DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

FEASIBILITY STUDY ON WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

VOLUME II

ANNEX - I～IX AGRICULTURE AND IRRIGATION

JANUARY, 1993

JAPAN INTERNATIONAL COOPERATION AGENCY

DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

FEASIBILITY STUDY ON WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

VOLUME II

ANNEX - I~IX AGRICULTURE AND IRRIGATION

JANUARY, 1993

JAPAN INTERNATIONAL COOPERATION AGENCY

FEASIBILITY STUDY
ON
WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

ANNEX-I ~ IX AGRICULTURE AND IRRIGATION

Contents

1. Scope of Work and Minutes of Discussions A1.1-1
   1.1 Scope of Work for the Feasibility Study on Walawe Irrigation and Extension Project A1.1-1
   1.2 Minutes of Discussion on Inception Report A1.2-1
   1.3 Minutes of Discussion on Progress Report (I) A1.3-1
   1.4 Minutes of Discussion on Interim Report A1.4-1
   1.5 Minutes of Discussion on Progress Report (II) A1.5-1
   1.6 Minutes of Discussion on Draft Final Report (FINAL REPORT only) ... A1.6-1
   1.7 Comments from MASL (FINAL REPORT only) A1.7-1

2. Meteorology and Hydrology A2-1
   2.1 General A2-1
      2.1.1 Sri Lanka A2-1
      2.1.2 Walawe basin A2-1
   2.2 Meteorology A2-2
      2.2.1 Meteorological observation A2-2
      2.2.2 Rainfall A2-3
   2.3 Hydrology A2-5
      2.3.1 Gauging stations A2-5
      2.3.2 Previous studies on Uda Walawe reservoir inflow A2-5
      2.3.3 Extension of run-off data A2-6
      2.3.4 Operation of Samanalawewa reservoir A2-8
   2.4 Water Quality A2-8
   2.5 Ground Water A2-10

3. Soil and Land Use A3-1
   3.1 Soil A3-1
      3.1.1 Introduction A3-1
      3.1.2 Basic assumptions A3-1
      3.1.3 Soil distribution in the Study area A3-6
   3.2 Present Land Use Condition A3-6
   3.3 Land Use Plan in the Study Area A3-8
      3.3.1 Land capability classification and evaluation method A3-8
      3.3.2 Land class distribution and evaluation method A3-9
      3.3.3 Land utilization types A3-9
      3.3.4 Proposed land use plan A3-10
   3.4 Recommendation A3-12

4. Topographic Surveys A4-1
   4.1 Available Topographic Data and Information A4-1
   4.2 Topographic Surveys Executed under the Study A4-2

5. Geology and Soil Mechanics A5-1
5.1 General A5-1
5.1.1 Objectives of the Study A5-1
5.1.2 Geological and soil mechanics information A5-1
5.2 Geology A5-2
5.2.1 Regional Geology A5-2
5.2.2 Geology in and around the Study area A5-2
5.2.3 Geohydrology A5-5
5.3 Geotecnical Evaluation of Structure Foundation A5-5
5.3.1 General A5-5
5.3.2 Walawe bridge site A5-6
5.3.3 Water intake weir sites on the Timbolketiya river A5-6
5.3.4 Canals and tanks A5-7
5.4 Geotechnical Evaluation of Construction Materials A5-9
5.4.1 Laboratory test A5-9
5.4.2 Earth materials for canal embankment A5-10
5.4.3 Concrete aggregates A5-11
5.4.4 Road construction materials A5-13
5.5 Summary and Conclusion A5-13
5.5.1 Summary and conclusion A5-13
5.5.2 Recommendations for further investigation A5-16

6. Agriculture and Agro-economy A6-1
6.1 National Economy and Regional Development Plans A6-1
6.1.1 National economy A6-1
6.1.2 National agricultural development plan A6-3
6.1.3 Regional development plans A6-4
6.1.4 Previous developments and development plans A6-5
6.2 Socio-economic Situation A6-7
6.2.1 Administrative organization A6-7
6.2.2 Population, households and farmers A6-8
6.3 Agricultural Activities A6-9
6.3.1 Cropping pattern and cultivated area A6-9
6.3.2 Farming practices, yield and production A6-10
6.3.3 Livestock A6-11
6.4 Land Tenure and Holdings A6-13
6.5 Agricultural Marketing, Post Harvest and Prices A6-15
6.5.1 Agricultural Marketing system A6-15
6.5.2 Post harvest and processing A6-18
6.5.3 Prices of agro-products and inputs A6-18
6.6 Agricultural Supporting System A6-20
6.6.1 Agricultural research A6-20
6.6.2 Extension services A6-21
6.6.3 Agricultural credit A6-23
6.6.4 Farmer organizations A6-24
6.6.5 Agricultural inputs A6-24
6.7 Farm Economy A6-25
6.7.1 Present crop budget and present agricultural production value A6-25
6.7.2 Present household economy A6-26
6.8 Farmer Intention to Crop Diversification A6-29
6.9 Present Agricultural Constraints and Development Potential A6-30
6.9.1 Physical conditions A6-30
6.9.2 Economic conditions A6-31
6.9.3 Social conditions A6-32

6.10 Proposed Cropping Pattern A6-33
6.10.1 Basic concept and conditions for crop selection A6-33
6.10.2 Cropping calender A6-33
6.10.3 Alternative cropping patterns A6-33
6.10.4 Proposed cropping pattern A6-34
6.11 Proposed Farming Practices A6-35
6.11.1 General considerations A6-36
6.12 Expected Yields and Production A6-37
6.12.1 Paddy A6-37
6.12.2 Sugarcane A6-38
6.12.3 Big onion A6-38
6.12.4 Banana A6-39
6.12.5 Vegetable A6-39
6.12.6 Expected production A6-39
6.13 Anticipated Marketing, Processing and Price Prospects A6-39
6.13 1 Marketing development A6-39
6.13.2 Processing of agricultural products A6-41
6.13.3 Price prospects A6-42
6.14 Future Crop Budget A6-43
6.15 Future Farm Economy A6-43
6.16 Settlements plan A6-44
6.16.1 Present situation in the study area A6-44
6.16.2 Selection criteria and instructions A6-45
6.16.3 Settlement assistance A6-45
6.17 Proposed Agricultural Supporting System A6-46
6.17.1 Agricultural research A6-46
6.17.2 Agricultural extension A6-47
6.17.3 Agricultural credit A6-47
6.17.4 Agricultural inputs A6-48
6.18 Basic Approach to Organizational Development A6-48
6.18.1 Summary of problems of organization A6-48
6.18.2 Basic approach for development A6-49
6.18.3 Proposed improvement A6-49
6.18.4 Training programme (Agricultural training) A6-49

7. Irrigation Drainage and Rural Infrastructure A7.1-1
7.1 Present irrigation and drainage Condition A7.1-1
7.1.1 Existing irrigation and drainage system A7.1-1
7.1.2 Water resource and irrigation condition A7.1-2
7.1.3 Assessment of existing irrigation and drainage facilities in the old area A7.1-4
7.1.4 Water management and its organization A7.1-6
7.1.5 Water Management in drought A7.1-8
7.2 Record of Irrigation Area by Crop (Tables only) A7.2-1
7.3 Present Condition of Rural Infrastructure A7.3-1
7.3.1 Roads A7.3-1
7.3.2 Household A7.3-3
7.3.3 Health and medical facilities A7.3-3
7.3.4 Education facilities A7.3-3
7.3.5 Public transportation services A7.3-4
7.3.6 Communication and postal services A7.3-4
7.3.7 Electricity supply A7.3-5
7.3.8 Drinking water supply A7.3-5
7.3.9 Waste and sewage treatment A7.3-5
7.3.10 Assessment of present condition and its constraints A7.3-5

7.4 Assessment for Flow Capacity of LMBC and BBC A7.4-1
7.4.1 General A7.4-1
7.4.2 Control point A7.4-1
7.4.3 Calculation of head loss A7.4-1
7.4.4 Result A7.4-4
7.5 Estimate of Irrigation and Drainage Water Requirements A7.5-1
7.5.1 Irrigation field tests A7.5-1
7.5.2 Estimate of irrigation water requirements of the Study area A7.5-3
7.5.3 Irrigation and other water requirements of related areas A7.5-7
7.5.4 Water requirement of the Walawe area A7.5-8
7.5.5 Estimate of drainage water requirement A7.5-8
7.6 Preliminary Design of Irrigation and Drainage Facilities A7.6-1
7.6.1 Rehabilitation and improvement work of the existing irrigation and drainage facilities A7.6-1
7.6.2 Proposed irrigation facilities in the irrigation extension area A7.6-3
7.6.3 Proposed drainage facilities in the irrigation extension area A7.6-6
7.6.4 Proposed road network in the irrigation extension area A7.6-7
7.6.5 Proposed on-farm and land reclamation works in the irrigation extension area A7.6-7
7.7 Rural Infrastructure Development Plan A7.7-1
7.7.1 Basic considerations A7.7-1
7.7.2 Development plan A7.7-2
7.8 Preliminary Design of the Timbolketiya Diversion Scheme A7.8-1
7.8.1 Background A7.8-1
7.8.2 Basic conditions and considerations A7.8-1
7.8.3 Alternative facility plans A7.8-2
7.8.4 Conclusion and recommendation A7.8-4
8. Water Balance Study A8-1
8.1 General A8-1
8.2 Available Water Resources A8-1
8.3 Water Demands A8-2
8.4 Results of Water Balance Calculation A8-4
8.4.1 Conditions of calculation A8-4
8.4.2 Results of water balance study A8-5
8.5 Conclusions A8-6
9. Implementation Program, Project Cost, Benefit and Economic Evaluation A9.1-1
9.1 Project Cost Estimate A9.1-1
9.1.1 Condition of cost estimate A9.1-1
9.1.2 Direct construction cost A9.1-2
9.1.3 Associated costs A9.1-3
9.1.4 Disbursement schedule and price contingency A9.1-3
9.1-5 Summary of construction cost A9.1-4
9.2 Basic Assumptions for Economic Evaluation A9.2-1
9.2.1 General A9.2-1
9.2.2 Basic assumptions A9.2-1
9.2.3 Economic prices A9.2-1
9.2.4 Economic project costs A9.2-2
9.2.5 Economic benefits A9.2-2
9.3 Economic Evaluation A9.3-1
9.3.1 EIRR, B/C and B-C A9.3-1
9.3.2 Sensitivity analysis A9.3-1
9.4 Financial Evaluation A9.4-1
9.4.1 Basic assumptions A9.4-1
9.4.2 Farm budget analysis A9.4-1
9.4.3 Repayment capability of project A9.4-2
9.5 Increase of employment opportunity A9.5-1
9.6 Indirect benefits and Socio-economic Impacts A9.6-1

Annex - I

Scope of Works and Minutes of Discussions

ANNEX-I SCOPE OF WORK AND MINUTES OF DISCUSSIONS

Contents

1-1	Scope of Work for the Feasibility Study on Walawe Irrigation and Extension Project	A1.1-1
1-2	Minutes of Discussion on Inception Report	A1.2-1
1-3	Minutes of Discussion on Progress Report (I)	A1.3-1
1-4	Minutes of Discussion on Interim Report	A1.4-1
1-5	Minutes of Discussion on Progress Report (II))	A1.5-1
1-6	Minutes of Discussion on Draft Final Report	A1.6-1
1-7	Comments from MASL	A1.7-1
1-8	Answer for Comment from the JICA Team	A1.8-1

SCOPE OF WORK

FOR

THE FEASIBILITY STUDY

ON

WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

AGREED UPON BETWEEN

MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

COLOMBO, 21ST NOVEMBER 1990

A.A. WIJETUNGA
SECRETARY,
MINISTRY OF LANDS, IRRIGATION
AND MAHAWELI DEVELOPMENT

古川和吉

KAZUYOSHI FURUKAWA
LEADER,
THE PRELIMINARY STUDY TEAM,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the Democratic Socialist Republic of Sri Lanka (hereinafter referred to as "the Government"), the Government of Japan has decided to undertake the feasibility study on Walawe Irrigation Upgrading and Extension Project (Left Bank) (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 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:

1. to formulate comprehensive agricultural water resources development programmes in Walawe Irrigation Upgrading and Extension Project (Left Bank) (approximately 30,000 ha.);

2. to conduct a feasibility study on Extension of Walawe Left Bank (approximately 15,000 ha.);

3. to undertake on-the-job training of the Government's officials in the course of the study.

III. STUDY AREA

The study area is to cover Walawe Left Bank, 30,000 ha. (Location map attached in Annex 2).

IV. SCOPE OF THE STUDY

In order to achieve the above objectives, the Study will cover the following items.

PHASE I STUDY

1. Collection and analysis of the relevant existing data and information, and field survey including:

   (i) Natural condition

   a. Topography

   b. Meteorology and hydrology

   c. Geology and soil

   d. Others

K.F

(2) Agriculture

a. Land use and tenure

b. Cropping pattern, yield and Livestock

c. Agro-economy and institution

d. Others

(3) Agricultural infrastructure

a. Irrigation and drainage

b. Farm road

c. Other rural infrastructure

(4) Socio-economic situation

a. Population, household and farmers

b. Regional socio-economy and farm household economy

c. Extension services

d. Social and farmers organizations

e. Agricultural credit

f. Farmers' intension

g. Marketing

h. Others

K.F

(5) Other information related to the project

a. Administrative organizations related to the project

b. Environmental impact

c. Others

2. Formulation of an agricultural development plan of Walawe Left Bank (old area and extension)

3. Formulation of an irrigation and drainage plan of Walawe Left Bank (old area and extension).

PHASE II STUDY

1. Feasibility Study in the extension area of Walawe Left Bank. The Study covers the following items:

(1) Additional field survey, data collection and analysis including;

a. Hydrology and meteorology

b. Geology and soil classification

c. Land use and tenure

d. Cropping pattern, yield and Livestock

e. Irrigation and drainage

f. Inundation problem, flood damage

g. Water requirement for crop and domestic use

h. Regional socio-economy and farm household economy

i. Social and farmers organizations (inclusive of training)

j. Farm power

k. Construction materials

l. Environment

m. Post Harvest Technology, Marketing and Agro-Industry

n. Others

(2) Formulation of an agricultural development programme.

(3) Formulation of irrigation and drainage development programme

(4) Preliminary design of the major structures of the Project

(5) Formulation of Plan for Irrigation system management (inclusive of operation and maintenance plan for irrigation and drainage).

(6) Verification of feasibility

a. Preparation of the implementation schedule

b. Estimation of the project costs and benefits

(7) Recommendation

V. THE STUDY SCHEDULE

The Study will be carried out in accordance with the tentative schedule attached in Annex 1.

K.F

VI. REPORTS

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

1. Inception Report

   Thirty (30) copies at the commencement of the Phase I Study.

2. Progress Report (I)

   Thirty (30) copies at the end of the field work of the Phase I Study.

3. Interim Report

   Thirty (30) copies at the commencement of the Phase II Study.

