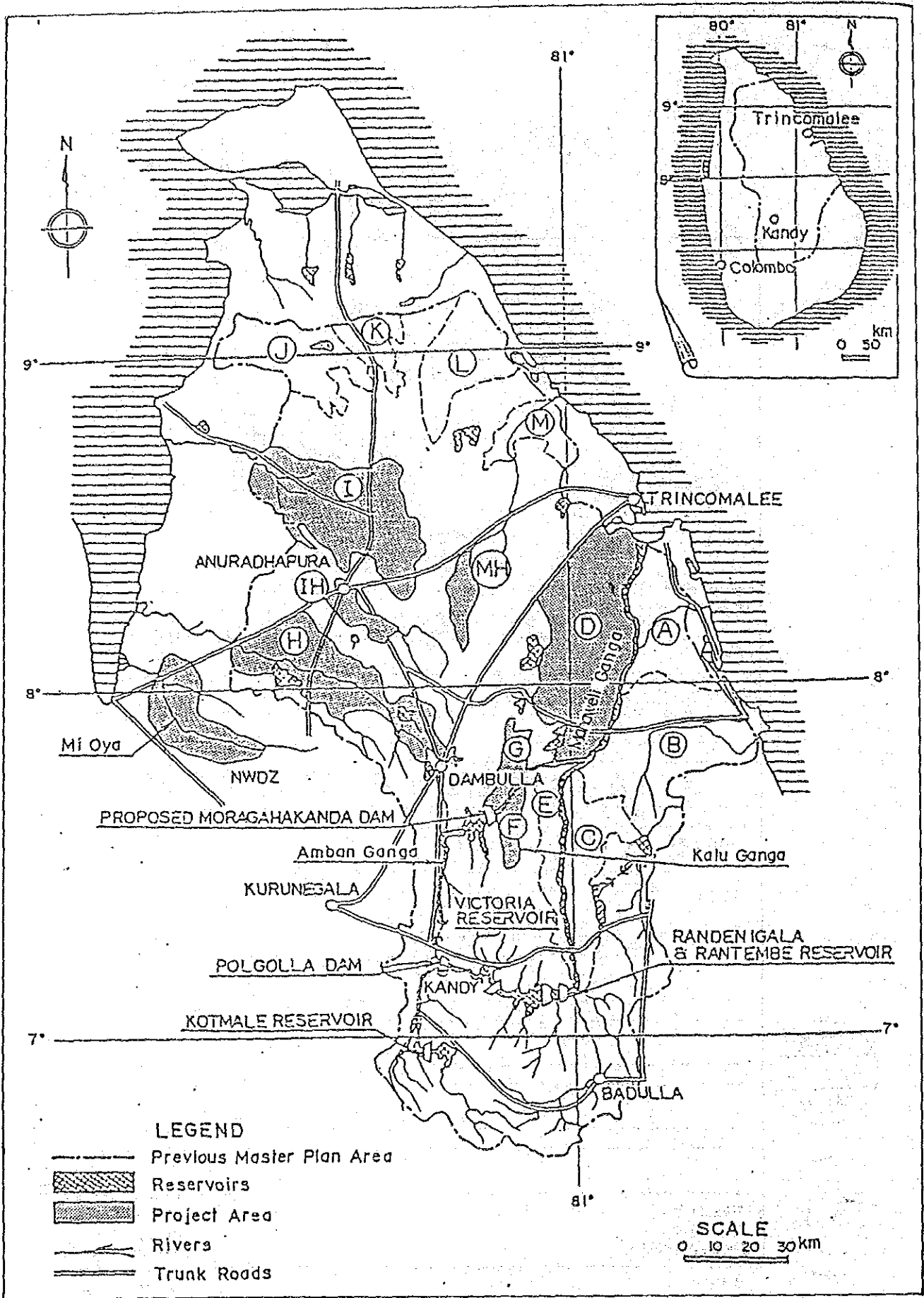
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LOCATION MAP



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 தி. திட்டமிடல் அமைச்சு
 DEPARTMENT OF EXTERNAL RESOURCES
 Ministry of Finance and Planning

දේශීය ආදායම් ගොඩනැගිල්ල (15 වන මහල)
 உள்நாட்டிணைக்க கட்டிடம், (15வது மாடி)
 Inland Revenue Building (15th Floor)
 කැ. පො. 277, කොළඹ 2
 த. பெ. இல. 277, கொழும்பு 2
 P. O. Box 277, Colombo 2

4th March, 1986.

Mr. M. Itami,
 First Secretary (Economic Co-operation),
 Embassy of Japan,
 Colombo 7.

Dear Mr. Itami

Updating the Feasibility Study on the
 proposed Moragahakanda Reservoir Project


Please refer to your letter dated 28th January 1986, relating to assistance for development studies in 1986.

As you are aware, a feasibility study on the Moragahakanda Reservoir Project was done by a JICA team in 1978. The Ministry of Mahaweli Development has now requested us to seek the assistance of your Government to update this feasibility study.

As the Cabinet has decided to give preference to the construction of Moragahakanda Reservoir, updating of the feasibility study is considered to be extremely important.

I shall, therefore, be grateful if your authorities are requested to include this study to the list of development studies already submitted to your Government.

Yours sincerely,


 (S. Weerapana)
 Assistant Director,
 External Resources

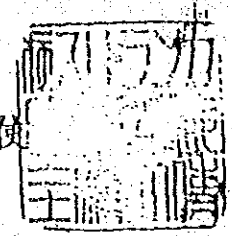
取扱注意
取扱注意

有償資金協力課長

第 898 号
昭和 62 年 9 月 22 日

外務大臣 殿

在 スリランカ
大 使 館



国際協力事業団宛

件名

モラボハカング農業開発計画

引用公・電信
日付・番号

貴電経協南才列号

(経協有償)

引用貴電に關し、

今般大蔵企画者外國援助局より、当館に於て、
本件 T/R を送付致し、別添ハセホリ送付
す。

(3)

62.9.30
開協議

62.9.29

本借送付先：
本借写送付先：
省内写配布希望先：

付添付
付添郵便 (行)
付添郵便 (DP)

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 Telephone }
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 ලිපිනය } Colombo
 Telex } 1232



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විදේශ සම්පත් දෙපාර්තමේන්තුව

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 මහල, මධ්‍යම පළාත

DEPARTMENT OF EXTERNAL RESOURCES
 Ministry of Finance and Planning

දේශීය ආදායම් තොරතුරු මධ්‍යස්ථානය (15 වන මහල)
 මහල, මධ්‍යම පළාත (15 වන මහල)
 Inland Revenue Building (15th Floor)

ම. ල. 277, කොළඹ 2.
 P. O. Box 277, Colombo 2.

21st September, 1987.

Mr K. Maruyama,
 First Secretary,
 Economic Co-operation,
 Embassy of Japan,
 Colombo 7.

Dear Mr Maruyama,

Moragahakanda Reservoir Project
Japanese Aid

Further to my letter dated 8th September, 1987,
 I am sending herewith the following documents for your
 information and onward transmission to your authorities:

- a) Tentative Terms of Reference for a pre-feasibility study of the Hydrological Resources and development possibilities of the Amban Ganga and Kalu Ganga basins in relation to the preparation of a development plan for areas in the north central-province and north western province.
- b) Tentative Work Schedule.
- c) Location Map.

I would like to bring to your notice that in the Work Schedule, provision has been made for the review and updating of the Feasibility Report of the Moragahakanda Reservoir Project, in addition to other work stipulated and described.

Yours sincerely,

(S. Weerapana)
 Assistant Director.

TENTATIVE TERMS OF REFERENCE FOR A PRE-FEASIBILITY
STUDY OF THE HYDROLOGICAL RESOURCES AND DEVELOPMENT
POSSIBILITIES OF THE AMBAN GANGA AND KALU GANGA
BASINS IN RELATION TO THE PREPARATION OF A DEVELOP-
MENT PLAN FOR AREAS IN THE NORTH CENTRAL PROVINCE
AND NORTH WESTERN PROVINCE.

1. OBJECTIVES OF THE STUDY

The objectives of the study are to formulate an overall agricultural plan for possible areas in the north central province and north western province, taking into consideration the hydrological resources from the diversion of the Mahaweli Ganga at Polgolla, the Amban Ganga and Kalu Ganga basins, which are the major water resources, and also utilizing the other possible minor rivers in the areas that will be studied.