4. Progress Report (II)

   Thirty (30) copies at the end of the field work of the Phase II Study.

5. Draft Final Report

   Thirty (30) copies within one (1) month after the end of the Phase II Study.

   The Government of Sri Lanka shall provide its comments on the Draft Final Report within one (1) month after its reception.

6. Final Report

Fifty (50) copies within two (2) months after the receipt of the comments on the Draft Final Report.

VII. UNDERTAKING OF THE GOVERNMENT OF SRI LANKA

1. To facilitate smooth conduct of the Study, the Government of Sri Lanka shall take necessary measures;

(1) to secure the safety of the 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 exempt them from alien registration requirements and consular fees,

(3) to exempt the members of the Japanese Study Team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into Sri Lanka for the conduct of the Study,

(4) to exempt the members of the Japanese Study Team from income tax and other charges of any kind imposed on or in connection with any emoluments or allowance 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 remittances as well as utilization of the 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, according to prevailing regulations of the Government of Sri Lanka,

(7) to secure permission to use all data and documents related to the Study including photographs in Japan,

(8) to provide medical services as needed. Its expenses will be chargeable on the members of the Japanese Study Team.

2. The Government of Sri Lanka will 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 willful misconduct on the part of the members of the Japanese Study Team.

3. The Ministry of Lands, Irrigation and Mahaweli Development of Sri Lanka (hereinafter referred to as "the Ministry") shall act as counterpart agency to the Japanese Study Team and also as coordinating body to other relevant organizations for the smooth implementation of the Study.

4. The Ministry 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) Counterpart personnel

(3) Suitable office with necessary equipment and furniture

(4) Necessary number of vehicles with drivers

(5) Credentials or identification cards to the members of the Japanese Study Team

(6) Supplementary engineering survey
topographic survey

VIII. UNDERTAKING OF JICA

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

K.F

1. To dispatch, at its own expense, the Study Team to Sri Lanka,

2. To pursue technology transfer to the Sri Lanka counterpart personnel in the course of the Study.

IX. OTHERS

JICA and Ministry of Lands, Irrigation and Mahaweli Development of Sri Lanka will consult with each other in respect of any matter that may arise from or in connection with the Study.

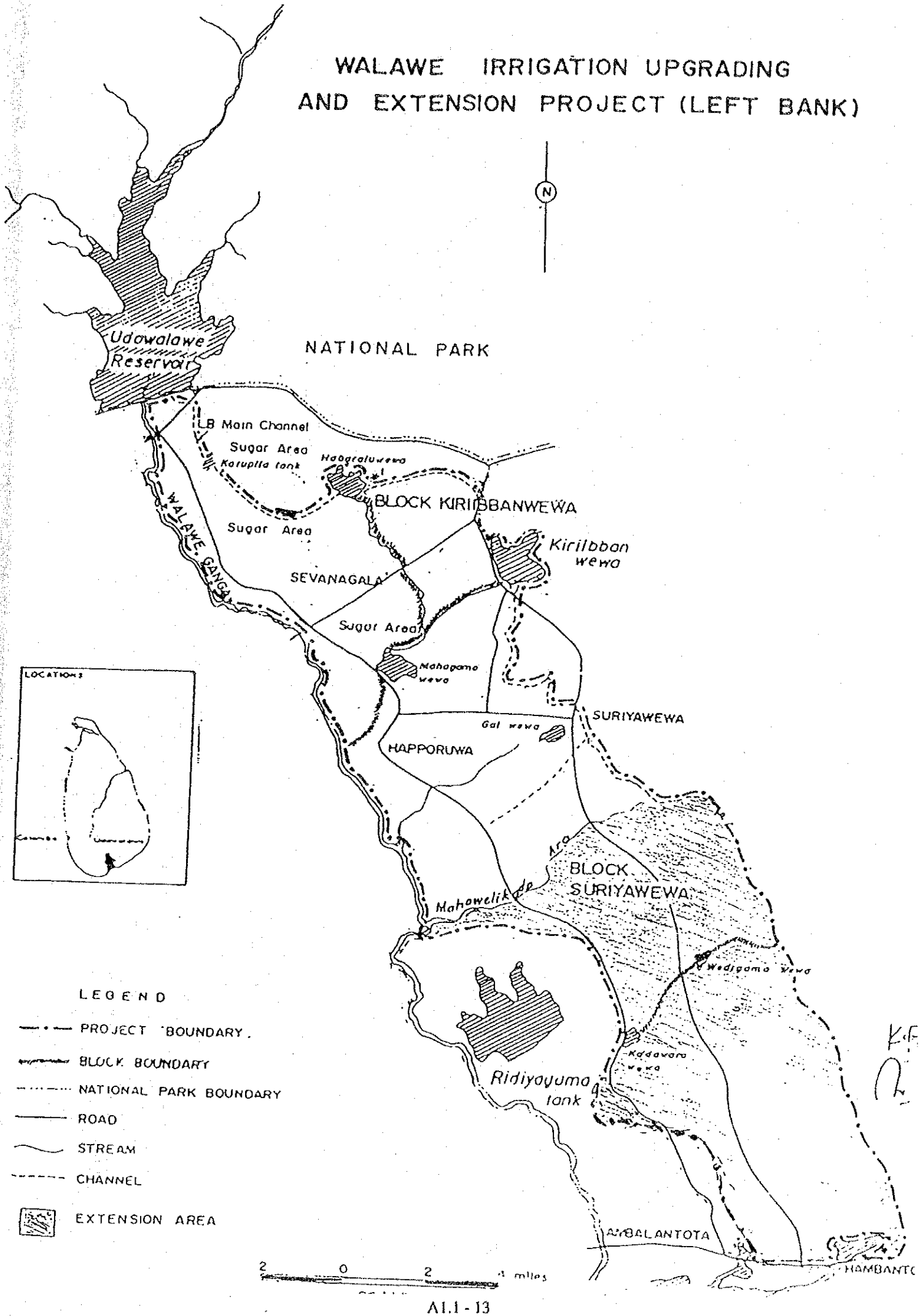
TENTATIVE SCHEDULE

Item \ Month	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
WORK IN SRI LANKA	▬▬ ▬▬ ▬ O
WORK IN JAPAN	□ □ □
REPORTS	△ △ △ △ △ △ INC/R P/R (I) INT/R P/R (II) DF/R F/R

(Remarks) INC/R : Inception Report P/R : Progress Report
INT/R : Interim Report DF/R : Draft Final Report
F/R : Final Report
O Comments on DF/R by SRI LANKA side

K.F

WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT (LEFT BANK)



MINUTES OF DISCUSSION

ON

INCEPTION REPORT

FOR

THE FEASIBILITY STUDY

ON

WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

(LEFT BANK)

OCTOBER 4, 1991

A. A. WIJETUNGA
SECRETARY,
MINISTRY OF LANDS, IRRIGATION
AND MAHAWELI DEVELOPMENT

大谷俊人
TOSHIHITO OHTANI
TEAM LEADER OF JICA STUDY TEAM

WITNESSED BY : KATSUMI OTANI
JICA

Thirty (30) copies of the Inception Report were submitted to the Government of Sri Lanka on October 1, 1991. JICA Study Team explained the Inception Report. Meetings were held to discuss the Inception Report as follows:

A. First Meeting

1. Date and Time : October 2, 1991 (11:00 am - 12:10 pm

2. Place : Conference Room of Ministry of Lands, Irrigation and Mahaweli Development

3. Attendants : See attached list (A)

4. Summary of Discussion:

Meeting was opened by the Secretary of the Ministry of Lands, Irrigation and Mahaweli Development by his statement that the President and the Minister for Lands, Irrigation and Mahaweli Development have placed the highest priority on the Walawe Left Bank Project for the development of the southern area of the country. Ministry and Mahaweli Authority of Sri Lanka (MASL) would extend every assistance to the JICA Study Team on their part. The following issues were discussed and/or confirmed between the Ministry and JICA Study Team :

(1) The Inception Report was generally accepted by the Ministry with following observations.

(2) Regarding the crop diversification, the Secretary stated that it would be difficult to introduce a step-wise development mentioned in the Report from the some experiences of the Ministry. It was stressed by the Secretary that promoting cultivation of high value crops other than paddy should be looked into from the beginning of the project, where soil and other conditions were permitted to introduce high value crops.

(3) The data and information related to the Samanalawewa reservoir, especially its operation plan will be supplied by the Ministry to the Team.

(4) The proposed project should be formulated encompassing not only irrigation and drainage system but also agricultural and social infrastructure. The infrastructure should be provided at the minimum requirement level.

(5) The undertaking of the Ministry mentioned in the Inception Report will be met fully by the Ministry.

B. Second Meeting

1. Date and Time : October 3, 1991 (10:00 am - 11:30 am)

2. Place : Conference Room of the Planning and Monitoring Unit of Mahaweli Authority of Sri Lanka

3. Attendants : See attached list (B)

4. Summary of Discussion

The undertaking of the Ministry were confirmed between MASL of the Ministry and JICA Study Team as follows:

(i) Counterpart personnel will be provided as per attached list (C). Additional full time counterpart personnel for Mr. Yamada will be nominated on coming Monday.

(ii) Office space with appropriate furniture and equipment will be provided for the site. Office in Colombo will be decided on coming Monday.

(iii) Supporting staff for field survey will be provided as follows:

- Farm economic survey (Six persons including one supervisor for 1 month)
- Soil survey (1 field assistant and 5 labourers for 1 month)

(iv) Laboratory tests of soils, water quality and soil mechanics will be carried out by the Ministry in accordance with the technical specifications to be prepared by the Study Team.

(v) Three vehicles composing one jeep type car and two sedan type cars will be provided as a base requirement from coming Monday. Additional required vehicles will be provided in accordance with the request of the Team.

(vi) Extension of visit visa of the Team members will be arranged by the Ministry.

Attendance of the Meeting on Left Bank Development in Walawe held on 02.10.1991 at Ministry of Lands, Irrigation and Mahaweli Development

1.	Mr A.A.Wijetunge	Secretary,Ministry of Lands, Irrigation & Mahaweli Development.
2.	Mr W.Tennakoon	Secretary, Mahaweli Development
3.	Mr K.H.S. Gunatilaka	Director General,MASL
4.	Mr P.T.Senaratne	Secretary General,MASL
5.	Mr Ariya Abeysinghe	Director, Agricultural Planning, MLID
6.	Mr M.J.S.Amarasinghe	General Manager, MEA
7.	Mr G.J.P.Gunawardena	Managing Director,MECA
8.	Mr G.W.D.M. Goonaratne	Director Engineering II,MASL
9.	Dr R.D.Wanigaratne	Director,PMU
10.	Mr M.Galpoththage	Project Coordinator,UW & UM
11.	Mr H.D.L.U.Nirodharawardena	Project Director, Uda Walawe - Left Bank
12.	Mr T.D.P.Karunatilaka	Chief Irrigation Engineer, MEA
13.	Mr D.A.Handapangoda	Resident Project Manager,Walawe
14.	Mr Asoka Cooray	Principal Engineer/Env.Planner-PMU
15.	Mr Chula Wellappili	Regional/Physical Planner-PMU
16.	Mr Senaka Samarasinghe	Settlement Planner-PMU
17.	Mr S.M.D.Malalaratne	Asst.Project Coordinator-MASL
18.	Mr W.O.Peiris	Project Irrigation Engineer, Walawe
19.	Mr T.Yamashita	JICA, Colombo
20.	Mr K.Yamada	JICA Study Team
21.	Mr T.Yumino	-do-
22.	Mr K.Okada	-do-
23.	Mr T.Otani	-do-
24.	Mr L.K.Devasiri	-do-

List B

Attendance of the Meeting on Left Bank Development in Walawe held on 03.10.1991 at PMU

1.	Dr R.D.Wanigaratne	Director/PMU
2.	Mr M.J.J.Amerasinghe	General Manager/MEA
3.	Mr Senaka Samarasinghe	Settlement Planner/PMU
4.	Mr T.D.P. Karunatilaka	CIE/MEA
5.	Mr N.P.Jayawardena	CE/MEA
6.	Mr T.N.Srithara	MECA
7.	Mr U.S.K.Pitawala	DE/MECA
8.	Mr W.Osmand Peiris	IE (Uda Walawe)
9.	Mr D.A.Handapangoda	RPM (Walawe)
10.	Mr B.S.Liyanagama	AD/WMS
11.	Mr Chula Wellappili	Regional/Physical Planner-PMU
12.	Mr Asoka Cooray	Environmental Planner/PMU
13.	Mr M.Galpoththage	PC/MEA (Walawe)
14.	Mr K. Otani	JICA
15.	Mr K.Yamada	JICA Study Team
16.	Mr T.Yumino	-do-
17.	Mr K.Okada	-do-
18.	Mr T.Otani	-do-
19.	Mr L.K.Devasiri	-do-

List C

Feasibility Study on Walawe Irrigation Upgrading and Extension Project (Left Bank)

Study Team Composition:

JICA Study Team	Position	MASL Counterpart Team	Position
T.Ohtani	Team Leader	Dr R.D.Wanigaratne	Director/PMU
		Mr N.A.L.Cooray	Environmental Planner/PMU
K.Okada	Irrigation and Drainage Engineer	Mr T.D.P. Karunatilaka(HQ)	Chief Irrigation Engineer/M
		Mr Osman Peiris (Field)	Irrigation Engineer/Uda Walawe
T.Yumino	Meterologist/ Hydrologist	Mr D.G.L. Ranatunge	Director/MECA
		Mr B.S.Liyanagama	AD/WMS
K.Yamada	Pedologist/Land Use Planner	Mr S.Dimantha	Head/Land Use Division-ID
		Mr C.Wellappili	Regional/Physical Planner-P
		Mr S.Samarasinghe	Settlement Planner/PMU
M.Nonoguchi	Geologist/Soil Mechanics Engineer	Mr K.Siridaran (full time)	Geologist/MECA
		Mr U.S.K.Pitawala (full time)	Soil Mechanics Engineer/MEC
L.K.Devasiri	Agronomist	Mr M.Galpoththage	Project Coordinator/ Agronomist - Uda Walawe
		Mr M.A.Ranjit (field-part time)	DRPM/Uda Walawe
		Mr Sirisena (field-full time)	Block Agricultural Officer
Y.Nishikawa	Design Engineer Cost Estimator	Mr N.P.Jayawardena(full time)	Chief Engineer/Design-Uda Walawe
		Mr L.Nirodhawardena	Project Director-Uda Walawe Right Bank
Y.Ogata	Agro-Economist	Mr D.A.Meemeduma	Economic/Financial Planner-PMU
		Mr N.P.Tittagalla(full time)	Senior Agricultural Economist/PMU
	Assisted by :	Mr A.A.J.S.Amerasinghe	General Manager/MEA
		Mr G.J.P.Gunawardena	Managing Director/MECA
		Mr D.A.P.Handapangoda	RPM-Uda Walawe.

A1.2-6

MINUTES OF DISCUSSION
ON
PROGRESS REPORT (I)
FOR
THE FEASIBILITY STUDY
ON
WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT
(LEFT BANK)

DECEMBER 23, 1991

K.H. S. GUNATILAKA
DIRECTOR GENERAL
MAHAWELI AUTHORITY OF
SRI LANKA

TOSHIHITO OHTANI
TEAM LEADER,
JICA STUDY TEAM

The JICA Study Team submitted 30 copies of the Progress Report (I) to the Mahaweli Authority of Sri Lanka, Ministry of Lands, Irrigation and Mahaweli Development on 19th December, 1991. A meeting was convened for 23rd December 1991 to discuss the Report.

1. Date and Time : 23rd December 1991 (11:20 am - 12:45 pm)
2. Place : Operations Room of Mahaweli Authority of Sri Lanka
3. Attendance : See Attached list
4. Summary of Discussion:

The discussion was presided by Mr. K. H. S. Gunatilaka, Director General of Mahaweli Authority of Sri Lanka (MASL). The JICA Study Team explained the outline of the Progress Report (I) at the beginning of the discussion. The discussion was made based on the "Progress Report (I)". The following issues were discussed and confirmed between both parties:

(1) The Progress Report (I) was generally accepted by the Mahaweli Authority.

(2) The alternative diversification models suggested in the Report were considered favourably by MASL, with the inclusion of other field crops into the cropping patterns. MASL undertook to look into the possibility of getting investors for agro-industrial projects including sugar.

(3) Simulation study on basin-wide water balance of the Walawe river will be made by MASL independently, based on the proposed cropping patterns prepared by the JICA Team.

(4) Measurement of the percolation rates of paddy fields in RBE (Reddish brown earths) and LHG (Low humic gley) soils and conveyance losses in canals in both Right and Left bank areas will be carried out by MEA (Mahaweli Economic Agency of MASL), and the results will be conveyed to the JICA Team at the beginning of the Phase II Study.

(5) In the assessment of the water resources for the irrigation development in the Left Bank, the water release to the Right Bank area will be 405 MCM as was estimated by the ADB in its Appraisal Report of Walawe Improvement Project in 1984.

(6) Both parties recognized the need for an environmental impact study. This will be discussed after the Team's return to Sri Lanka for the Phase II of the Study. The Team will discuss this issue with JICA on their return to Japan.

Attendance at the meeting held on 23rd December 1991 to discuss the Progress Report (1) submitted by JICA on the Feasibility Study on Walawe Irrigation Upgrading and Extension Project

1.	Mr. K.H.S. Gunatilake	- Director General, MASL
2.	Mr. P.T. Senaratne	- Secretary General, MASL
3.	Mr. Ananda Herath	- Managing Director, MEA
4.	Dr. R D Wanigaratne	- Director, PMU.
5.	Mr. Ariya Abeysinghe	- Director/Ag. Planning, MLIMD
6.	Mr. G.W.D.M. Goonaratne	- Director Engineering II, MASL
7.	Mr. M.J.S. Amerasinghe	- General Manager, MEA
8.	Mr. A. Cooray	- Principal Engineer, PMU
9.	Mr. M. Galpoththage	- Project Coordinator, UW, MEA
10.	Mr. T.D.P. Karunatilaka	- CIE, MEA
11.	Mr. H.A.Wickramaratne	- CIE, MEA
12.	Mr. S. Dimantha	- Head, Land Use Division, I.D.
13.	Mr. D.A. Meemeduma	- Economic/Financial Planner,PMU
14.	Mr. B.S. Liyanagama	- Assistant Director/WMS
15.	Mr. N.P. Tittagalla	- Agricultural Economist, PMU
16.	Mr. Senaka Samarasinghe	- Settlement Planner, PMU/MASL
17.	Mr. H.D.L.U. Nirodhawardane	- Project Director, U/W
18.	Mr. N.P. Jayawardena	- Chief Engineer, MECA
19.	Mr. T. Otani	- Team Leader, JICA
20.	Mr. K. Okada	- JICA Team
21.	Mr. L.K. Devasiri	- JICA Team
22.	Mr. Y.Ogata	- JICA Team
23.	Mr. Y.Nishikawa	- JICA Team
24.	Mr. T.Yamashita	- JICA - Sri Lanka Office

MINUTES OF DISCUSSION

ON

INTERIM REPORT

FOR

THE FEASIBILITY STUDY

ON

WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

(LEFT BANK)

JUNE 9, 1992

K.H. S. GUNATILAKA
DIRECTOR GENERAL
MAHAWELI AUTHORITY OF
SRI LANKA

TOSHIHITO OTANI
TEAM LEADER,
JICA STUDY TEAM

WITNESSED BY YOSHIMI KATSUMATA
JICA

The JICA submitted 30 copies of the Interim Report to the Mahaweli Authority of Sri Lanka, Ministry of Lands, Irrigation and Mahaweli Development in May, 1992. A meeting was convened for 3rd June, 1992 to discuss the Report.

1.	Date and Time	:	3rd June, 1992 (11:10 am - 12:45 pm)
2.	Place	:	Operations Room of Mahaweli Authority of Sri Lanka
3.	Attendance	:	See Attached list

4. Summary of Discussion:

The discussion was presided by Mr. K. H. S. Gunatilaka, Director General of Mahaweli Authority of Sri Lanka (MASL). The JICA Study Team explained the outline of the Report and work plan and schedule in Phase II. The discussion was made based on the "Interim Report". The following issues were discussed and confirmed between both parties:

(1) The Interim Report was generally accepted by the Mahaweli Authority.

(2) Irrigation water demand of the right bank area to the Walawe reservoir for the Study is 405 MCM as was estimated by ADB in 1984. The irrigation water demand of the right bank area estimated by MASL recently is 408.5 MCM.

(3) Study on livestock development in the study area will be made in Phase II study.

(4) In-depth study on proposed cropping pattern will be made in Phase II study placing emphasis on the studies on selection of industrial crops and possible private sector investment.

Meeting to discuss the Interim Reports on
Walawe (LB) Irrigation Upgrading and Extension Project
held on 3rd June 1992 at 11.00 a.m.

Attendance :	Mr K.H.S. Gunatilaka	- Director General, MASL.
	Mr P.T.Senaratne	- Secretary General, MASL
	Mr G.J.P.Gunawardena	- MD/MECA
	Mr A.M.A.Abeysinghe	- DAP/MLIMD
	Mr M.J.S.Amerasinghe	- GM/MEA
	Dr R.D.Wanigaratne	- D/PMU
	Mr T.Otani	- JICA Team
	Mr K.Okada	- JICA Team
	Mr L.K.Devasiri	- JICA Team
	Mr K.Yamada	- JICA Team
	Mr Y.Nishikawa	- JICA Team
	Mr M.Kawasaki	- JICA/Colombo
	Mr A.Cooray	- PE/EP-PMU
	Mr M.Galpoththage	- PC (UW & UM)
	Mr H.A.Wickremaratne	- CIE/MEA
	Mr G.W.Liyanage	- Sr.Agronomist/MEA
	Mr S.Dimantha	- Head/Land Use Division
	Mr G.P.Perera	- Agronomist/MEA
	Mr G.W.D.M.Goonaratne	- DE II/MASL
	Mr S.M.D.Malalaratne	- A/PC-MASL
	Mr Anura Wijetunge	- IE (Walawe) MEA
	Mr U.K.Sumanadasa	- RPM (Uda Walawe)
	Mr N.P.Tittagalla	- Ag.Economist/PMU
	Mr C.Wellappili	- RPP/PMU
	Mr H.J.Peiris	- Consultant.

MINUTES OF DISCUSSION
ON
PROGRESS REPORT (II)
FOR
THE FEASIBILITY STUDY
ON
WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT
(LEFT BANK)

13TH AUGUST, 1992

K.H.S. GUNATILAKA
DIRECTOR GENERAL
MAHAWELI AUTHORITY OF
SRI LANKA

TOSHIHITO OTANI
TEAM LEADER
JICA STUDY TEAM

The JICA study team submitted thirty (30) copies of the Progress Report (II) to the Mahaweli Authority of Sri Lanka, Ministry of Lands, Irrigation and Mahaweli Development on 10th August 1992. A meeting was convened on 11th August 1992 to discuss the Report.

1. Date and Time : 11th August 1992 (11:10 am - 12: 30 pm)

2. Place : Operation Room of Mahaweli Authority of Sri Lanka

3. Attendance : See attached list

4. Summary of discussion :

The discussion was presided by Mr. K. H. S. Gunatilaka, Director General of Mahaweli Authority of Sri Lanka (MASL). The JICA Study Team explained the outline of the Report. The discussion was made based on the " Progress Report (II)". The following issues were discussed and confirmed between both parties;

(1) The Progress Report (II) was generally accepted by MASL.

(2) Water balance study will be made for two scenarios, irrigation water demand of Right Bank area of (i) Case 1; 340-350 MCM based on the report prepared by MMP and (ii) Case-2; original estimate (405 MCM).

(3) Proposed cropping pattern is accepted to MASL.

(4) Distribution of paddy and OFCs extent per farmer will vary depending on the availability of suitable soil classes within the Area. Two plots for paddy and OFCs may be allotted for individual farmers in different locations. The issue will be further discussed at the design stage.

(5) Southern end of the Extension area will be excluded from the irrigation development area. Alternative land to compensate for the exclusion will be considered in the western middle part of the area.

(6) Demonstration facility for food processing will be planned in the Development Center for training of farmers.

(7) MASL will provide office space and one vehicle for the environmental survey team who will continue their works till 20th September 1992.

(8) MASL will make every effort to provide the remaining results of laboratory tests for soil and soil mechanics to the Team by 18th August 1992.

(9) The Study Team will take steps to include the utilization of organic fertilizer and natural pesticide in the project.

Attendance at the Meeting held on 11th August 1992 at the MASL Operations Room to Discuss JICA Progress Report (II)

1.	Mr. K.H.S. Gunatilaka	Director General, MASL
2.	Mr. P.T. Senaratna	Secretary General, MASL
3.	Mr. M. Kawasaki	JICA/Colombo
4.	Mr. T. Otani	Team Leader/JICA Study Team
5.	Mr. K. Okada	Member of Team/JICA
6.	Mr. L. Devasiri	Member of Team/JICA
7.	Mr. Y. Ogata	Member of Team/JICA
8.	Mr. Y. Nishikawa	Member of Team/JICA
9.	Mr. K. Fukumoto	Member of Team/JICA
10.	Ms. Nalani Amarasekara	Member of Team/JICA
11.	Dr. S.U.K. Ekaratne	Environmental Team/JICA
12.	Dr. A.S. Seneviratne	Envrionmental Team/JICA
13.	Mr. R.A. Wijewansa	TEAMS
14.	Mr. C. Abayasinghe	TEAMS
15.	Mr. G.J.P. Gunawardena	M.D./MECA
16.	Mr. G.W.D.M. Goonaratne	D.E. II/MASL
17.	Dr. R.D. Wanigaratne	D/PMU
18.	Mr. N.J.S.Amerasinghe	G.M./MEA
19.	Mr. G.L.L.J. Dabera	F.C./MASL
20.	Mr. Ariya Abeysinghe	D.(Ag. Planning)/MLIMD
21.	Mr. G.W. Liyanage	Senior Agronomist/MEA
22.	Mr. U.K. Sumanadasa	RPM/Uda Walawe
23.	Mr. P. Samaraweera	Director/WMS
24.	Mr. H.A. Wickramasinghe	C.I.E./MEA
25.	Mr. T.D.P. Karunatilaka	C.I.E./MEA
26.	Mr. M. Galpoththage	P.C.(UW & UM)/MEA
27.	Mr. H.D.L.U.Nirodhawardana	P.D. (U/W)/MEA
28.	Mr. D.A. Meemeduma	Econ.& Fin.Planner/PMU
29.	Mr. S. Dimantha	Head, Land Use Div./I.D.
30.	Mr. S.M.D. Malalaratne	P.C./MASL
31.	Mr. Asoka Cooray	Prin. Eng./Env. Planner/PMU

MINUTES OF DISCUSSION
ON
DRAFT FINAL REPORT
FOR

THE FEASIBILITY STUDY
ON
WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT
(LEFT BANK)

NOVEMBER 10, 1992

K.H.S. GUNATILAKA
DIRECTOR GENERAL,
MAHAWELI AUTHORITY OF
SRI LANKA

TOSHIHITO OTANI
TEAM LEADER,
JICA STUDY TEAM

WITNESSED BY MITSUHIKO OTA
JICA

JICA submitted thirty (30) copies of the Draft Final Report to the Mahaweli Authority of Sri Lanka (MASL), Ministry of Lands, Irrigation and Mahaweli Development in October 1992. Meetings were held to discuss the Report on November 6, 1992.

1. Time: From 10:40 to 15: 30
2. Places: Conference Room of Planning and Monitoring Unit and Operation Room of MASL
3. Attendance: See attached list

4. Summary of discussion

The discussion was presided by Mr. K.H.S. Gunatilaka, Director General of Mahaweli Authority of Sri Lanka. The JICA Study Team explained the outline of the Report. The discussion was made based on the Report. The following issues were discussed and confirmed between both parties;

(1) The Report was generally accepted by MASL.
(2) Comments on the Report will be sent to JICA before the end of November 1992.
(3) Project phasing shall give priority to construction of main roads including bridge over the Walawe river.
(4) Biological control of aquatic weeds, especially Hydrilla, will be recommended in the Final Report.
(5) Use of natural pesticide and organic fertilizer will be emphasized in the Final Report.
(6) MASL has no objection for making the Final Report open to the public in Japan.

Attendance at the Meeting held on 6th November, 1992 at the MASL to discuss the Walawe LB Irrigation Upgrading and Extension Project

No.	Name	Designature	Signature
1.	Mr. K.H.S. Gunatilake	Director General/MASL	
2.	Mr. Mitsumiko OTA	JICA Head Office,Tokyo	
3.	Mr. Toshihito Otani	JICA Study Team, Leader	
4.	Mr. Koji Okada	JICA Study Team, Member	
5.	Mr. Lalith Devasiri	JICA Study Team, Member	
6.	Mr. Yoshihiko Ogata	JICA Study Team, Member	
7.	Dr. R.D. Wanigaratne	Director/PMU	
8.	Mr. Asoka Cooray	Pri.Eng./Env.Planner/PMU	
9.	Mr. M.J.S. Amerasinghe	G.M./MEA	
10.	Mr. T.D.P. Karunatilake	CIE/MEA	
11.	Mr. H.A. Wickramaratne	CIE/MEA	
12.	Mr. M. Galpoththage	P.C.(UW/UM)/MEA	
13.	Mr. G.W. Liyanage	Senior Agronomist/MEA	
14.	Mr. G.D. Perera	Agronomist/MEA	
15.	Mr. S.W. Dissanayake	Env.Officer/MEA	
16.	Mr. G.J.P. Gunawardena	MD/MECA	
17.	Mr. N.P. Jayawardena	Engineer/MECA	
18.	Mr. T.N. Sritharan	Geologist/MECA	
19.	Mr. G.W.D.M. Goonaratne	D.E.II/MASL	
20.	Dr. S.U.R. Ekaratne	TEAMS	
21.	Mr. R.A. Wijewansa	TEAMS	
22.	Mr. A.B. Fernando	TEAMS	
23.	Ms. Nalani Fernando	TEAMS	
24.	Mr. C. Abesinghe	TEAMS	

මැදපුම් හා අපවහනපුම් ඒකකය
අංක 493/1, (බිම මහල), ටී. බී. ජයා මාවත, කොළඹ 10
දුරකථනය: අධ්‍යක්ෂ: 597197 කාර්යාලය: 598496, 59
493/1, (தரை மாடி) ரீ. பி. ஜயா மாவத்தை, கொழும்பு 10
Planning and Monitoring Unit
No. 493/1, (Ground Floor,) T. B. Jayah Mawatha, Colombo 10.
Telephone: Director 597197, Office: 598496, 598967

OUR FAX: 94-1-687498
YOUR FAX 81-3-3265-6469

22nd December, 1992.