2. OUTLINE OF THE STUDY

The study shall be basically divided into two parts, viz.

- (a) Stage I - which will consist of the identification of the available hydrological resources.
- (b) Stage II - the preparation of an overall agricultural development plan.

2.2 Stage I

Studies to be performed in the field

The collection and review of existing data and information relevant to hydrological analyses of the surplus water of the Mahaweli Ganga, the Amban Ganga and Kalu Ganga, including the exploration of other available water resources for irrigation development in the study areas. The following data and information will also be required to be obtained by the field study.

- (a) Meteorology and hydrology,
- (b) Existing vegetation conditions,
- (c) Irrigation and drainage conditions,
- (d) Existing agricultural conditions
- (e) Regional and national development plans that are relevant to the Mahaweli development programme.
- (f) Existing water distribution systems of anicuts and reservoirs and of those which are under design or construction for irrigation.

In order to assist in the above studies and review, the following studies done previously on the Mahaweli Development Programme are available.

- (a) UNDP/FAO Master Plan,
- (b) Accelerated Mahaweli Development Programme,
- (c) Implementation Strategy Study,
- (d) Mahaweli Water Resources Management Project,
- (e) Hydrological Crash Programme,
- (f) Transbasin Diversion Study,
- (g) Polgolla Diversion Study.

Following the above field studies, the basic concepts for hydrological analyses on the Mahaweli river systems should be established, and the available water for irrigation development in the study area, should be determined.

Home Study

The studies described below shall be performed in the home offices, using the basic concepts established and agreed upon as mentioned above.

- (1) Hydrological analyses of the Mahaweli Ganga, Amban Ganga, Kalu Ganga and other rivers, including the effect of the fixed diversion policy at Polgolla.
- (2) Explore and determine the available water resources for irrigation development in the study area, considering water regulations at the Moragahakanda reservoir and the reservoir proposed on the Kalu Ganga, and water requirements for existing irrigation and hydropower projects in the area.

2.3 Stage II - Studies to be performed in the field.

- (1) Collection and review of existing data and information relevant for the preparation of an overall agricultural development plan. The data and studies referred to below, will be in respect of the proposed development areas.
 - (a) Topographic conditions
 - (b) Morphological studies in the proposed development areas.
 - (c) Geological conditions and soil characteristics at probable hydraulic structure sites, for

example, dams, canals, tunnels etc.

- (d) Soil characteristics in relation to landuse.
 - (e) Existing vegetation conditions.
 - (f) Existing agricultural patterns.
 - (g) Agro economic and institutional surveys
 - (h) Irrigation and drainage conditions.
 - (i) Existing infrastructure.
 - (j) Available hydropower generation in relation to regional and national economy, including marketing.
 - (k) Existing settlement patterns.
- (2) The following field surveys and investigations will require to be performed under the following items.
- (a) Morphological surveys on the rivers and irrigation areas by field reconnaissance.
 - (b) Existing irrigation and drainage facilities, including possible streams and rivers that could be used as alternatives to the NCP Canal.
 - (c) Present conditions of agriculture, including agriculture support services in the study area.
 - (d) Soils and land classification surveys
 - (e) Landuse surveys
 - (f) Hydropower demand surveys
 - (g) Regional economic and marketing surveys
 - (h) Agro economic and institutional surveys.
 - (i) Topographic surveys of proposed damsites.
 - (j) Survey of available construction materials.
 - (k) Survey of existing cost prices for the different Works and Services.
 - (l) Environmental survey.

Resulting from the above studies, establish basic concepts for the preparation of an overall agricultural development plan for the proposed areas.

Home Study

Utilizing the basic concepts established as outlined above, the following studies shall be performed in the Home offices.

- (1) Analyses of results of field surveys and investigations, including alternative studies for the following sectors :
 - (a) Irrigation development.
 - (b) Agricultural development.
 - (c) Dams and hydropower development
- (2) Analyses of results of surveys and investigations on inter-sector basis
 - (a) Multipurpose reservoir planning
 - (b) Water distribution planning
 - (c) Environmental assessments.
- (3) Formulation of priority projects for irrigation development, considering the results of intersector analyses.
- (4) Evaluation of the projects from the economic and social aspects.
- (5) Formulation of an overall agricultural development plan, including short term and long term implementation programmes.
- (6) Approximate cost estimates for different components of the projects.

2.4 Work Schedule

The tentative Work Schedule is shown in Fig. 1-1. It is presumed that all works will be completed within about 22 months.

It is expected that the hydrological and other studies will require about 9.5 months, and the preparation of the overall agricultural development plan about 12.5 months.

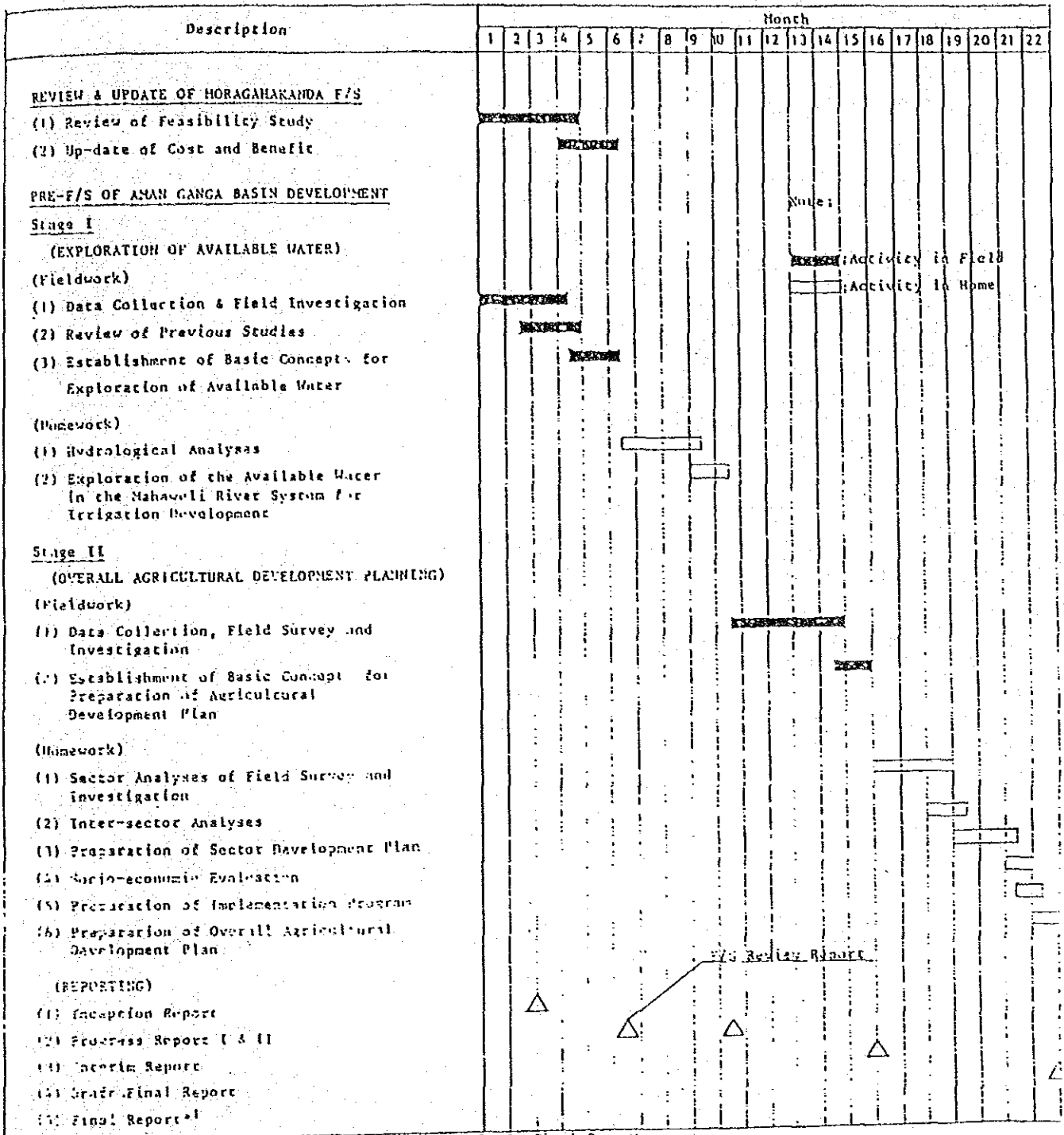
The preparation of the draft final report will be completed within the 22 months, and the final report will be submitted within two months after the receipt of comments on the draft final report from the government of Sri Lanka.