Dr. T Otani
Team Leader for Walawe F/S (JICA)
Nippon Koei Ltd
TOKYO.

Dear Dr Otani,

COMMENTS ON DRAFT FINAL REPORT ON WALAWE F/S (LEFT BANK) ETC.

Thank you for your Fax No. TM 1992-3 received today.

I am forwarding by Fax the comments on the Draft Final Report which was submitted by MASL to JICA office in Colombo. Your copy was posted and may receive it in a few days time.

As regards item 3 of the comments, changes required to the EIA report can be submitted as an appendum after the CEA/Environmental cell evaluation is complete.

With kind regards.

Yours sincerely,

(Dr. R. D. Wanigaratne).
Director
Planning and Monitoring Unit
MAHAWELI AUTHORITY OF SRI LANKA.

මහවැලි අධිකාරිය
இலங்கை மகாவலி அதிகார சபை
Mahaweli Authority of Sri Lanka

තැ. පෙ. 2201, 500, වී. වී. ජයා මාවත, කොළඹ - 10
தபெ. இல 2201 வி. பி. ஜயா மாவத்தை, கொழும்பு
P. O. Box No. 2201 500, T. B. Jayah Mawatha, Colombo - 10

Ref: 7031

12th December 1992

Mr. Y. Sakamaki,
Resident Representative,
JICA
Colombo.

Dear Mr. Sakamaki

Comments on the Draft Final Report of the Walawe (Left Bank) Irrigation Upgrading and Extension Project

I wish to submit the following comments on the draft final report that was submitted in November 1992.

1. Water Resources, Irrigation and Drainage

a) The proposal submitted for the irrigation development, whose basic concept is the reuse system is acceptable. The proposed layout is considered very suitable for this project considering the soils and topography. However it will be necessary to go into further details on some aspects that require changes which could be attended to during the detailed design stage.

b) The problems encountered at present by the Samanalawewa dam can have adverse effects on the Walawe development. However, it is expected that all such problems will be resolved by the time the detail designs are undertaken. With full Samanalawewa inflow available, the irrigation reliability is only 80%. In the event of there being a shortage of water at the final design stage it is suggested that Timbolkettiya diversion be taken up.

අධ්‍යක්ෂ ජනරාල්
Director General
687238

ලේකම් ජනරාල්
Secretary General
687235

Telephone: 687362 5
Cable: MAHAGANGA
Telex: 21338
Fax: 687240

2. Agricultural Extension and Research

a) As regard agricultural extension, it is agreeable to the proposed Agriculture Extension Programme, but it is suggested that multimedia tools be used extensively for cost effectiveness of the Agriculture Extension Programme. The future thrust in Agriculture Extension will be in the use of multimedia. For this, the project should provide the necessary equipment and training.

b) Research : A recent survey conducted on Farming Systems based on Crop/Livestock integration had revealed that, 40% of the farmers used crop residues to feed ruminant livestock and even under a low level of integration in the dry zone, the farmers who raised ruminant livestock earned an average of 30% more income than farmers who do not raise livestock. Therefore, it is proposed that crop-livestock integrated activities be undertaken by the project where pasture should be established in a portion of irrigable allotment of the farmers, in order to raise cattle and other ruminant livestock.

c) Pilot Project to Promote Exports: As suggested to the Consultants, it is proposed to undertake a Pilot Project to promote export of agricultural produce to Japan which should include a very good component of post-harvest techniques and cold chain/storage facilities.

3. Assessment of Environmental Impacts and Mitigation Measures

The environmental impact assessment report (volume III) has been submitted to the EIA cell of the Ministry of Lands, Irrigation and Mahaweli Development for evaluation and approval. This cell has representatives from the Central Environmental Authority and has been formed to meet the legal requirement as mentioned in section 1.2.1 of the EIA report (volume III). Its findings will not be known for sometime as the first meeting to discuss the Walawe EIA report is fixed for 17th December, 1992. We do not anticipate much changes and expect an environmental clearance without much variation. However I would like to comment on some of the items on the EIA report (volume III).

i. The cost indicated in taking mitigative action and for monitoring, the details of which are given in the EIA report are not reflected in the Financial Construction Cost of Proposed Project Works given in Table 9 of the main report (volume I). A separate line item should be included under direct cost to indicate 'environmental mitigative action and monitoring'.

ii. Land allocation for fuelwood areas, Conservation forest and Pasture land is indicated in Table 7 of the Main report and the proposed land use plan under Open/Firewood forest, forest reserve and livestock farm.. The areas so demarcated should be shown in drawing No. 5 of Volume IV 'Proposed Land Use Plan'.

iii. The proposed jungle corridors should be provided with power fences on either side and their costs should be included under mitigative action.

iv. In the environmental impact study report (Volume III) section 4.1.3 it is indicated 'ground water samples taken from six wells in the project area, show high levels in terms of electrical conductivity and dissolved chloride and fluoride ions, making such water unfit for irrigation and drinking purposes. Unless drainage is effective salinization of irrigated fields can take place over time. Therefore it is important that drainage be given adequate recognition in project planning'.

While we agree that drainage should be given adequate recognition to minimize salanization, it is suggested that settlements be provided with drinking water from a source that conforms to acceptable standards. This has to looked into in detail at the design stage.

v. The 'proposed organization for project management' chart, given in figure 9 of the main report should indicate that there will be an environmental officer at the block level, while at the project level the agriculture division is to be strengthened to include the environment division under the project agricultural officer.

4. General comments on the Main Report

i. Section 4.7.2 item (iv), line 1 of the main report should be amended by deleting the word 'Not' and it should read 'To establish an official co-ordinating body at the project level consisting of'

ii. Section 4.7.2 item (v), 8th word should be corrected.

iii. Section 5.3.2 (2) line 2, 1st word 'implemented', should be corrected to read 'completed'.

iv. Page 127, Figure 9, Proposed Organization for Project Management should be corrected to include the following.

(a) The Institutional Development Unit (IDU) of the MEA will be represented by an Assistant Manager at the Project level. This officer will be at the same level as D.T.E, C.A.O. and others shown in the chart. Similarly an IDU officer will be attached to each Block Manager as well.

(b) The same chart indicates the Coordination Committee represented by CEB, Irrigation Department and others. Since the operational policy of the Hydro power reservoirs are determined by the CEB and Water Management Secretariat (WMS) of the MASL, the WMS should be included in this committee. The MASL and MEA head office representation should also be included in this committee.

v. Section 3.1.3 (2) of the main report, last sentence states ' A summary of meteorological data at SRI and HAB observatories is presented in Table 3'. However it is noted that Table 3 on page 108 of the report gives the data from the Agricultural Research station.

vi. Page S-1 of main report line 4 should be ...; 'Ministry of Lands, Irrigation and Mahaweli Development'.

vii. Page S-2 para 4 line 2, delete the word "colonization" and substitute "settlement".

viii. Page S-3 para 7, may bo re-stated as the meaning does not come out very clearly of what Rs. 1,000/= and Rs. 6,600/= net reserves are.

ix. Page S-4, line 3 amend 'commanding' to 'Command'.

x. Page S-8, section 10 (iv) may to be amended to ' Provision of infrastructure and development of 120 ha. of land for setting up 22 villages....'

xi. Section 4.3.1, subsection 3, Page 47

(a) The land use plan has not indicated the extent of lowland (paddy) and upland net irrigable area. Thus, land clearing will refer to a greater than TOA (Turnout area) extent whilst rough levelling could also be equal or greater than TOA. However, On-farm Development of the irrigable area is the net irrigable area which will be alienated to farmer families at 1.0 ha each. Therefore, Table 7 is ambiguous in the first 2 lines.

(b) It would be helpful if this distinction is created and the "Present" and "With Project" land use table explained in that form.

xii. Section 4.3.3., sub-section i, page 48

Suggest: the deletion of " ... unutilized straw " because there is a disposable sales value to the Paper Mills Factory for the straw.

xiii. Section 4.3.5., sub section 1

Suggest including "item vii": "To demonstrate or impart technical know-how to farmers to store ofc in the farm yard as a means to stabilizing harvest-time farmgate prices".

(Note: JICA had conducted such demonstrative adaptive research in their JICA farm at Medagama, System C, Zone 3.)

xiv. Section 5.2, sub section 8, page 76

Suggest the inclusion of: "The centre would lay priority to the need for participation of women in farmers organizations and training in cottage industry".

xv. Section 5.4.2., sub-section 6, page 80

(a) Project cost summary is supported by Table 9 at page 114. However, Table 9 at page 114 does not give the 6 year expenditure forecast and the effect of the price escalation annually.

(b)The adopted FX and LC price escalation factors affecting each of the 6 years is not indicated.

Yours Sincerely,

K.H.S. Gunatilaka
Director General
Mahaweli Authority of Sri Lanka

Copy: Mr. T. Ohtani, Team Leader, Walawe F/S

25 December 1992

FEASIBILITY STUDY ON WALAWE IRRIGATION
UPGRADING AND EXTENSION PROJECT

ANSWER TO THE COMMENTS ON DRAFT FINAL REPORT ON WALAWE F/S (LEFT BANK) RECEIVED FROM MASL ON 24 DECEMBER 1992

JICA Study Team for the Project (The Team) received captioned comments through JICA's head office in Tokyo on 24 December 1992. The comments on the Draft Final Report will be attached to the Final Report. Team's views and answers of the comments are described as follow:

1. Water Resources, Irrigation and Drainage

The Team understands that the comments mentioned will be useful suggestions for the detailed design stage and no modification of these fields is required for the finalization of the Report.

2. Agricultural Extension and Research

a) Agricultural extension

The Team also understands that the use of multimedia for the agricultural extension work is important. Therefore, in the Draft Final Report, we proposed to provide the equipment of radio broadcasting equipment at the Development center in Suriyawewa, personnel computers for O&M office. We would like to recommend to use these equipment efficiently not only for the water management but for the agricultural extension work.

b) Research

We think it is better to utilize and enhance the research activities on the existing livestock farm at Mahagama managed by MASL for research of introduction of crop-livestock integrated activities in the irrigation area of the project. However, it is considered that the project should devote special attention to realize the proposed cropping pattern in the initial stage, which is

comprised of paddy, sugar cane, onion, banana, and vegetables. Introduction of crop-livestock integrated activities will be considered after success of the initial project management.

c) Pilot project to promote export

Post harvest facilities and marketing facilities including storages and polas are proposed as components of rural infrastructure in the Draft Final Report. Regarding the cold chain facilities, it is considered that the facilities in the right bank area of the Walawe river will fully be utilized at first stage of the development. When the needs of the cold chain facilities will exceed the existing capacity, then such facilities will be planned separately.

3. Assessment of Environmental Impacts and Mitigation Measures

i) Cost of mitigative action and for monitoring

The Team will provide separate line item for the captioned cost as commented by MASL in the Final Report.

ii) Proposed land use map (Drawing No. 5)

The Team will modify the captioned map as commented by MASL in the Final Report. It is noted, however, that the area of conservation forest has already been indicated in the Drawing No. 5.

iii) Jungle corridor

The Team considers that the jungle corridor will be provided / constructed at the same time when the proposed Lunugamvehera National Park is established. In addition, location of the corridors is planned far from the project area, it is very difficult to include the work as a component of the project. No cost for the fencing of the corridor is considered in the Report.

iv) Ground water and drinking water

Due to unsuitable water quality of the ground waters for drinking purpose in the project area, the Drat Final Report has proposed to use the surface water as drinking water which will be supplied by the irrigation canal systems. As a component of the rural infrastructure, rural water supply systems were proposed.

It is considered that there is less possibility of salanization since the aquifer of the ground water will be improved in terms of quantity and quality with properly provided irrigation condition, drainage systems. In addition, salinity soil areas were excluded from the proposed irrigation area in the demarcation of the irrigation area

v) Nomination of environmental officers

The Team will modify the organization chart as commented by MASL in the Final Report.

4. General Comments on the Main Report

The Team will finalize the Report by referring to the comments and suggestions of MASL.

Annex - II

Meteorology and Hydrology

ANNEX II METEOROLOGY AND HYDROLIGY

Contents

2.1 General
- 2.1.1 Sri Lanka
- 2.1.2 Walawe Basin

2.2 Meteorology
- 2.2.1 Meteororogical Observation
- 2.2.2 Rainfall

2.3 Hydrology
- 2.3.1 Gauging stations
- 2.3.2 Previous studies on Uda Walawe reservoir inflow
- 2.3.3 Extension of run-off data
  - 2.3.3.1 Extended run-off data for Embilipitiya, Timbolketiya and Mau Ara
  - 2.3.3.2 Extended run-off data for Uda Walawe reservoir
- 2.3.4 Operation of Samanalawewa reservoir

2.4 Water Quality

2.5 Ground Water

List of Tables

Table A 2.2-1 Meteorological Data at Sugar Research Institute
Table A 2.2-2 Meteorological Data at Agriculture Research Station
Table A 2.2-3 Meteorological Data at Hambantota Observatory
Table A 2.2-4 Monthly Rainfall at Alupota (M008) (Historic)
Table A 2.2-5 Monthly Rainfall at Balangoda (M041) (Historic)
Table A 2.2-6 Monthly Rainfall at Blackwood (M060) (Historic)
Table A 2.2-7 Monthly Rainfall at Detanagala (M100) (Historic)
Table A 2.2-8 Monthly Rainfall at Lauderdale Group (M306) (Historic)
Table A 2.2-9 Monthly Rainfall at Mahawelatenna (M337) (Historic)
Table A 2.2-10 Monthly Rainfall at Nagarat Estate (M408) (Historic)
Table A 2.2-11 Monthly Rainfall at West Haputale Estate (M624) (Historic)
Table A 2.2-12 Monthly Rainfall at MEA (Historic)
Table A 2.2-13 Monthly Rainfall at SRI In Sevanagala (Historic)
Table A 2.2-14 Monthly Rainfall at Liyangahatota (Historic)
Table A 2.2-15 Monthly Rainfall at RRS in Ambalantota (Historic)
Table A 2.2-16 Correlation Coefficients and Regression Equations
~ A 2.2-18
Table A 2.2-19 Monthly Rainfall at Alupota (M008) (Extended)
Table A 2.2-20 Monthly Rainfall at Balangoda (M041) (Extended)
Table A 2.2-21 Monthly Rainfall at Blackwood (M060) (Extended)
Table A 2.2-22 Monthly Rainfall at Detanagala (M100) (Extended)
Table A 2.2-23 Monthly Rainfall at Lauderdale Group (M306) (Extended)
Table A 2.2-24 Monthly Rainfall at Mahawelatenna (M337) (Extended)
Table A 2.2-25 Monthly Rainfall at Nagarat Estate (M408) (Extended)
Table A 2.2-26 Monthly Rainfall at West Haputale Estate (M624) (Extended)
Table A 2.2-27 Monthly Rainfall at MEA (Extended)

Table A 2.2-28 Monthly Rainfall at SRI In Sevanagala (Extended)
Table A 2.2-29 Monthly Rainfall at Liyangahatota (Extended)
Table A 2.2-30 Monthly Rainfall at RRS In Ambalantota (Extended)
Table A 2.2-31 Probable Daily Rainfall at Each Raingauge Station
Table A 2.2-32 Probable Annual and Monthly Aereal Rainfall at the Uda Walawe Dam Catchment
Table A 2.2-33 Probable Annual and Monthly Aereal Rainfall at the Uda Walawe Dam Direct Catchment
Table A 2.3-1 Historic Run-Off Data at Uda Walawe and Timbolketiya
Table A 2.3-2 Historic Run-Off Data at Embilipitiya
Table A 2.3-3 Historic Run-Off Data at Mau Ara
Table A 2.3-4 Extended Run-Off Data at Embilipitiya
Table A 2.3-5 Extended Run-Off Data at Timbolketiya
Table A 2.3-6 Extended Run-Off Data at Mau Ara
Table A 2.3-7 Run-Off at the Samanalawewa Dam Site Estimated by Ceb
Table A 2.3-8 Extended Run-Off Data at Uda Walawe
Table A 2.3-9 Extended Run-Off Data at Uda Walawe Direct Catchment
Table A 2.4-1 Water Sampling Location
Table A 2.4-2 Analysis of Water Samples (November 1991)
Table A 2.4-3 Analysis of Water Samples (July 1992)

List of Figures

Fig.A 2.1-1 Boundary of Wet and Dry Zones
Fig.A 2.2-1 Chronogram of Rainfall Stations
Fig.A 2.2-2 Annual Isohyets
Fig.A 2.2-3 Thiessen Polygon
Fig.A 2.3-1 Chronogram of Stream Flow Gauging Stations
Fig.A 2.3-2 Moving Average of Annual Run-off
Fig.A 2.4-1 Sampling Site of Water for Water Quality Analysis

ANNEX II METEOROLOGY AND HYDROLOGY

2.1 General

2.1.1 Sri Lanka

Sri Lanka is a small island country lying in the south of Indian sub-continent. It locates 5°55'-9°50' north latitude and 79°42'-81°53' east longitude. The area is 65,609 km^2. Mountains with elevations over 2,000 m concentrate in the center of the southern half of the island. All major rivers originate in this mountainous region and flow radially towards sea.

Climatically Sri Lanka is divided into two zones: the dry and wet zones. The dry zone occupys 3/4 of the total area covering the north, east and south-east of the island. And the wet zone occupys 1/4 of the total area and covers the central mountainous region and the south-western part of the country. By definition the dry zone is an area where annual rainfall is less than 75 inches (1905 mm) or rainfall during the south west monsoon season is less than 20 inches (508 mm). The area with more rainfall is called the wet zone. A certain discrepancy ia found between the zone boundaries by two definitions as shown in Fig. A 2.1-1.

The seasonal climate of Sri Lanka is dominated by the dynamics of the intertropical convergence zone (ITCZ). Around November ITCZ shifts towards the equater. It causes the north-east monsoon occuring from the Indian sub-continent which becomes moist during travelling over Bay of Bengal and brings much rainfall both to the dry and wet zones in Sri Lanka. The period from October to March when the north-east monsoon prevails is called the Maha season.

ITCZ moves north and reaches southern India in May when the south-west monsoon starts. It brings much rainfall to the wet zone and dry and hot wind to the dry zone. The period from May to September when the south-west monsoon prevails is called the Yala season.

According to Koeppen's climate classification, the dry zone is classified as the tropical savanna climate and the wet zone as complex of the tropical rain forest and the monsoonal climate. Yearly average temperature in the dry zone is 27-28 °C.

From the land use point of view, the wet zone is devoted to the cultivation of mainly tree crops. There are lots of tea, coconuts and rubber plantations. On the other hand, the dry zone is endowed with comparatively flat lands and fertile soils and suitable for production of food crops. More agricultural development potential for food production remains in the dry zone. But lack of water is one of the major constraints and provision of irrigation facilities is a prerequisite for development of the dry zone.

The Government has made efforts for irrigation development for many years. One of such Government's efforts was the Walawe Irrigation Scheme which was inaugurated in early 1960s aiming at 32,000 ha of irrigation development and resettlement of people in the southern dry zone of the country.

2.1.2 Walawe basin

The Walawe river basin is located in the south of Sri Lanka island. The catchment area is 2,442 km^2.

The Walawe river rises in the mountain range west of Balangoda and drains into the Indian Ocean near Ambalantota. Major tributaries are the Weli oya, the Timbolketiya river, the Hulanda oya, and the Mau ara.

The northern and western parts of the Walawe basin are mountainous areas and fall in the wet zone. The eastern and southern parts are plains and are in the dry zone. The upper Walawe basin, the Weli oya basin and the upper basins of the Timbolketiya river and the Hulanda oya are in the wet zone. And the rest including the whole Mau ara basin is in the dry zone.

There are lots of small tanks in the middle and lower Walawe basin. These tanks were constructed in the early historic period (BC200-AD650) thru the middle historic period (AD650-AD1200) for irrigation purposes. According to archaeological survey, the present Walawe irrigation project area on both banks and the present Uda Walawe National Park area were one of the most densely populated areas in Sri Lanka in those historic periods.

Modern water resources development undertakings were started from downstream. The Liyangastota anicut was constructed at 21.5 km from the river mouth in 1889. It is irrigating about 6,200 ha of paddy fields on both banks and feeding the Ridiyagama reservoir on the left bank.

In the middle reach of the Walawe river, the Uda Walawe reservoir was constructed in 1967 for irrigation and mini-hydro power generation. It presently commands 12,000 ha of paddy field on the right bank and 2,000 ha of sugar field and 3,000 ha of paddy field on the left bank. In the upper Walawe basin the Samanalawewa project was completed in 1992 for power generation purposes.

Kaltota irrigation scheme is using water of the Walawe river at downstream of the Samanalawewa dam.

On the Hulanda oya, the Chandrikawewa reservoir was constructed in early 1960s. It was later brought into the right bank system under the Uda Walawe irrigation scheme.

On the Mau ara, there are three major tanks: the Habaraluwewa, Kiriibbanwewa and Mahagama tank.

The Timbolketiya river has no anicut or reservoir yet.

2.2 Meteorology

2.2.1 Meteorological observation

Meteorological observation in Sri Lanka is carried out by the Department of Meteorology (MET). Individual meteorological observations are also undertaken by the Irrigation Department (ID), the Department of Agriculture (AGRIC) and certain private institutes and companies. In Sri Lanka many rain gauge stations began rainfall observation in 1907. Chronogram is shown in Fig. A 2.2-1.

In and around the study area, meteorological data are available in 6 (six) observatories, i.e., Hambantota, Sugar Research Institute (SRI), Agriculture Research Station (ARS), Rice Research Station (RRS) and MEA. Meteorological data at SRI, ARS and Hambantota are presented in Table A 2.2-1, Table A 2.2-2 and Table A 2.2-3.

The Hambantota and SRI observatories are selected as representative observatory of southern and northern areas in the study area. Summaries of meteorological data at the SRI and Hambantota observatories are tabulated below.

Sugar Research Institute observatory

Item	Annual Mean	Mean Max.	Mean Min.
Temperature (°C)	28.2	32.6	23.6
Relative Humidity (%)	75.6	82.8	69.2
Evaporation(mm)	1,871.9	195.8/month	116.4/month
Sunshine Duration (hrs)	2,447.4	231.6/month	175.6/month
Wind Velocity (km/hrs)	4.9	8.6	2.4
Rainfall (mm)	1,411.3	276.3/month	28.7/month

Hambantota observatory

Item	Annual Mean	Mean Max.	Mean Min.
Temperature (°C)	7.2	30.2	24.1
Relative Humidity (%)	78.9	81.3	76.5
Sunshine Duration (hrs)	2,482.0	254.2/month	174.0/month
Wind Velocity (km/hrs)	4.9	8.6	2.4
Rainfall (mm)	1,075.5	187.5/month	42.2/month

2.2.2 Rainfall

Twenty-three (23) rainfall stations are being and/or had been operated in and around the Walawe river basin. Observed annual rainfall is 4,500 mm in the upper basin, 1,500 mm near the Uda Walawe dam and 1,000 mm in the coastal area. Based on the mean annual rainfall, an isohyetal map of the basin is drawn as shown in Fig. A 2.2-2. Considering the isohyetal map, observation period and location of station, twelve (12) stations are selected for hrdrological study of the Walawe river basin. Historic data of the twelve stations are shown in Table A 2.2-4 thru Table A 2.2-15. Missing data were estimated based on correlation analysis. Correlation coefficients and regression equations are shown in Table A 2.2-16 thru Table A 2.2-18. Extended monthly rainfall data of twelve stations are shown in Table A 2.2-19 thru Table A 2.2-30.

The basin is divided into twelve (12) sub-areas applying the Thiessen polygon method as shown in Fig. A 2.2-3 to estimate the basin rainfall.

The mean annual basin rainfall of the whole Walawe river basin (2442 km^2) is 2,047 mm, that of the Uda Walawe dam catchment (1152 km^2) is 2,384 mm and that of the Samanalawewa catchment (338 km^2) is 2,875 mm as shown below:

Code	Observatory	Catchment Area (sq.km)	Areal Ratio (%)	Mean Annual Rainfall (mm)	Mean Annual Areal Rainfall (mm)
RRS	Ambalantota	83.0	3.4	1,043	5.5
LGT	Liyangahatota	295.5	12.1	1,272	153.9
ARS	Angunukolapelassa	19.5	0.8	970	7.8
MEA	Timbolketiya	715.5	29.3	1,445	423.4
M306	Lauderdale Group	210.0	8.6	3,403	292.7
M337	Mahawelatenna	361.5	14.8	2,061	305.0
M060	Blackwood Estate	283.3	11.6	2,504	290.5
M624	West Haputale Estate	58.6	2.4	2,361	56.7
M408	Nagarat Estate	134.3	5.5	2,541	139.8
M041	Balangoda	134.3	5.5	2,331	128.2
M100	Detanagala	83.0	3.4	2,840	96.6
M008	Alupota	63.5	2.6	4,485	116.6
Total		2,442.0			2,046.7

Mean annual rainfall on the above Table shows historical data basis.

Samanalawewa Dam Catchment Area:

Code	Observatory	Catchment Area (sq.km)	Areal Ratio (%)	Mean Annual Rainfall (mm)	Mean Annual Areal Rainfall (mm)
M337	Mhawelatenna	13.8	4.1	2,061	84.5
M624	West Haputale Estate	4.6	1.4	2,361	33.1
M408	Nagarat	38.8	11.5	2,541	292.2
M041	Balangoda	134.3	39.6	2,331	923.1
M100	Detanagala	83.0	24.6	2,840	698.6
M008	Alupota	63.5	18.8	4,485	843.2
Total		338.0			2,874.7

Uda Walawe Dam Catchment Area (including Samanalawewa Dam areas):

Code	Observatory	Catchment Area (sq.km)	Areal Ratio (%)	Mean Annual Rainfall (mm)	Mean Annual Areal Rainfall (mm)
MEA	Timbolketiya	111.4	9.6	1,445	138.7
M337	Mahawelatenna	332.9	28.9	2,061	595.6
M060	Blackwood Estate	234.0	20.3	2,504	508.3
M624	West Haputale Estate	58.6	5.1	2,361	120.4
M408	Nagarat Estate	134.3	11.7	2,541	297.3
M041	Balangoda	134.3	11.7	2,331	272.7
M100	Detanagala	83.0	7.2	2,840	204.5
M008	Alupota	63.5	5.5	4,485	246.7
Total		1,152.0			2,384.2

Probable daily maximum rainfall at major rainfall gauge stations are shown in Table A 2.2-31. Probable annual and monthly rainfalls at the Uda Walawe dam are shown in Table A 2.2-32 and Table A 2.2-33.

2.3 Hydrology

2.3.1 Gauging stations

Flow measurement and hydrological observations in major river basins in Sri Lanka are carried out by the Hydrology Division of the Irrigation Department (ID). In the Walawe river basin, there are thirteen (13) gauging stations as shown below. Out of which four (4) gauging stations are located on the main river course and nine (9) on the tributaries.

Code	Station	Drainage Basin (sq.km)	Annual Avrage (MCM)	Discharge (mm)	* (M or T)
1804A	Belihul Oya	42	-	-	T
1804	Belihul Oya	49	90	1,838	T
1806	Samanalawewa	353	591	1,675	M
1808	Weragala	261	212	812	T
1810	Mawigala	23	14	609	T
1811	Waguregama	99	-	-	T
1805	Uda Walawe	1,155	1,018	881	M
1807	Timbolketiya	269	156	581	T
1801	Embilipitiya	1,580	1,417	897	M
1812	Modarawana	109	34	320	T
1803	Halmillaketiya	166	41	247	T
1809	Mahagama	366	54	148	T
1802	Liyangahatota	2,284	2,697	1,181	M

* M: Main river course, T: Tributary

Observation period of stream flow is generally very short compared with the observation period of rainfall. Chronogram is shown in Fig. A 2.3-1.

2.3.2 Previous studies on Uda Walawe reservoir inflow

Data of the Uda Walawe observatory (Code No. 1805) are available only four years from May 1957 to June 1961 and the measurement had been stopped after the completion of the Uda Walawe dam in 1967. Uda Walawe reservoir operation records, however, are available from 1968 to date.

Previous studies on the Walawe river basin had generated two kinds of monthly inflow data for the Uda Walawe reservoir. One is the data from 1949 to 1985 in the study on "Master Plan for the Electricity Supply of Sri Lanka" made by Ceylon Electricity Board (CEB). The other is the data from 1942 to 1983 in the study on "Walawe Irrigation Rehabilitation and Improvement Project" performed by SOGREAH.