2.5 Reports

The following reports will be prepared in English and submitted to the Government of Sri Lanka :

- (1) Inception Report : Twenty (20) copies at the end of 2nd month after commencement of the work.
- (2) Progress Report I : Thirty (30) copies at the end of the Stage I, Field Works.
- (3) Progress Report II : Thirty (30) copies at the end of Stage I.
- (4) Interim Report : Thirty (30) copies at the end of Stage II, Field Works.
- (5) Draft Final Report : Thirty (30) copies at the end of Stage II,
and
- (6) Final Report : Fifty (50) copies within 2 months after receiving the comments on the Draft Final Report from the Government of Sri Lanka.

TENTATIVE WORK SCHEDULE



Note: *1 : 2 months after receiving comments on Draft Final Report.

5) Questionnaire

QUESTIONNAIRE

- (1) Where can I get the following data?
 - (a) UNDP/FAO Master Plan
 - (b) Accelerated Mahaweli Development Program
 - (c) Implementation Strategy Study
 - (d) Mahaweli Water Resources Management Project
 - (e) Hydrological Crash Program
 - (f) Plogolla Diversion Study

- (2) Hydrology and Meteorology data of the Study area
 - (a) Precipitation
 - (b) evapo transpiration
 - (c) Temperature
 - (d) Duration of Sunshine

- (3) Past water usage of dams
 - (a) Respective dams and diversions
 - (b) Water management system
 - (c) H - Q curve, H - means water level
Q - means water quantity
 - (d) Inventory of tanks including past records and general rules of operation

- (4) Present system about irrigation and drainage

- (5) Soil map of the study area

- (6) Land usage plan of the study area

- (7) Crop introduction plan

- (8)
 - (a) Farmer's organization
 - (b) Agricultural supporting system
 - (c) Agricultural technology

- (9) Map of ground water

- (10) (a) Prevailing price of construction materials and wages
- (b) Prices of agricultural product
- (c) Cost of production
- (d) Marketing system

- (11) Aerial photograph and its scale

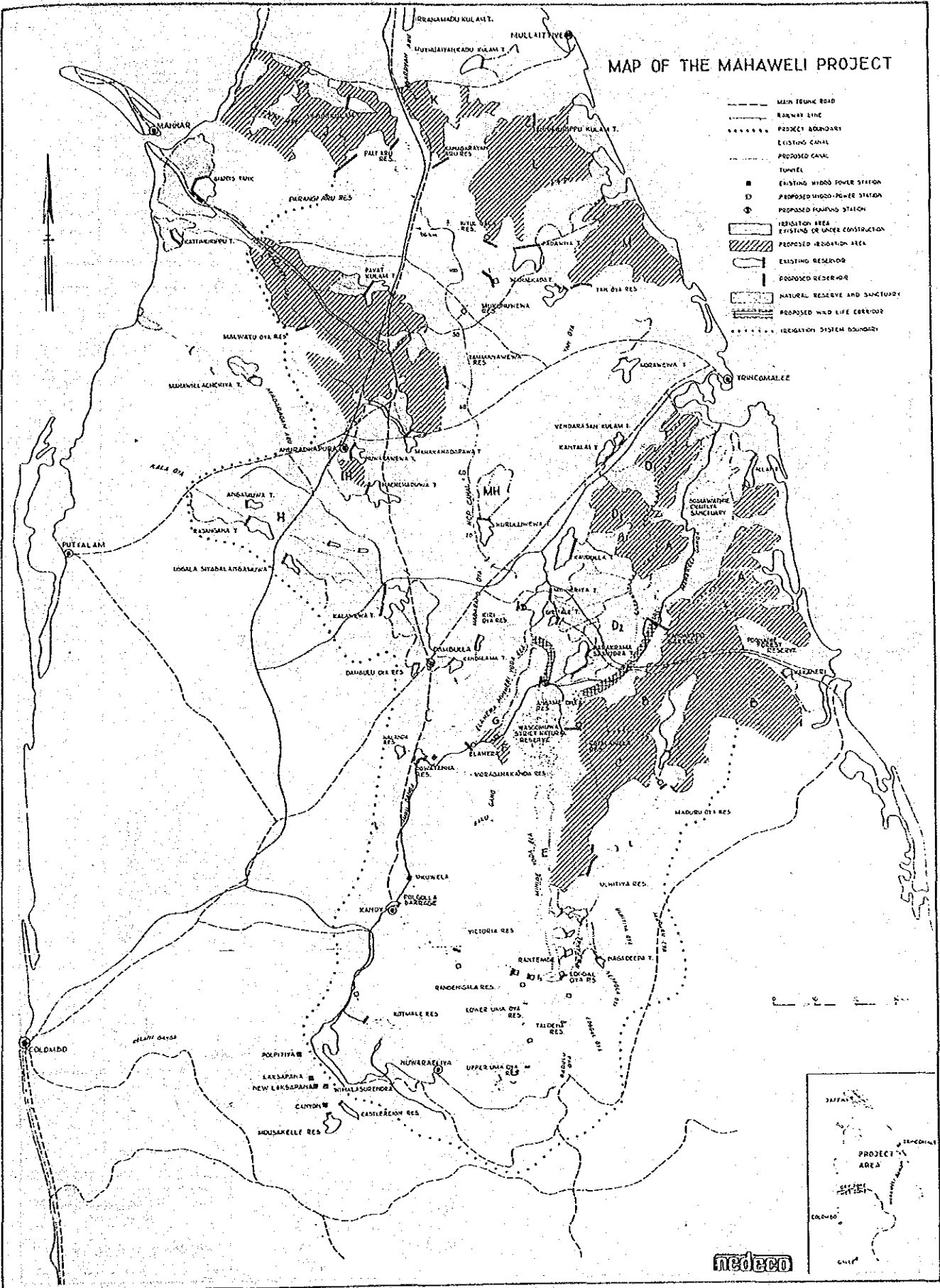
- (12) Topographic map and its scale

6) 収 集 資 料

1. システムエリアの図表
2. ダム関係資料
(Kotmale, Victoria & Moragahakanda)
3. 参 考 資 料

MAP OF THE MAHAWELI PROJECT

- MAIN TRUNK ROAD
- RAILWAY LINE
- PROJECT BOUNDARY
- EXISTING CANAL
- PROPOSED CANAL
- TUNNEL
- EXISTING HYDRO POWER STATION
- PROPOSED HYDRO-POWER STATION
- PROPOSED FLOODING STATION
- ▨ RESERVATION AREA
- ▩ EXISTING OR UNDER CONSTRUCTION
- ▨ PROPOSED RESERVATION AREA
- ▩ EXISTING RESERVOIR
- ▩ PROPOSED RESERVOIR
- ▩ NATURAL RESERVE AND SANCTUARY
- ▩ PROPOSED WILD LIFE CORRIDOR
- IRRIGATION SYSTEM BOUNDARY



MECO

Table 4. Agricultural benefits and irrigation costs at a 10% discount rate ^{a/}

System	Area ^{b/} ha	Present value of costs Rs/ha Mill. Rs.	Percent value of benefits Rs/ha Mill. Rs.	Present value of net benefits Rs/ha Mill. Rs.	Economic rate of return ^{c/}	
A	36,200	55,000	85,000	3,000	1,090	10 - 14
B	50,500	75,000	85,000	4,290	500	10 - 14
C	21,400	95,000	115,000	2,460	430	10 - 14
D 1	11,300	50,000	90,000	1,020	460	12 - 16
D 2	3,700	45,000	95,000	350	190	12 - 16
E	3,500	50,000	80,000	290	100	10 - 14
G	2,600	45,000	100,000	260	140	10 - 16
MOZ	134,100	100,000	135,000	10,100	4,690	10 - 14

Note: The figures given are indicative only and subject to change.