In the CEB study, the monthly inflow was estimated through conversion of monthly rainfall to monthly discharge utilizing the multiple regression method. Missing rainfall data were compensated applying the HEC4 multisite, the multiple regression model originating from US Army Corps of Engineers.

On the contrary, in the SOGREAH study, Uda Walawe Reservoir operation records were utilized to estimatie the inflow for the period from 1968 to 1984.
Average annual inflow and run-off coefficient in both studies are as follows:

Item	Period	SOGREAH	CEB
Average annual inflow			
	Before 1967	1,019	984
	After 1968	1,161	820
	1960 to 1984	1,093	902
Average run-off coefficient			
	Before 1967	0.35	0.34
	After 1968	0.43	0.31
	1960 to 1984	0.41	0.32

To contrast the both study results, five-year moving averages on annual runoff are shown in Fig.A 2.3-2. Areal rainfall and run-off data at the up and down stream reaches, CEB study results of the Samanalawewa (code No.1806) and the Embilipitiya sites (code No.1801) are also shown for reference. From the Figure, following can be pointed out:

- The same run-off tendency can be observed on both study results for a period from 1952 to 1967.
- Run-off volume estimated by the reservoir operation records shows fairly high values compared with the estimated values of the multiple correlation method.
- Furthermore, run-off volume estimated by the reservoir operation records exceeds the run-off volume of its downstream reaches.
- From detailed comparison on both estimates, run-off volumes during the low-water stage are nearly the same, however, considerable differences appear during the high-water stage.

The main purpose of the study is to examine the water balance of the Uda Walawe Reservoir and to estimate further irrigation development potential. From this point of view, estimation of the inflow into the reservoir has to be conservative. Therefore, the inflow had better be estimated by the conversion from areal rainfall applying the multiple regression method rather than by the reservoir operation records.

2.3.3 Extension of run-off data

In this study 30 years monthly run off data are necessary for examining water balance. Run off data were extended utilizing the multi-regression equations derived from historic run off data at specific station and rainfall data at selected stations.

As shown in Fig.A 2.2-2, there are twelve stream flow gauging stations in the Walawe river basin. Out of which four stations i.e., Uda Walawe (code No.1805), Embilipitiya (code No.1801), Timbolketiya (code No.1807) and Mau Ara (code No.1809), are tabulated in Table A 2.3-1 to A 2.3-3 because those data have close relation to this study.

2.3.3.1 Extended run-off data for Embilipitiya, Timbolketiya and Mau Ara

Calculation results are shown in Table A 2.3-4 for Embilipitiya, Table A 2.3-5 for Timbolketiya and Table A 2.3-6 for Mau Ara. As for the inflow into the Uda Walawe reservoir, detailed discussion is made in Section 3.3.2. Run-off at the Samanalawewa dam site

had been estimated by the Ceylon Electricity Board (CEB) in the Master Plan for the Electricity Supply of Sri Lanka. Estimated run-off value in the said study is employed as the run-off at the Samanalawewa Dam site in this study. Estimated results are shown in Table A 2.3-7.

2.3.3.2 Extended run-off data for Uda Walawe Reservoir

Due to the short observation periods of the Uda Walawe stream gauge station, inflow to the Uda Walawe Reservoir is extended in the following procedures;

a) Correlation of historic stream flow records is analyzed between the Uda Walawe station and the Embilipitiya station which has long observed run-off records. The result shows high correlation coefficient as 0.97.

b) Using the extended run-off value of the Embilipitiya station, run-off at the Uda Walawe station i.e., inflow to the Uda Walawe Reservoir, is calculated by means of the regression equation settled in the correlation analysis.

Calculated results of monthly inflow value to the Uda Walawe reservoir are shown in Table A 2.3-8. In this study, those calculated inflow values are called as "without Samanalawewa Dam case". After the commencement of the Samanalawewa reservoir operation, on the contrary, the direct drainage area of the Uda Walawe dam decreases by 338 km2 and the regulated discharge from the Samanalawewa reservoir is expected. Inflow to the Uda Walawe reservoir from the direct catchment can be calculated by the following equation;

$$Q_0 = Q_1 - Q_2$$

where, Q_1 : without Samanalawewa Dam inflow described as above
Q_2 : run-off value at the Samanalawewa dam site estimated by the CEB
Q_0 : inflow from the direct catchment of the Uda Walawe dam after commencement of the Samanalawewa reservoir operation

Q_0 is called as the "with Samanalawewa Dam case" in this study. Calculated results of Q_0 are shown in Table A 2.3-9.

Computed results of the extended runoff at the Uda Walawe reservoir are summarized below together with the CEB and SOGREAH study results for reference.

(Unit: MCM)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Re-computed	86.00	49.70	73.50	110.40	113.50	53.50	36.50	28.30	36.00	64.90	153.27	95.20	900.50
CEB Study	81.97	47.18	74.11	124.97	104.25	53.57	36.05	25.00	30.34	58.07	131.46	104.82	872.22
SOGREAH Study	80.66	48.36	77.70	166.65	134.73	35.59	39.65	31.89	39.28	92.43	195.64	154.24	1,155.93

Based on the above Table, run-off in the basin can be expressed as follows:

Source	Calculated Duration	Drainage Area (sq.km)	Annual Areal Rainfall (mm)	Annual Run-off (MCM)	Run-off Coefficient
Re-computed	1960 to 1990	1,152	2,384	901	0.32
CEB Study	1960 to 1984	1,152	2,384	872	0.32
ADB Study	1960 to 1984	1,152	2,384	1,156	0.42

Results of run-off calculation for the whole Uda Walawe catchment, the direct catchment of the Uda Walawe dam and the Samanalawewa dam catchment are summarized below:

(Unit: MCM)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Run-off at the Uda Walawe Dam site (direct drainage basin 1,152 sq.km)	86.00	49.70	73.50	110.40	113.50	53.50	36.50	28.30	36.00	64.90	153.20	95.20	900.50
Run-off at the Samanalawewa Dam site (drainage basin 338 sq.km)	39.80	28.20	43.80	67.10	57.40	40.90	27.90	25.10	27.60	42.50	66.40	60.40	527.20
Run-off at the Uda Walawe Dam site (direct drainage basin 814 sq.km)	46.20	21.50	29.70	43.30	56.10	12.60	8.60	3.20	8.40	22.40	86.80	34.80	373.30

2.3.4 Operation of Samanalawewa reservoir

The Ceylon Electricity Board (CEB) is responsible for the operation of the Samanalawewa reservoir. Operation rule of the Samanalawewa reservoir is not fixed yet. But principle is that the reservoir shall be operated so as to achieve the expected firm energy and the average annual energy targets.

At the request of MASL, CEB provided inflow-outflow data of the Samanalawewa reservoir which were outcome of a preliminary reservoir operation study by CEB. The water balance study for the Walawe left bank development has been conducted using this data to examine the influence of the Samanalawewa operation.

In Sri Lanka, the Water Management Panel has responsibility for the water management of major rivers such as the Mahaweli, Kelani and Walawe rivers. The chairman of WMP is the Director General of MASL and members are Chairman of CEB, Secretary of Ministry of Irrigation, Secretary of Ministry of Agriculture, Director of Water Management Secretariat, Managing Director of MEA, Director of Headworks, Director of Agriculture Department, Director of Irrigation Department, Director of Irrigation Management Department, Chairman of Sugar Industries, and Government Agents of related districts. The Water Management Panel meets twice a year at the beginning of each season to decide the proposed crops, cultivation area, irrigation water requirements, date of water issue for each scheme and the available capacity for hydro-power generation, total energy output and monthly plant availability. The Water Management Secretariat is a sub-structure of WMP and constituted by Director of WMS (chairman) and representatives of CEB, Irrigation Department, MEA, Headworks. WMS meets weekly to make adjustments and decide weekly schedule of water management.

2.4 Water Quality

Water quality has been surveyed at 12 sites to clarify the suitability of water for drinking and irrigation purposes. Survey was conducted in November 1991 and July 1992. Collected water samples were analized at the laboratory of the department of Chemistry of the University of Colombo. Groundwater samples were taken from dug wells at six sites. Surface water samples were taken from the Walawe river at four sites and from waste water aeration ponds of the paper mill and the sugar factory. Locations for the sampling are shown in Table A 2.4-1 and Fig.A 2.4-1. Items measured at the site and at the laboratory are; atmospheric and water temperatures, pH, electric conductivity (EC), suspended sediment (S.S.), dissolved Oxygen (D.O.), chemical analysis for HCO3- , Cl-, F-, NO3-N, Ca+2, Mg+2, Na+. Results of measurement and WHO standard for drinking water are shown in Table A 2.4-2 and Table A 2.4-3.

Following is the results of analysis of sample waters;

(1) pH

PH range from 7.1 to 9. The shallow well water and the surface water of the Walawe river show weak to strong alkalinity. According to Sri Lanka Standard Specification for Potable Water (hereinafter referred to as SSPW), the desired level is 7.0 ~ 8.5 and the permissible level is 6.5 ~ 9.9. Being within the limit of pH value, all sampled water can be used for drinking and irrigation purposes.

(2) Electric conductivity (EC)

EC values of shallow wells are high ranging 1000 ~ 2000 μS/cm. EC values of the Walawe river water are below 300 μS/cm except Ambalantota bridge in the drought season. EC value at the waste water aeration pond of the Sevanagala sugar factory is extremely high.

SSPW's desired level of EC is 750 μS/cm and permissible level is 3500 μS/cm. Because of the high E.C. values, well water is not so desirable for drinking and irrigation uses. Surface water of the river, on the contrary, is adequate for drinking and irrigation use since E.C. values of sampled water show less than 300 μS/cm.

(3) Suspended sediment (SS)

Measured values range 50 to 200 mg/l for both the well water and river water. An allowable extent of suspended sediment in water is less than 50 mg/l for fish, less than 100 mg/l for crops and less than 500 mg/l for drinking water before treatment.

(4) Dissolved oxygen (DO)

Dissolved oxygen of the sampled water shows more than 5 mg/l which is suitable for growing fish and crops.

(5) Chemical analysis

According to SSPW, desired level and permissible level for dissolved ions are as follows:

(Unit: mgl)

	Cl	F	Ca	Mg	NO_3-N
Desired level	200	0.6	100	30	-
Permissible level	1,200	1.5	240	140	10

From the analyzed results of dissolved ions, all the well waters exceed the standard for fluorine ion for drinking water and some of the well water exceed the standard for chlorine ion, calcium ion and magnesium ion.

Taking the calculated S.A.R. and measured E.C. values, sampled water is plotted on the diagram for the classification of irrigation water. Results show that the well water in most cases requires salinity control and/or selection of crops with good salt tolerance. The river water has no particular ploblem in its quality.

In summary, the surface water of the Walawe river can be used for drinking and irrigation purposes. On the contrary, the well water exceeds the standard values in terms of E.C., dissolved fluorine and chlorine ions. When the well water is used for drinking and irrigation, treatment will be required. Monitoring should be continued for waste water of the paper mill and the sugar factory.

2.5 Ground Water

Geologically, Study area consists of Precambrian metamorphic rocks metamorphosed under granulite and amphibolite facies conditions. According to "The Hydrogeochemical Atlas of Sri Lanka" published by the University of Peradeniya, Department of Geology, groungwater over the Uda Walawe basin can broadly be classified into Calcium type for the upperstream, Magnesium type for the middlestream and Sodium/Potassium type for the downstream reaches with the Triliner Diagram. Non-dominant Cation type is further distributed in places over the basin.

From the survey results on the wells utilized in the Study area, groundwater is generally scarce and often saline.

Judging from the results of water quality analysis and the present condition of utilizing groundwater, potentiality seems to be exceedingly limited as drinking and irrigation water source.

TABLES

Table A 2.2-1 METEOROLOGICAL DATA AT SUGAR RESEARCH INSTITUTE

Station : Sugar Research Institute Elevation of the Station above MSL : 61.0 meters
Station Index : SRI
Latitude : 6° 26' N.
Longitude : 80° 53' E.

ITEM	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Temperature (°C)													
Mean	26.6	27.3	27.9	28.4	29.3	28.7	28.8	29.0	28.9	28.2	27.3	26.6	28.2
Mean Max.	31.5	32.9	33.1	32.9	33.0	32.8	33.1	33.3	33.5	32.9	31.7	31.0	32.6
Mean Min.	21.6	21.7	22.8	23.8	25.4	24.6	24.5	24.8	24.4	23.6	22.9	22.2	23.5
Relative Humidity (%)													
Mean	76.6	74.1	75.9	79.0	78.1	72.9	70.0	69.2	70.7	77.6	82.8	80.2	75.6
Evaporatipon (mm)													
Mean	147.1	160.5	165.3	140.2	143.8	157.2	185.6	195.8	179.7	153.1	116.4	127.1	1871.9
Sunshine Hour (hour)													
Mean	195.9	226.8	231.6	200.2	212.0	190.0	218.8	203.9	195.7	195.0	175.6	180.0	2447.4
Wind Velocity (km/h)													
Mean	3.7	3.3	3.0	2.4	3.7	6.6	8.1	8.6	6.8	3.7	2.8	3.3	4.9
Rainfall (mm)													
Mean	62.1	76.5	179.9	146.9	107.6	39.7	28.7	37.7	58.5	255.6	276.3	141.8	1411.3

Table A 2.2-2 METEOROLOGICAL DATA AT AGRICULTURE RESEARCH STATION

Station : Agriculture Research Station
Station Index : ARS
Latitude : 6°10' N.
Longitude : 80°53' E.

ITEM	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Temperature (°C)													
Mean	25.7	26.2	27.6	28.6	28.9	28.2	28.3	28.0	28.1	28.0	27.2	26.6	27.6
Relative Humidity (%)													
Mean	81.9	79.4	79.6	80.6	78.7	79.0	77.6	77.3	78.8	79.0	82.0	82.1	79.6
Evaporatipon (mm)													
Mean	144.8	146.3	170.2	156.2	160.0	162.5	167.2	164.0	160.3	143.7	129.6	139.4	1799.3
Sunshine Hour (hour)													
Mean	217.8	241.2	242.0	221.2	232.2	212.5	221.8	228.5	213.2	219.8	231.2	188.6	2563.7
Wind Velocity (km/h)													
Mean	4.0	4.2	4.1	3.1	4.9	6.2	5.7	6.1	5.4	4.0	3.4	4.9	4.7
Rainfall (mm)													
Mean	83.3	35.5	79.0	101.5	57.2	86.7	25.7	57.2	92.5	127.8	139.8	70.8	921.8

Table A 2.2-3 METEOROLOGICAL DATA AT HAMBANTOTA OBSERVATORY

Latitude : 06°07' N Longitude : 81°08' E Barometer Height : 5 ft Anemometer Height : 10 ft
I = 08:30 Sri Lanka Standard Time II = 17:30 Sri Lanka Standard Time

Month		Pressure at MSL mb	Dry Bulb Temp. °C	Relative Humidity %	Mean Daily Max. Temp. °C	Mean Daily Min. Temp. °C	Highest Max. Temp. °C	Lowest Min. Temp. °C	Mean Wind Speed kmph	Mean Daily Wind Spd kmph	Prevail. Wind Direct.	Monthly Rainfall mm	Number of Rain Days	Rainfall Driest Month mm	Rainfall Wettest Month mm	Heaviest Rainfall in 24 hrs mm	Mean Sunshine Hours hrs/day	Cloud Cover Octas	Number of Days of Thunder	Number of Days of Fog
January	I	1012.4	25.1	80	29.4	22.7	33.0	18.2	19.8	21.5	NE	100.8	9	0.0	376.2	121.9	6.7	4.3	3	0
	II	1009.1	27.0	75			(1942)	(1960)	27.0		NE			(4 yrs)	(1933)	(1913)		5.4		
February	I	1012.2	25.4	80	29.9	22.8	33.6	15.6	19.0	20.3	NE	58.4	5	0.0	273.0	101.9	7.7	3.9	2	0
	II	1008.8	27.7	75			(1941)	(1918)	27.5		ENE			(8 yrs)	(1938)	(1938)		4.9		
March	I	1011.6	26.8	79	30.6	23.6	24.2	18.8	14.8	16.4	NE	66.3	7	0.0	258.1	158.0	8.2	3.4	5	0
	II	1008.2	28.6	74			(1952)	(1946)	23.7		E			1872, 1895	(1927)	(1975)		4.8		
April	I	1010.6	27.8	81	30.9	24.7	34.6	20.9	10.5	15.2	NNE	109.0	10	0.8	333.0	149.4	7.6	4.5	10	0
	II	1007.3	28.8	76			(1911)	(1922)	21.1		SW			(1882)	(1909)	(1909)		5.8		
May	I	1009.0	27.8	83	30.6	25.4	35.8	22.1	19.0	21.9	SW	120.9	12	0.0	512.3	265.2	6.6	5.2	4	0
	II	1006.6	28.2	79			(1946)	(1944)	28.3		SW			1894, 1953	(1940)	(1975)		5.8		
June	I	1009.0	27.1	83	30.2	25.0	36.9	21.6	22.7	23.1	SW	55.1	12	1.0	235.2	69.3	5.8	5.4	1	0
	II	1006.5	27.8	78			(1946)	(1942)	30.3		SW			(1979)	(1900)	(1973)		5.8		
July	I	1009.1	26.7	82	30.7	24.7	35.9	19.6	20.9	23.1	SW	43.2	7	0.0	224.3	80.5	6.0	5.2	1	0
	II	1006.5	27.3	74			(1928)	(1933)	28.0		SW			(1888)	(1953)	(1953)		5.8		
August	I	1009.4	26.6	82	30.5	24.6	36.8	20.4	21.4	23.8	SW	42.2	8	0.0	186.2	87.1	6.5	5.2	1	0
	II	1006.5	27.6	75			(1911)	(1933)	29.9		SW			(3 yrs)	(1969)	(1969)		5.8		
September	I	1010.4	26.8	81	30.2	24.6	35.6	21.0	20.8	23.5	SW	45.5	8	0.0	451.6	148.3	6.6	5.0	2	0
	II	1007.0	27.3	78			(1929)	(1929)	31.2		SW			(1887)	(1877)	(1961)		5.9		
October	I	1011.1	26.9	81	30.1	24.2	35.6	20.3	16.1	19.1	SW	125.7	13	0.5	563.9	125.2	6.6	4.8	8	0
	II	1007.7	27.2	78			(1925)	(1917)	25.0		SW			(1964)	(1877)	(1965)		6.0		
November	I	1011.5	26.2	82	29.7	23.4	35.5	19.6	12.1	14.3	NE	187.5	15	10.2	472.2	134.4	6.8	4.7	8	0
	II	1008.3	27.3	78			(1938)	(1917)	19.6		SW			(1909)	(1893)	1944, 1933		6.2		
December	I	1012.0	25.6	81	29.3	22.9	32.7	18.2	16.3	17.8	NE	120.9	12	1.8	485.9	287.0	6.4	4.6	5	0
	II	1008.8	27.2	78			(1964)	(1937)	22.7		NE			(1883)	(1969)	(1969)		5.9		
Annual	I	1010.7	26.6	81	30.2	24.1	36.9	15.6	17.8	20.0	—	1075.5	118	489.6	2061.6	287.0	6.8	4.7	50	0
	II	1007.6	27.7	76			(1946)	(1918)	26.2		—			(1880)	(1877)	(1969)		5.7		
Period of data (years)		30	25	25	30	30	65	65	25	30	10	30	30	107	107	75	25	25	10	10

Table A 2.2-4 MONTHLY RAINFALL AT ALUPOTA(M008) (Historic)

Station code : M008 Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	279.9	346.7	151.1	353.6	487.9	363.2	518.9	249.9	673.6	308.9	422.1	188.7	4344.5
1961	179.1	274.6	287.3	432.3	692.7	370.1	380.2	660.9	455.4	473.7	490.0	374.4	5070.7
1962	325.1	181.6	351.5	344.7	780.5	305.8	329.7	267.5	487.9	733.3	624.8	471.2	5203.6
1963	355.1	295.1	452.1	604.8	608.6	638.0	550.9	472.7	656.1	675.6	911.9	376.2	6597.1
1964	246.4	216.7	446.0	532.6	960.4	451.6	778.3	331.2	669.3	440.7	585.0	290.3	5948.5
1965	133.3	189.7	321.1	677.2	1349.0	719.3	202.4	985.0	623.8	667.8	892.6	478.5	7239.7
1966	270.8	180.1	540.0	1058.0	283.0	424.2	361.2	495.0	1064.0	771.7	694.4	567.7	6710.1
1967	199.6	284.0	355.9	231.4	192.8	513.1	226.8	305.6	199.9	758.2	621.3	279.7	4168.3
1968	389.4	82.3	266.4	357.4	336.3	756.2	377.4	259.6	413.0	461.0	632.7	459.2	4790.9
1969	157.5	62.2	114.0	351.0	860.0	335.0	66.3	270.0	283.0	635.3	279.7	342.1	3756.1
1970	259.3	188.7	362.5	413.3	247.9	327.4	304.5	202.4	327.4	604.8	428.0	162.6	3828.8
1971	255.0	283.5	259.8	537.7	471.2	325.1	307.3	458.0	800.4	470.2	388.1	285.8	4842.1
1972	121.7	78.2	218.4	450.9	987.3	240.3	398.0	240.3	743.0	725.2	453.6	186.7	4843.6
1973	63.3	197.6	258.1	386.8	232.9	378.0	191.0	393.7	115.6	379.7	376.4	462.0	3435.1
1974	8.4	159.8	119.6	466.3	393.4	480.6	521.2	328.7	577.8	149.4	172.0	432.3	3809.5
1975	63.5	156.2	331.0	400.3	595.4	484.1	79.5	481.6	340.4	525.0	529.6	290.3	4276.9
1976	108.2	67.6	205.0	379.2	221.7	114.8	237.5	215.4	102.9	438.1	465.6	427.5	2983.5
1977	0.0	184.9	189.7	494.0	421.6	194.6	93.2	152.4	192.3	559.8	425.4	293.1	3201.0
1978	184.7	384.3	261.6	236.2	734.8	132.1	132.1	191.0	315.0	413.8	524.0	223.5	3733.1
1979	21.6	206.5	200.2	213.9	308.4	138.2	253.0	23.4	709.2	500.9	525.5	341.4	3442.2
1980	33.5	61.7	253.7	411.7	316.5	219.7	332.5	245.4	208.5	382.0	395.5	190.5	3051.2
1981	159.3	78.0	243.8	495.6	255.0	377.7	294.1	173.2	500.9	339.9	621.5	302.8	3841.8
1982	79.8	80.8	395.5	393.0	703.4	999.4	341.1	270.0	170.4	548.4	693.1	173.4	4848.3
1983	85.6	58.2	86.7	150.5	347.6	442.6	429.6	385.1	413.9	298.3	265.1	800.3	3763.5
1984	390.0	300.8	327.9	676.1	390.1	348.1	339.8	86.4	75.9	266.7	281.6	150.9	3634.3
1985	264.2	101.8	347.2	182.8	544.7	674.5	302.1	173.8	246.3	626.5	178.1	402.2	4044.2
1986	130.7	172.6	102.7	417.9	193.5	331.4	166.3	363.1	655.2	525.2	238.6	252.0	3549.2
1987	152.1	56.3	172.1	242.1	243.1	181.6	12.5	501.1	297.6	671.2	540.0	267.5	3337.2
1988	135.0	290.0	505.5	455.0	636.5	637.3	392.0	608.9	961.0	219.5	502.0	244.6	5587.3
1989	140.0	6.0	136.0	256.5	944.0	789.0	766.5	358.5	416.5	690.9	374.3	364.2	5242.4
1990	239.2	236.3	399.2	278.4	607.3	430.1	361.1	117.1	149.5	483.8	413.5	119.8	3835.3
Ave.	175.2	176.2	279.4	415.5	527.3	423.3	324.1	331.2	446.6	507.9	482.1	329.1	4418.1
Max.	390.0	384.3	540.0	1058.0	1349.0	999.4	778.3	985.0	1064.0	771.7	911.9	800.3	7239.7
Min.	0.0	6.0	86.7	150.5	192.8	114.8	12.5	23.4	75.9	149.4	172.0	119.8	2983.5

Table A 2.2-5 MONTHLY RAINFALL AT BALANGODA(M041) (Historic)

Station code : M041 Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	192.8	351.8	273.3	284.7	113.0	45.0	195.3	22.4	188.5	150.9	144.5	151.9	2114.1
1961	176.8	101.3	194.8	281.7	262.6	177.8	40.6	138.9	17.8	330.2	594.4	201.9	2518.8
1962	149.6	152.9	174.8	331.5	320.8	69.8	204.0	100.3	186.4	100.3	240.0	184.1	2214.5
1963	327.9	124.7	208.3	459.7	121.9	246.4	139.7	61.0	94.0	218.4	538.5	332.7	2873.2
1964	99.1	124.5	223.5	195.6	129.5	119.4	181.1	48.3	144.3	135.4	133.1	206.8	1740.6
1965	23.6	100.6	170.9	411.2	333.5	64.5	19.6	125.7	122.4	236.0	397.3	308.9	2314.2
1966	194.8	90.4	169.2	435.9	14.0	46.7	36.3	38.6	309.1	381.8	277.4	232.9	2227.1
1967	167.6	142.5	231.9	326.9	154.7	173.7	36.3	60.5	20.3	462.0	607.1	162.1	2545.6
1968	2.5	0.0	134.4	164.6	96.5	247.4	107.9	52.8	124.0	542.5	278.4	234.7	1985.7
1969	32.5	114.0	164.6	350.0	379.2	211.6	203.5	207.3	113.8	462.3	196.6	442.5	2877.9
1970	135.6	114.0	315.2	330.5	229.9	52.1	70.9	89.2	51.6	148.1	388.9	178.8	2104.8
1971	361.9	189.7	231.7	368.6	154.7	180.6	78.0	294.9	442.0	291.3	382.8	157.2	3133.4
1972	46.5	20.6	443.0	238.3	343.7	29.2	62.7	73.4	233.9	362.5	508.0	166.9	2528.7
1973	54.6	29.2	288.3	165.6	64.3	142.5	30.5	120.9	30.5	366.3	291.3	368.0	1952.0
1974	0.0	236.2	241.8	398.5	104.6	165.1	176.0	151.9	212.1	54.1	254.3	412.8	2407.4
1975	72.4	187.7	368.0	504.4	200.7	490.0	41.2	180.3	141.0	123.7	499.9	198.4	3007.7
1976	38.1	55.9	167.9	274.3	173.7	7.6	26.2	70.4	22.9	483.9	218.9	107.4	1647.2
1977	167.6	329.9	345.4	546.9	310.9	88.9	85.1	81.0	36.6	375.7	377.2	263.7	3008.9
1978	29.7	152.1	73.9	90.9	350.5	57.4	50.3	162.1	169.9	247.9	386.1	77.2	1848.0
1979	167.1	59.9	16.3	269.5	472.9	95.5	153.9	27.7	224.8	617.5	490.2	231.9	2827.2
1980	9.9	33.5	85.6	333.2	151.6	70.1	80.0	71.9	113.5	140.6	523.0	183.5	1796.4
1981	103.0	74.6	102.1	159.9	173.6	165.1	7.6	45.6	0.0	125.7	297.0	140.5	1394.7
1982	70.2	22.5	143.7	212.1	118.0	448.8	89.0	93.0	0.0	529.0	701.0	120.3	2547.6
1983	20.0	57.5	18.0	200.9	314.3	33.1	30.5	55.0	83.4	258.2	281.6	282.5	1635.0
1984	292.8	184.3	701.5	403.7	82.0	142.3	124.0	43.0	177.0	196.3	488.4	206.9	3042.2
1985	85.9	123.1	291.7	244.7	424.8	516.0	31.1	21.4	107.1	513.3	362.0	365.4	3086.5
1986	135.2	55.0	172.0	662.8	18.1	90.9	58.5	141.1	217.6	168.1	123.5	178.1	2020.9
1987	105.1	55.5	175.6	135.1	312.8	106.1	0.0	129.8	185.0	272.2	410.0	220.9	2108.1
1988	67.0	204.3	436.4	458.5	127.4	144.6	210.1	66.5	222.5	208.3	252.7	255.8	2654.1
1989	25.4	0.0	157.2	310.7	185.0	162.3	283.0	68.0	49.7	320.0	396.4	72.1	2029.8
1990	86.4	221.9	363.8	364.8	290.1	166.2	81.4	58.0	19.5	268.4	390.6	132.6	2443.7
Ave.	111.0	119.7	228.5	319.9	210.6	153.4	94.7	93.6	131.0	293.3	368.7	218.7	2343.1
Max.	361.9	351.8	701.5	662.8	472.9	516.0	283.0	294.9	442.0	617.5	701.0	442.5	3133.4
Min.	0.0	0.0	16.3	90.9	14.0	7.6	0.0	21.4	0.0	54.1	123.5	72.1	1394.7

Table A 2.2-6 MONTHLY RAINFALL AT BLACKWOOD(M060) (Historic)