^{a/} Benefits do not include yet reservoir fisheries benefits and other direct benefits that become possible due to the introduction of irrigation water. Irrigation costs include costs of settlement and social infrastructure, costs of irrigation infrastructure including new tanks, costs of transmission canals and interest during construction. Costs of facilities that serve more purposes such as multi-purpose dams are not included yet as it is impossible at this stage to make a reliable guess of the shares of costs to be borne by irrigation and energy production. Operation and maintenance costs are also not included yet.

^{b/} Area figures exclude completed areas and areas under construction using water diverted by the Folsolla/Bowaterne works (i.e. area D1: 25,500 ha; D2 7,700 ha; E 5,100 ha; G 1900 ha; H 41,500 ha; I 3,700 ha; H 3,200 ha).

^{c/} In view of the tentative character of the data, a range rather than a fixed figure has been given for the economic rate of return.

Accountant
123,130

ANNEX F

Table S-1 Soils and drainage classes per system, excluding areas with an adequate water supply at present

Irrigation system	'low land' c/				'intermediate land' b/				'upland' a/				Net irrigation area d/	
	poorly drained		imp. drained		sub total		well drained		sub total		sub total			
	LHG ha	AL+GR ha	OAL ha	SS ha	AL ha	RBE ha	AL ha	RBE ha	NCB ha	AL ha	RYL ha	ha		
A	2700	4200	11000	1200	8300	27400	2100	3400	5500	2500	800	0	3300	36200
B	4000	200	5800	500	4500	15000	3700	11500	15200	11200	9100	0	20300	50500
C	6800	500	500	0	1500	9300	3400	0	3400	6800	0	900	7700	20400
D1	1000	1800	0	900	400	4100	2600	200	2800	4400	0	0	4400	11300
D2	0	0	0	0	2400	2400	0	1300	1300	0	0	0	0	3700
F	1200	0	0	0	0	1200	600	0	600	1700	0	0	1700	3500
G	800	0	0	0	0	800	700	0	700	900	0	200	1100	2600
I	28400	0	0	0	0	28400	6400	400	6800	17700	0	0	17700	52900
J	6500	2700	0	0	800	10000	1900	600	2500	5200	0	400	4700	22800
K	2300	0	0	0	600	2900	1300	300	1600	3600	0	0	3600	3100
L	15000	0	0	0	1200	16200	5000	600	5600	13800	0	800	2600	39000
M	2400	0	0	0	2600	5000	1100	1300	2400	3100	0	800	3900	11300
Grand Total	71100	9400	17300	2600	22300	122700	28800	13600	48400	70900	9900	3100	7300	262300

a/ Lowland is only suitable for double cropped paddy. SS soils are to expensive to reclaim however and will therefore not be cropped

b/ Intermediate land is suitable for paddy in the Maha and dry-foot crops in the Yala

c/ Uplands are assumed to be only suitable for so-called dry-foot or upland crops

d/ Excluding areas with adequate water supply which are given in table 4.---

- LHG = Low Mucic Gley
- AL = Alluvial Soils
- GR = Grumusols
- OAL = Old Alluvial
- SS = Solodized Solonetz
- AL = Alluvial
- RBE = Reddish Brown Earths
- NCB = Noncalic Brown Soils
- RYL = Reddish Yellow Latosols

ANNEX F

Table S-4 Future cropping intensities, cropped area and paddy yields assumed for without-project case

Irrigation system	Existing irrigation area with inadequate water supply ha	Estimated Cropping intensity				Cropped area		Estimated paddy yields	
		Maha		Yala		Maha	Yala	Maha	Yala
		%	%	%	%	ha	ha	tons/ha	tons/ha
A	5700	80	20	100	4560	1140	2.8	1.5	
B	2700	80	20	100	2160	540	2.0	1.5	
F	200	98	80	178	196	160	3.5	3.0	
I	17400	75	20	95	13050	3480	2.0	2.0	
J	2900	75	0	75	2175	0	2.0	n.r.	
K	200	75	0	75	150	0	2.0	n.r.	
L	8100	75	0	75	6075	0	2.0	n.r.	
M	1200	75	0	75	900	0	2.0	n.r.	

n.r. = not relevant

Note : Cropped area = Irrigation area x cropping intensity

ANNEX F

Table S-2 Net irrigation area and drainage classes per system

Irrigation system	Existing land with adequate water supply a/			New land and existing land with inadequate water supply			Total					
	Lowland		Upland	Lowland		Upland	Lowland		Upland	Grand total		
	ha	ha	ha	Existing	New	Total	ha	ha	ha	ha		
A	0	0	0	5700	21700	27400	5500	3300	27400	36200 ^{b/}		
B	0	0	0	2700	12300	15000	15200	20300	15000	50500 ^{b/}		
C	0	0	0	0	9300	9300	4400	7700	9300	21400 ^{b/}		
D1	18600	0	6900	0	4100	4100	2800	4400	22700	11300 ^{b/}		
D2	7700	0	7700	0	2400	2400	1300	0	10100	3700 ^{b/}		
E	0	3000	3100	0	0	0	0	0	0	0		
F	0	0	0	0	1200	1200	600	1700	1200	3500		
G	1900	0	0	0	800	800	700	1100	2700	700		
H	24200	2500	14800	0	0	0	0	0	24200	2500		
I	3700	0	0	17400	11000	28400	6800	17700	32100	6800		
J	0	0	0	2900	7100	10000	2500	10300	10000	2500		
K	0	0	0	200	2700	2900	1600	3600	2900	1600		
L	0	0	0	8100	8100	16200	5600	17200	16200	5600		
M	3200	0	0	1200	3800	5000	2400	3900	8200	2400		
Total	59300	5500	24800	38200	84500	122700	49400	91200	182000	54900		
											116000	352500

a/ - Areas provided with water by the Polgolla-Bowatenne diversions and area E, which gets an adequate water supply from run of the river flow.

b/ - A part of the area profiting from the Polgolla-Bowatenne diversions will in fact not receive an adequate water supply until the Kotmale project is completed.

Areas to be developed or improved under the accelerated programme. New land = 117,300 ha, Existing land = 3,400 ha, Total = 125,700 ha.

PERCENT AVAILABLE AREA IRRIGATED IN
SYSTEMS H, IH, MH, G, D1 AND D2

Source : WMS Data

F & I

(Area Irrigated (%))

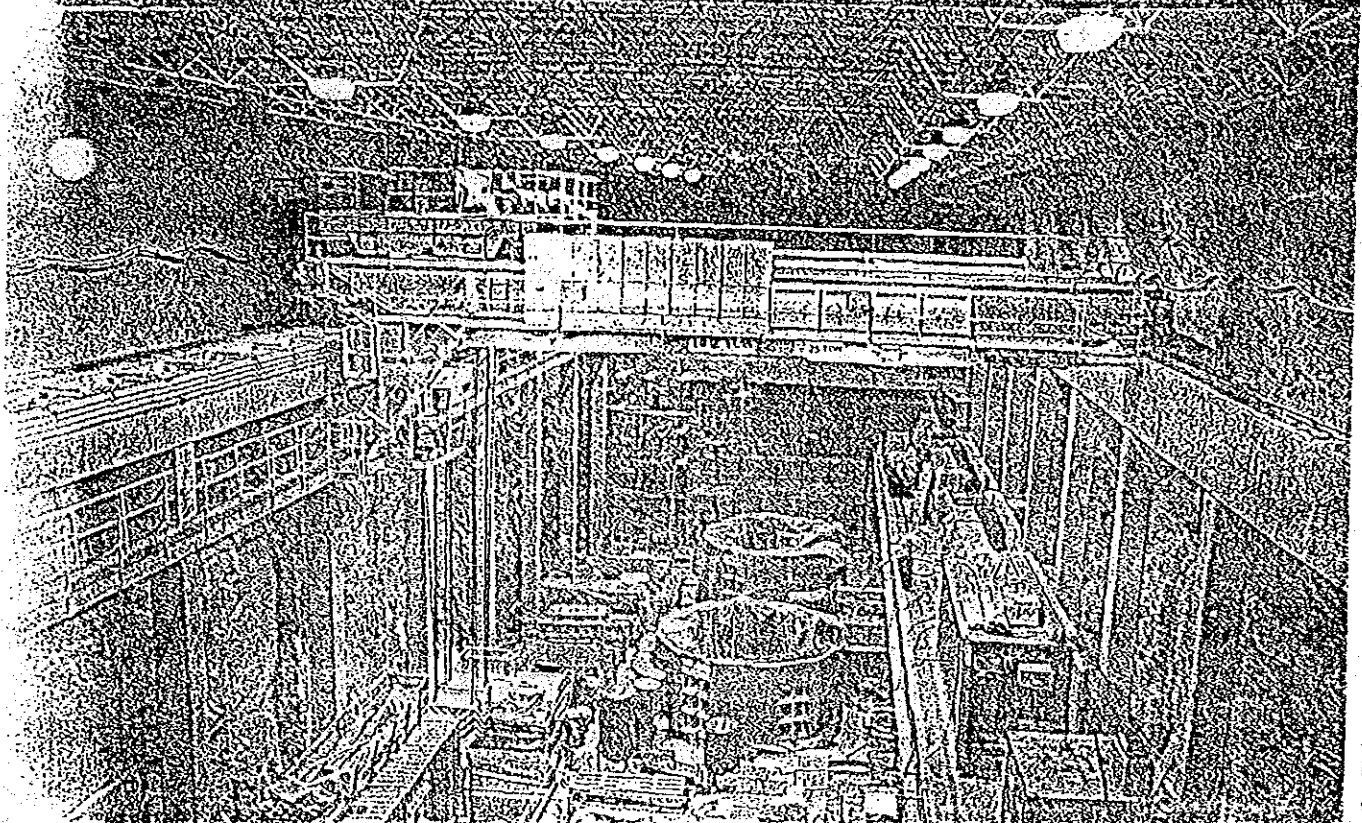
	Command Area (ha)	M 83/84	Y 84	M 84/85	Y 85	M 85/86	Y 86	M 86/87	Y 87	M Average	Y Average
<u>System H</u>											
Dambulu Oya	2160	97	97	97	50	100	100	98	49	98	74
Kandalama	4900	86	100	100	50	100	100	83	45	92	74
Kalawewa RB	13300	98	98	98	100	100	50	95	50	98	74
Kalawewa Yoda Ela	4700	96	49	100	43	100	69	92	51	97	53
Kalawewa LB	6100	100	65	100	50	100	100	95	46	99	65
Rajangane	6700	100	100	100	100	100	81	80	86	95	92
	Σ 47,260										
<u>System IH</u>											
Nachchaduwa	2400	100	100	100	80	100	42	99	50	100	68
Nuwarawewa	971	100	85	93	66	100	93	0	82	73	81
Tissawewa	500	n.a.		80	60	100	100	63	80	81	81
	Σ 3,871										
<u>System MH</u>											
Hurulu Wewa	4090	100	83	100	0	100	22	94	29	98	33
	4500	100	100	100	55	100	89	62	100	90	86
<u>System G</u>											
Elahera	4500	100	100	100	90	100	90	100	100	100	95
<u>System D1</u>											
Giritale	3000	100	100	100	82	100	82	100	100	100	91
Minneriya	8900	100	100	100	0	100	100	100	44	100	61
Kaudulla	4500	100	100	100	91	99	100	20	30	61	79
Kantalai/Vendarasan	9919	64	94	63							
	Σ 26,919										
<u>System D2</u>											
Parakrema Samudra	10100	100	100	100	100	100	100	100	100	100	100

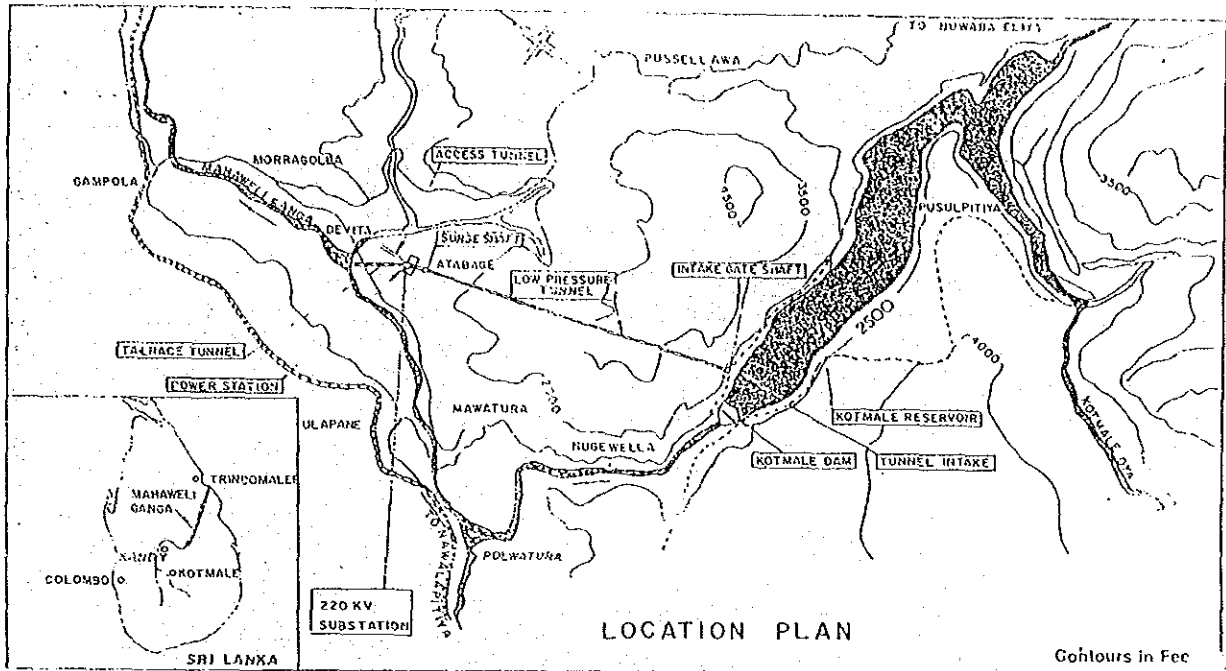
2. ダム関係資料
(Kotmale, Victoria & Moragahakanda dams)

ダム関係資料

Mahaweli Authority of Sri Lanka

KOTMALE HYDROPOWER PROJECT



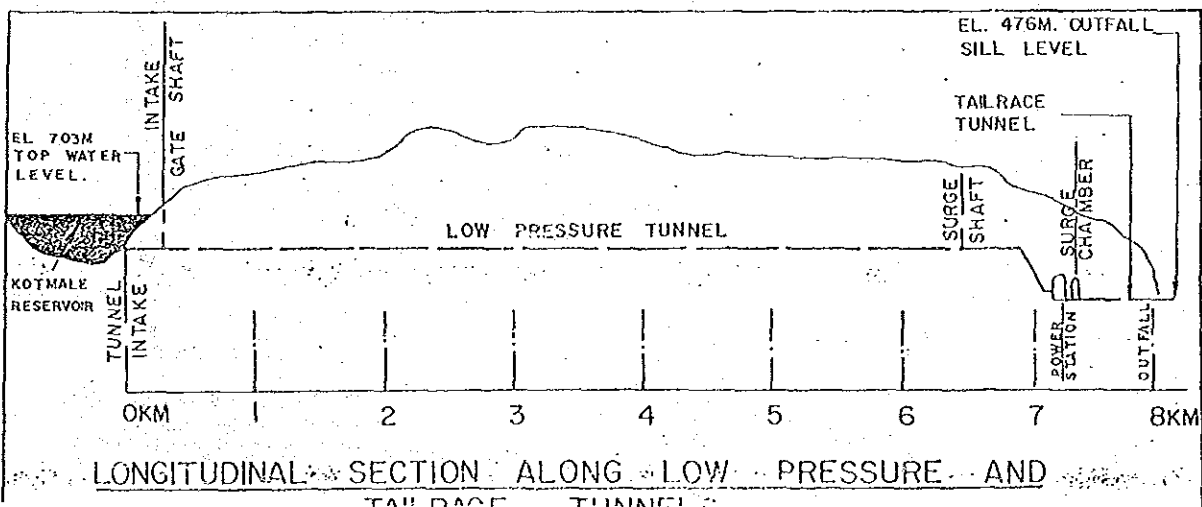


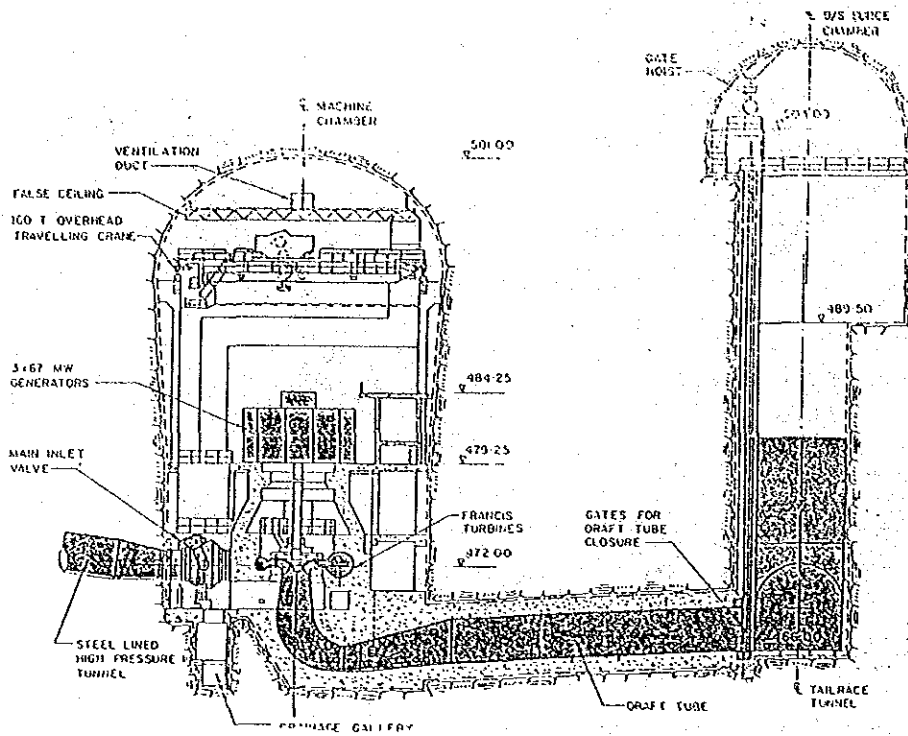
Project Description. (Kotmale Hydro power Project)

The Kotmale Project is one of five major headworks projects being undertaken under the Accelerated Mahaweli Ganga Scheme. It is the most upstream of these projects and develops the hydro potential of a major right bank tributary of the Mahaweli Ganga, the Kotmale Oya. The development consists essentially of a regulating reservoir on the Kotmale Oya formed by the Kotmale dam (the first in Sri Lanka with an upstream concrete membrane) at a point about 6½ km upstream of its confluence with the Mahaweli Ganga; a system of tunnels and shafts leads the water to an underground power station (the first underground station in Sri Lanka) on the right bank of the Mahaweli Ganga another 6½ km downstream of that confluence. The primary function of the project is the generation of electric power but additional irrigation and power benefits will arise from the improved regulation of river flows at the Polgolla diversion immediately upstream of the Victoria reservoir, and into that reservoir itself. The two initial 67 MW turbine generators at Kotmale will produce an average annual energy output of 445 million KW. hr.

The Kotmale Oya originates in the south central massif at an elevation of about 2,100m. It is about 70km long and drains an area of about 585 square km. At the dam site its catchment area is 544 square km and the elevation of the river bed is 620m above sea level. The project site is situated some 80km east of Colombo and about 30km south of Kandy.

Construction work on the Kotmale project commenced in September 1979. Although the contractual completion date was 22nd August 1985, acceleration of the work resulted in impounding of water in the reservoir being rescheduled for November 1984 and generation of electricity early in 1985.





CROSS SECTION THROUGH MACHINE AND SURGE CHAMBERS

Project Data

HYDROLOGY

Catchment area at Dam Site 514 sq km
 Maximum observed discharge 761.5 m³/sec

RESERVOIR

Top water level (TWL) 703 m — MSL
 Maximum flood level 704.3 m — MSL
 Minimum operation level (MOL) 665 m — MSL
 Gross Storage up to TWL 174 x 10⁶ m³

DAM

Type — Rockfill with concrete membrane
 Maximum height above bed level 87 m
 Crest Elevation 706.5 m
 Length along crest 600 m
 Total quantity of rockfill (approx) 4.3 x 10⁸ m³
 Average depth of curtain grouting through underlying limestone layer 170 m below river bed level

SPILLWAY

Type — Radial gated chute type spillway
 Number & size of gates 3 No. 14 m x 15 m
 Maximum capacity of spillway 5,550 m³/sec

DIVERSION TUNNELS

Type — 'D' type concrete lined
 Number & size 2 Nos. 9.2 m equivalent diameter
 Lengths — 746 m and 841 m
 Maximum capacity — 1,700 m³/sec (1 in 100 year flood)

LOW PRESSURE TUNNEL

Type — Horseshoe shaped concrete lined
 Total length — 695.4 m
 Equivalent diameter — 6.4 m
 Maximum capacity — 113.3 m³/sec (during construction)

UPSTREAM SURGE SHAFT

Type — Restricted Orifice
 Diameter — 15 m concrete lined
 Height — 142 m

HIGH PRESSURE SHAFT/PENSTOCK

Type — Circular concrete lined (steel lined at base)
 Diameter — Varies from 5.5 m to 4.8 m
 Length — 120 m

UNDERGROUND POWER STATION

Size of cavern — 67 m x 20 m x 30 m
 Installed Capacity — 2 x 67 MW with provision for a third unit of 67 MW
 Turbine — Type — Vertical Francis
 Rating — 67 MW at 201.5 m Nett Head
 Speed — 375 RPM
 Generator — Type — Conventional 3 bearing, vertical
 Cooling — Closed air/water cooled
 Rating — 90 MW/0.85 pf
 Crank capacity — 160 tonnes
 Gross Head — 226 m
 Annual Power Generation — 445 GWH
 Firm Energy — 310 GWH

TAILRACE TUNNEL

Type — Horseshoe concrete lined
 Length — 635 m
 Equivalent Diameter — 6.4 m

CLIENT:

Government of Sri Lanka
 represented by the Mahaweli Authority of Sri Lanka

CONSULTANTS

Halcrow Water
 Burderop Park, Swindon, Wiltshire,
 SN4 0DD, England

in collaboration with:

Kennedy & Donkin
 Westbrook Mills, Godalming
 Surrey GU 7, 2AZ, England, and

Central Engineering Consultancy Bureau
 Colombo 10, Sri Lanka.

CONTRACTORS

AB Skanska Cementgjuteriet (SKANSKA)
 S-182 25 Danderyd, Sweden
 (for civil works)

ASEA
 S-721 8 3 Vasterås, Sweden
 (for electro-mechanical equipment)

FINAL COST:

The total estimated cost of the project including cost escalation, works by Government agencies, consultancy services etc, is about Rs. 8,500,000,000.

FOREIGN FUNDING:

Some 80 per cent of the foreign currency requirements for the Project are being provided by Aid and credit from Sweden.

Main features of the project

HYDROLOGY AND DISCHARGE FACILITIES

Catchment area	1891 km ²
Mean river flow (31 years of record)	105 m ³ /s
Highest recorded river flow (excluding Hulu Ganga)	6000 m ³ /s
Design flood	9510 m ³ /s
Discharge capacity of gated flood overspill	7900 m ³ /s
Maximum discharge capacity of low level outlets	760 m ³ /s
Maximum discharge capacity of tunnel for 210 MW power output	140 m ³ /s
Maximum discharge capacity of compensation outlets	10.5 m ³ /s

RESERVOIR

Maximum flood water level	441.2 metres above sea level (ASL)
Normal top water level	438 metres ASL
Lowest drawdown level	370 metres ASL
Gross storage capacity (at 438 m ASL)	722 million m ³
Useful storage capacity (between levels 438 and 370 m ASL)	688 million m ³
Surface water area (at 438 m ASL)	23.7 km ²

DAM

Crest roadway level	442.5 metres ASL
Crest length	520 metres
Maximum height above foundations	122 metres
Height above original river bed	106.5 metres
Minimum thickness	6 metres
Maximum thickness	25 metres
Volume of concrete	480,000 m ³

STILLING BASIN

Minimum level of apron	337 metres ASL
Average width of apron	110 metres
Maximum length of apron	105 metres
Lengths of training walls - left bank	153 metres
- right bank	127 metres
Volume of concrete in stilling basin	43,000 m ³

TUNNEL

<i>Present development of one tunnel</i>	
Number of intake shafts	2
Depth of intake shafts	92 metres
Excavated diameter of shafts	12 metres
Length of tunnel	5.7 km
Diameter of tunnel (inside concrete lining)	6.2 metres
Excavated diameter of tunnel	7.2 metres
Depth of surge chamber	116 metres
Diameter of surge chamber (inside concrete lining)	21 metres
Depth of riser shaft	34.6 metres
Diameter of riser shaft (inside concrete lining)	6.2 metres
Throttle diameter in riser shaft	2.9 metres

POWER STATION

<i>Present development for three machines</i>	
Length of machine hall and control block	82 metres
Width of machine hall	16 metres
Maximum structural width	35 metres
Height above lowest foundation	37 metres
Depth of lowest foundation below original ground level	26 metres

TURBINES

Type	Francis
Number in present development	3
Total number for complete development	6
Level of spiral casing centreline	228 metres ASL
Design (net head)	190 metres
Speed of rotation	333 rev/min

GENERATORS

Type	Semi umbrella
Number in present development	3
Total number for complete development	6
Generating voltage	12.5 kV
With a 0.85 power factor the rated output for each generator	70 MW
Total rated capacity for present development	210 MW
Total rated capacity for complete development	420 MW
Maximum continuous output for each generator	81 MW
Total maximum continuous output for present development	243 MW
Total maximum continuous output for complete development	486 MW
Energy production capability	
- Firm	686 GWH/year
- Secondary	(Initial) 284 GWH/year
	(Ultimate) 368 GWH/year

Power Intake - Invert level	355.0
Crest level	448.0
Surge Chamber - Base level	299.202
Top level	457.000

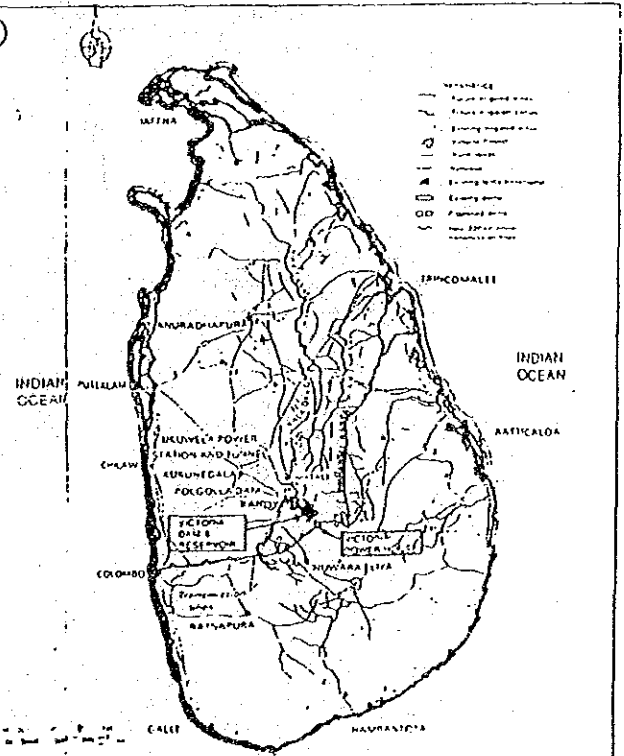
Lowlevel Outlets - 357.60

Outfall - 272.00

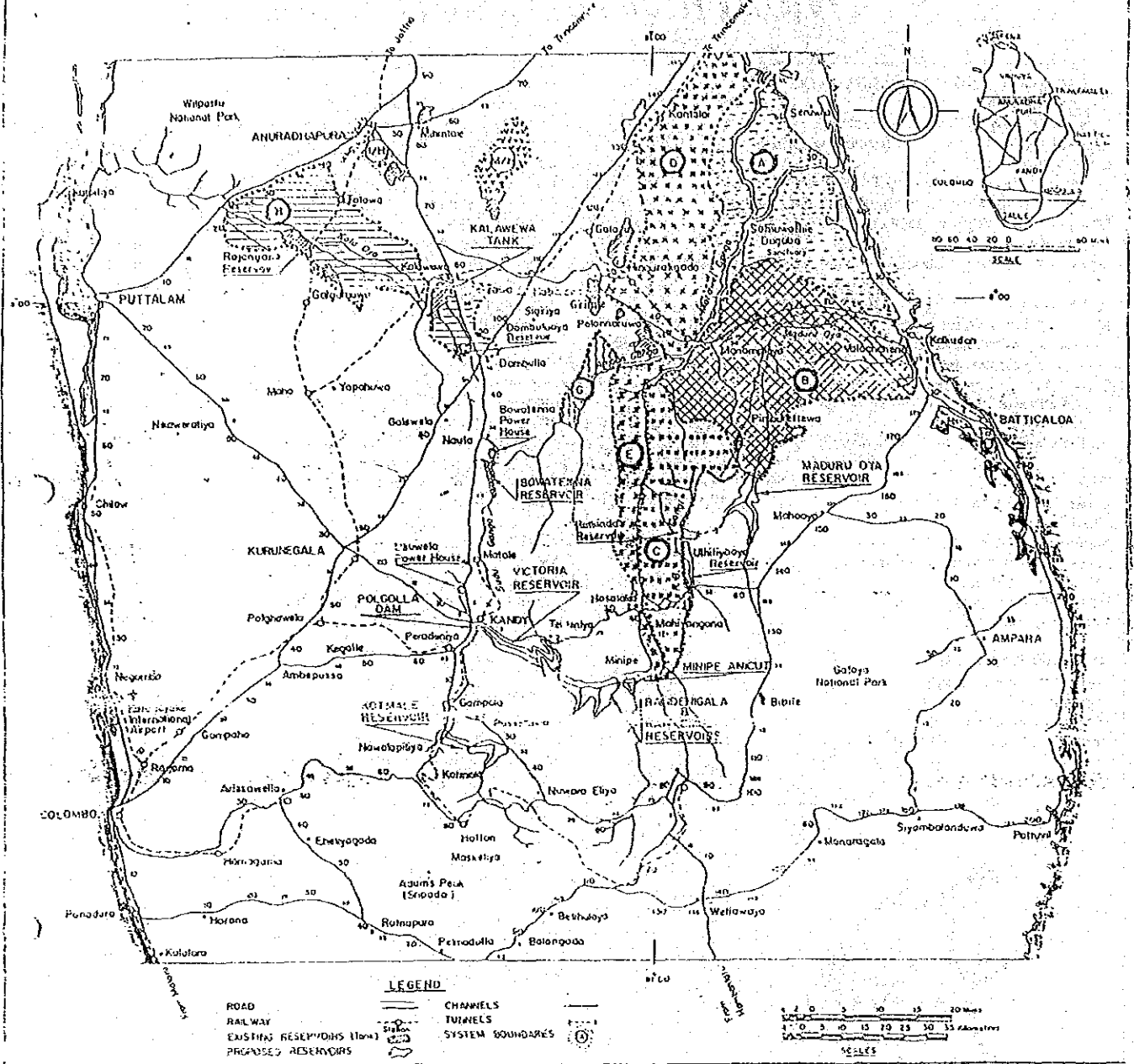
Turbine level - 228.00

Tailrace level - 230.00

Spillway - Automatic Radial Gates - 08 Nos.
(12.5 m x 6.5 m x 8)



ACCELERATED MAHAWELEI GANGA PROJECT: ROAD MAP TO PROJECT SITES



Main features of the project

Victoria Hydro-power Project

HYDROLOGY AND DISCHARGE FACILITIES	
Catchment area	1891 km ²
Mean river flow (31 years of record)	105 m ³ /s
Highest recorded river flow (excluding Huiu Ganga)	6000 m ³ /s
Design flood	9510 m ³ /s
Discharge capacity of gated flood overspill	7900 m ³ /s
Maximum discharge capacity of low level outlets	760 m ³ /s
Maximum discharge capacity of tunnel for 210 MW power output	140 m ³ /s
Maximum discharge capacity of compensation outlets	10.5 m ³ /s

RESERVOIR	
Maximum flood water level	441.2 metres above sea level (ASL)
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Minimum level of apron	337 metres ASL
Average width of apron	110 metres
Maximum length of apron	105 metres
Lengths of training walls - left bank	153 metres
- right bank	127 metres
Volume of concrete in stilling basin	43,000 m ³

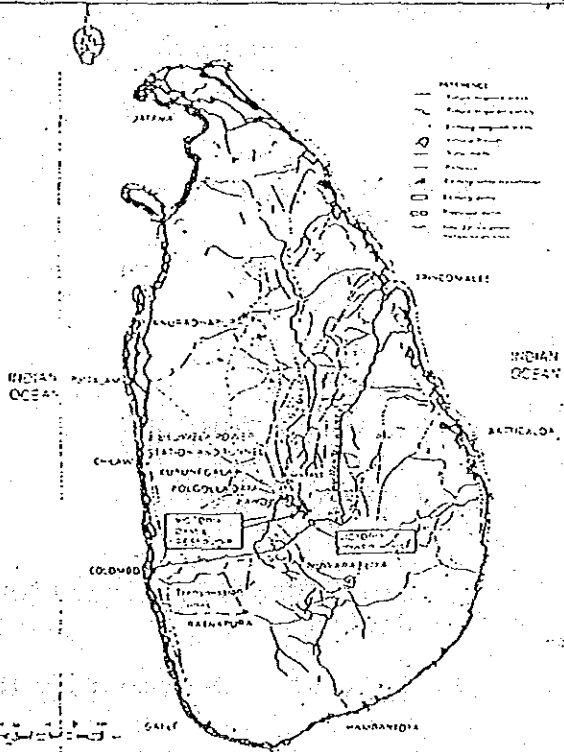
TUNNEL	
Present development (one bore)	
Number of intake shafts	2
Depth of intake shafts	92 metres
Excavated diameter of shafts	12 metres
Length of tunnel	5.7 km
Diameter of tunnel (inside concrete lining)	6.2 metres
Excavated diameter of tunnel	7.2 metres
Depth of surge chamber	116 metres
Diameter of surge chamber (inside concrete lining)	21 metres
Depth of riser shaft	34.6 metres
Diameter of riser shaft (inside concrete lining)	6.2 metres
Tyre-tie diameter in riser shaft	2.9 metres

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Maximum continuous output for each generator	81 MW
Total maximum continuous output for present development	243 MW
Total maximum continuous output for complete development	486 MW
Energy production capability	
- Firm	685 GWH/year
- Secondary	(Initial) 284 GWH/year (Ultimate) 368 GWH/year

ADDITIONAL INFORMATION	
Lowlevel Outlets (invert)	357.60 ASL
Spillway-automatic Radial Gates (12.5m x 6.5m)	08 Nos.
Power Intake - Invert level	355.00 ASL
Crest level	447.00 ASL
Surge Chamber - Invert level	299.202 ASL
Crest level	457.000 ASL
Downstream Portal (invert)	272.00 ASL
Toilroce level	230.00 ASL



MORAGAHAKANDA

Principal Features of the Project

DAM AND RESERVOIR

Catchment Area	782 km ²
Reservoir Area	40.5 km ²
Effective Storage Capacity	686 x 10 ⁶ m ³
High Water Level	EL.+ 195 m
Low Water Level	EL.+ 170 m

Parameter of Dams

Type	Main Dam	1st Saddle-dam	2nd Saddle-dam
	Rockfill	Concrete Gravity	Rockfill
Crest Elevation	EL.+ 199.0m	EL.+197.5m	EL.+199.0m
Max. Height	72.0 m	62.5 m	42.0 m
Crest Length	490 m	396 m	490 m
Dam Concrete Volume	-	376.000 m ³	-
Embankment Volume	2,430,000 m ³	-	430.000 m ³

Spillway

Type	Overflow Weir and Stilling Basin
Gates	4 Nos. 17.5 x 8.5
Design Flood Inflow	4,650 m ³ /sec. (1.2 times/200 year flood)
Design Outflow	3.400 m ³ /sec.

Penstock

Diameter	3.900 mm - 3.200 mm
Length	87 m

Power Station (First Stage only)

Installed Capacity	26 MW
Turbine	1 unit of Vertical Shaft, Francis
Generator	1 unit of 30.5 MVA
Rated head	54.8 m
Design Head	43.5 m
Max. Discharge	56.6 m ³ /sec.
Dependable Peak Power	16.1 MW
Annual Energy Output	145.1 GWH

Transmission Line

Voltage	132 kV, Single Circuit
Distance	16 km

Construction Cost

Rs 1,715.1 million (US\$114.34 million)
on 1978 price basis.

Construction Period

4.5 years (July, 1981 - December, 1985)

DOWNSTREAM DEVELOPMENT

<u>Proposed Project Area</u>	40,000 ha (98,900 ac)
Existing Area	40,000 ha (98,900 ac)
Other Scheme Newland	8,300 ha (20,500 ac)
	4,200 ha by Suger Corporation
	4,100 ha by E.E.C.
Moragahakanda New land	13,900 ha (34,400 ac)
Total	62,200 ha (153,800 ac)

Water Requirements

Mean Annual Diversion Requirements	1,788 x 10 ⁶ m ³
Unit Irrigation Requirements	1.43 l/sec/ha
Unit Diversion Requirements	1.91 l/sec/ha

Improvement of Existing Facilities

Elahera Anicut	No improvement is required
Angamedilla Anicut	To be improved
Improvement of Yoda Ela	21.7 km of Elahera-Minneriya Yoda Ela
Improvement of Main and Branch Canal	16.4 km of Faudulla H.L.B. 33.5 km of Parakrama Samudra D1. Total 49,9 km
Facility Improvement of Existing Area	38,000 ha (excluding System G 2,000 ha)

Proposed Construction Works for Newland

Irrigation Canal	System D1	58.2 km
	System D2	52.8 km
	System A/D	34.2 km
	Total	145.2 km
Drainage Canal	System D1	44.1 km
	System D2	32.5 km
	System A/D	14.8 km
	Total	91.4 km
Headworks for System A/D	Kalu Ganga Tank	
	Yoda Ela Anicut	
	Kalu Ganga Anicut	

Weights and Measures

1 acre (ac.)	= 0.405 hectares (ha.)
1 mile (ml.)	= 1.609 kilometers (km.)
1 square mile (sq.ml.)	= 2.589 square kilometers (km ²)
1 foot (ft.)	= 0.3048 meter (m)
1 acre foot (ac.ft.)	= 1,233.5 cubic meters (m ³)
1 cube	= 100 cubic feet = 2.832 m ³
1 inch (in.)	= 25.4 millimeters (mm)
1 cusec	= 0.0283 cubic meters per second (m ³ /sec)
1 pound (lb.)	= 0.4536 kilograms (kg)
1 bushel (bu.) of paddy	= 46 lb. = 20.87 kilograms (kg)

Currency Equivalents

1 US\$ = 15.0 Rs = 195 Yen (Dec. 1978, Exchange rate)

1 Rs = 0.067 US\$ = 13.0 Yen

Land Reclamation (unit: ha)

<u>System</u>	<u>Field</u>	<u>Homestead</u>	<u>Total</u>
D1	9,199	1,810	10,910
D2	2,200	440	2,640
A/D	2,600	540	3,140
Total	13,900	2,790	16,690

Related Structures (unit: No.)

Structure	<u>System</u>			Total
	D1	D2	A/D	
Aqueduct	0	3	6	9
Cross Drain	6	0	6	12
Drainage Inlet	9	0	5	14
Bridge	56	45	40	141
Turnout	39	11	22	72
Diversion	4	4	4	12
Check Gate	21	7	13	41
Water Management Device	6	5	3	14
Drop	24	2	6	32
Spillway and Wasteway	4	2	2	8
Washing and Bathing Place	18	16	11	45

Construction Cost

US\$60.0 million (1978 price basis)

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位置图