Station code : M060 Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	435.6	333.0	102.6	429.8	80.3	10.4	278.4	33.0	63.2	296.2	507.0	81.3	2650.8
1961	321.6	297.7	357.4	347.2	225.6	19.6	37.1	24.4	70.4	408.2	432.6	231.6	2773.4
1962	98.6	101.1	359.9	503.7	238.5	35.3	19.1	82.0	83.8	554.5	438.9	281.9	2797.3
1963	338.0	216.9	208.0	464.1	244.9	21.3	50.0	32.0	139.4	485.1	533.4	391.0	3124.1
1964	171.2	124.5	159.5	249.2	108.7	17.0	123.7	36.6	118.6	276.0	265.8	96.0	1746.8
1965	22.6	132.1	258.8	567.4	280.7	7.1	30.0	128.0	78.2	285.7	405.1	330.2	2525.9
1966	127.0	25.4	202.9	381.5	15.2	14.2	24.4	125.5	189.0	422.1	775.7	297.7	2600.6
1967	205.0	154.4	210.8	151.6	86.6	13.7	29.2	10.9	43.4	333.2	473.5	99.3	1811.6
1968	181.4	87.9	207.0	385.1	142.2	36.6	23.1	9.1	65.0	585.0	377.7	371.9	2472.0
1969	147.1	97.8	135.1	630.7	128.8	12.4	10.4	268.5	91.9	541.0	416.6	526.8	3007.1
1970	85.6	258.8	414.5	402.1	86.4	35.1	13.5	20.3	64.5	146.3	620.5	298.4	2446.0
1971	240.5	326.9	205.7	661.7	58.7	13.0	83.8	241.6	283.7	251.2	278.1	391.7	3036.6
1972	68.1	20.0	238.9	336.8	253.2	21.3	96.0	18.8	130.8	688.8	816.4	222.0	2911.1
1973	24.9	39.1	162.1	271.5	26.7	41.4	50.5	36.3	87.1	644.9	388.4	556.8	2329.7
1974	56.4	276.4	117.1	490.0	220.7	10.7	45.5	43.4	181.4	128.5	483.6	277.9	2331.6
1975	80.0	105.2	224.8	487.2	219.2	41.1	64.3	113.5	154.9	70.1	466.3	216.4	2243.0
1976	207.3	32.3	360.7	744.5	118.6	62.0	26.7	67.3	41.1	554.5	1157.0	523.7	3895.7
1977	0.0	262.0	221.6	628.9	228.8	16.2	71.6	61.5	184.2	828.6	587.5	225.0	3315.9
1978	183.7	240.0	259.2	270.4	195.3	4.7	33.0	9.9	79.6	326.2	405.3	189.6	2196.9
1979	52.8	221.7	230.7	349.1	101.6	36.8	37.8	14.9	284.8	698.5	541.9	206.1	2776.7
1980	27.1	29.9	221.1	458.6	113.2	6.3	11.9	15.4	118.9	216.1	371.5	255.9	1845.9
1981	124.7	79.2	213.5	286.9	99.0	25.3	737.0	49.3	116.3	183.9	463.4	119.2	2497.7
1982	42.4	19.3	230.0	266.8	259.7	60.8	23.0	64.0	76.0	383.6	619.5	202.3	2247.4
1983	10.6	39.8	146.7	136.1	107.1	15.7	33.6	23.5	38.3	227.3	359.8	217.1	1355.6
1984	130.7	91.6	326.0	479.3	115.4	20.8	72.4	107.1	147.5	139.8	356.3	166.9	2153.8
1985	128.3	85.1	240.9	187.8	81.2	42.8	50.6	88.7	94.6	—	—	—	—
1986	—	—	—	—	—	—	—	—	—	—	—	—	—
1987	—	—	—	—	—	—	—	—	—	—	—	—	—
1988	—	—	—	—	—	—	—	—	—	—	—	—	—
1989	—	—	—	—	—	—	—	—	—	—	—	—	—
1990	—	—	—	—	—	—	—	—	—	—	—	—	—
Ave.	135.0	142.2	231.4	406.5	147.6	24.7	79.9	66.4	116.4	387.0	501.7	271.1	2523.7
Max.	435.6	333.0	414.5	744.5	280.7	62.0	737.0	268.5	284.8	828.6	1157.0	556.8	3895.7
Min.	0.0	19.3	102.6	136.1	15.2	4.7	10.4	9.1	38.3	70.1	265.8	81.3	1355.6

Table A 2.2-7 MONTHLY RAINFALL AT DETANAGALA(M100) (Historic)

Station code : M100 Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	247.6	366.5	405.4	431.3	116.1	55.1	318.8	45.0	106.4	377.4	226.1	178.1	2873.8
1961	150.9	154.9	394.5	363.2	423.7	131.3	122.7	208.3	82.0	402.8	437.4	490.0	3361.7
1962	210.3	190.8	232.9	389.4	388.9	104.1	117.1	142.2	116.8	193.8	582.4	259.8	2928.5
1963	259.8	329.9	309.4	607.3	266.4	253.2	104.6	56.9	130.3	472.9	859.8	330.2	3980.7
1964	245.4	268.2	317.8	325.9	159.0	178.6	189.0	87.4	158.5	272.0	167.9	286.8	2656.5
1965	155.4	155.7	217.7	469.4	541.3	79.2	26.4	167.4	147.1	504.4	533.7	520.2	3517.9
1966	383.3	103.9	287.8	614.7	26.2	78.2	55.9	40.1	414.8	308.1	393.4	321.3	3027.7
1967	169.2	154.9	258.1	246.1	161.5	97.5	45.5	61.0	50.5	486.7	822.5	295.4	2848.9
1968	191.8	26.2	218.7	447.0	223.5	162.1	107.9	52.8	124.0	486.2	229.4	435.9	2705.5
1969	85.1	134.4	257.8	517.1	293.6	211.6	20.3	207.3	113.8	455.9	201.2	412.5	2910.6
1970	289.3	291.6	436.9	404.9	129.3	52.1	70.9	89.2	51.6	276.4	400.1	228.9	2721.2
1971	216.9	272.0	207.0	493.0	47.8	140.5	75.7	124.5	613.2	191.3	473.7	356.6	3212.2
1972	144.8	11.4	144.5	368.3	300.2	21.3	246.9	65.8	256.0	554.5	516.6	158.2	2788.5
1973	115.3	211.8	309.4	329.7	120.4	85.6	54.9	95.0	39.1	471.7	261.9	925.3	3020.1
1974	17.0	205.0	287.5	414.8	175.0	197.4	173.7	148.8	146.3	77.7	256.3	484.6	2584.1
1975	146.3	271.8	413.0	534.4	207.3	467.9	91.9	78.2	126.7	94.0	527.6	349.5	3308.6
1976	137.2	26.9	149.4	381.3	38.6	17.3	36.8	70.4	0.0	525.5	530.4	382.8	2296.6
1977	61.5	106.4	384.3	432.8	179.1	17.3	79.5	73.7	35.1	569.2	528.6	455.7	2923.2
1978	220.7	234.9	297.9	334.5	655.6	57.4	116.8	188.0	199.9	360.2	340.4	211.8	3218.1
1979	41.7	219.7	130.3	289.6	43.2	83.8	52.3	98.8	261.6	309.9	476.2	254.0	2261.1
1980	86.4	30.5	457.2	421.6	237.5	78.7	5.1	45.2	196.4	159.0	407.9	286.5	2412.0
1981	240.8	95.8	243.8	286.5	128.8	78.7	79.8	21.3	238.1	156.9	221.4	274.6	2066.5
1982	126.4	10.2	243.7	255.8	338.5	187.9	25.8	50.6	8.4	305.6	478.1	118.9	2149.9
1983	34.9	12.6	45.4	149.4	331.5	20.4	61.3	57.5	75.1	349.5	562.8	817.5	2517.9
1984	455.4	396.8	627.2	645.3	140.6	112.5	154.3	51.6	146.6	115.6	366.7	204.7	3417.3
1985	218.3	118.0	261.0	149.2	255.6	368.8	18.8	27.3	90.5	349.8	201.7	323.8	2382.8
1986	197.6	214.5	116.6	310.2	101.1	40.8	9.4	65.2	74.4	114.1	116.2	158.9	1519.0
1987	166.0	42.0	170.8	279.6	300.2	71.8	6.4	99.5	119.4	302.7	294.8	175.7	2028.9
1988	45.2	215.0	368.0	511.4	127.6	162.5	130.7	78.1	169.7	173.8	451.5	320.6	2754.1
1989	67.7	0.0	172.7	221.2	256.5	159.6	345.4	56.6	99.1	374.9	589.3	122.5	2465.5
1990	106.9	232.1	386.6	273.0	262.2	50.5	28.6	89.0	58.5	443.4	434.6	—	—
Ave.	168.9	164.7	282.4	383.8	225.1	123.3	95.9	88.5	143.5	330.2	415.8	338.0	2762.0
Max.	455.4	396.8	627.2	645.3	655.6	467.9	345.4	208.3	613.2	569.2	859.8	925.3	3980.7
Min.	17.0	0.0	45.4	149.2	26.2	17.3	5.1	21.3	0.0	77.7	116.2	118.9	1519.0

Table A 2.2-8 MONTHLY RAINFALL AT LAUDERDALE GROUP(M306) (Historic)

Station code : M306 Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	449.6	344.2	164.3	319.3	295.9	193.8	323.6	65.5	726.7	326.4	294.9	74.2	3578.4
1961	258.3	77.0	155.7	257.0	498.1	263.9	192.3	356.6	238.0	429.3	596.4	399.3	3721.9
1962	303.5	161.0	302.5	711.5	713.0	266.4	602.2	341.4	615.2	449.3	602.5	625.9	5694.4
1963	247.9	163.8	221.2	571.0	523.2	514.9	750.1	559.3	563.4	612.1	457.7	548.6	5733.2
1964	270.0	169.2	371.1	338.1	576.6	579.6	726.7	462.5	340.9	153.2	206.8	179.3	4374.0
1965	5.1	4.6	128.3	355.1	587.2	159.8	70.6	247.1	451.4	335.0	412.0	409.4	3165.6
1966	40.1	4.6	515.4	232.4	56.4	158.8	93.0	3.8	669.5	522.2	185.4	284.2	2765.8
1967	215.6	113.0	232.9	298.2	204.2	351.3	159.8	248.7	227.3	814.8	392.2	195.4	3453.4
1968	160.5	49.5	69.6	79.8	127.3	557.5	570.5	135.1	546.9	139.7	131.8	148.8	2717.0
1969	43.4	101.1	292.9	309.1	1265.0	372.9	86.9	294.9	274.3	562.6	335.0	763.5	4701.6
1970	208.8	138.9	419.9	282.4	277.6	246.1	223.0	220.2	201.4	374.1	484.6	195.3	3272.3
1971	264.2	192.0	147.1	398.5	288.8	355.3	279.9	312.7	850.6	193.8	813.3	453.9	4550.1
1972	134.1	69.8	121.2	240.5	837.9	177.5	278.4	260.1	613.9	530.9	634.2	99.8	3998.3
1973	62.7	191.5	576.1	262.9	107.9	339.3	141.0	303.0	114.8	544.3	232.7	381.5	3257.7
1974	11.4	90.4	41.9	263.1	331.7	433.6	430.8	251.0	475.0	214.9	276.4	166.6	2986.8
1975	93.4	159.8	215.4	412.5	431.8	605.5	141.5	304.8	295.4	475.5	423.9	422.4	3981.9
1976	122.4	45.7	253.0	369.7	227.1	67.8	113.8	182.9	56.1	302.8	386.1	428.0	2555.4
1977	6.9	141.7	217.2	343.4	439.7	224.0	73.7	195.0	212.6	330.7	574.8	264.9	3024.6
1978	83.1	245.1	240.8	246.4	707.6	181.9	224.5	411.7	368.3	281.6	723.1	194.8	3908.9
1979	35.8	103.4	55.1	334.0	389.4	284.0	273.2	116.1	489.7	386.1	468.1	350.3	3285.2
1980	36.1	8.9	105.2	252.0	131.6	268.2	219.0	191.3	89.9	229.9	140.0	200.8	1872.9
1981	93.2	159.8	87.6	387.5	274.0	371.2	89.7	317.3	119.7	182.5	371.3	155.3	2609.1
1982	0.0	80.1	236.2	547.4	643.2	851.8	315.4	192.0	62.9	383.6	624.0	87.4	4024.0
1983	117.6	119.1	88.9	41.8	293.3	144.8	122.2	188.6	302.0	124.3	251.8	366.7	2161.1
1984	412.9	140.9	254.7	504.9	257.5	347.3	245.4	0.0	246.1	337.8	529.7	134.4	3411.6
1985	214.9	202.2	311.5	199.4	115.4	771.2	107.8	72.0	107.9	619.7	344.3	319.4	3385.7
1986	129.7	188.8	198.6	463.5	175.0	120.0	100.9	335.8	505.6	254.5	213.4	149.0	2834.8
1987	129.5	0.0	175.0	252.6	173.0	221.7	0.0	413.8	198.6	481.5	192.7	175.1	2413.5
1988	78.7	101.0	310.5	281.7	—	—	—	—	—	—	—	—	—
1989	—	—	—	—	—	—	—	—	—	—	—	—	—
1990	—	—	—	—	—	—	—	—	—	—	—	—	—
Ave.	145.8	123.0	224.5	329.5	391.1	336.8	248.4	249.4	355.9	378.3	403.5	291.9	3480.0
Max.	449.6	344.2	576.1	711.5	1265.0	851.8	750.1	559.3	850.6	814.8	813.3	763.5	5733.2
Min.	0.0	0.0	41.9	41.8	56.4	67.8	0.0	0.0	56.1	124.3	131.8	74.2	1872.9

Table A 2.2-9 MONTHLY RAINFALL AT MAHAWELATENNA(M337) (Historic)

Station code : M337 Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	277.9	268.0	360.4	399.3	80.3	8.4	168.4	18.5	39.1	302.5	131.3	173.2	2227.3
1961	266.2	68.3	262.9	432.3	149.4	60.7	94.2	75.2	40.4	220.5	294.6	203.7	2168.4
1962	76.7	99.1	265.4	362.2	280.9	31.8	69.8	12.9	129.0	308.4	291.8	157.2	2085.2
1963	274.3	124.7	288.8	462.5	309.4	138.2	63.0	13.7	75.7	381.8	786.9	501.4	3420.4
1964	78.5	115.1	379.0	310.6	90.9	105.9	122.9	12.9	142.7	144.8	59.9	72.9	1636.1
1965	5.6	245.1	207.3	293.6	290.3	57.4	12.7	73.9	90.4	190.2	422.7	280.9	2170.1
1966	165.1	62.7	205.2	394.5	1.8	42.4	38.9	20.3	219.2	446.5	229.4	175.3	2001.3
1967	117.1	127.3	231.9	326.9	147.6	77.7	34.5	64.0	15.8	369.6	467.4	144.3	2124.1
1968	129.8	10.9	159.5	175.3	117.9	76.7	91.7	2.3	75.2	542.5	278.4	234.7	1894.9
1969	32.5	148.8	178.3	185.9	464.6	72.9	3.3	66.6	49.3	462.3	196.6	442.5	2303.6
1970	135.6	168.1	315.2	330.5	160.0	21.8	33.5	7.1	29.7	148.1	388.9	178.8	1917.3
1971	219.5	114.0	349.5	328.2	58.7	143.5	70.9	79.0	242.6	233.2	382.8	157.2	2379.1
1972	46.5	20.6	443.0	144.8	215.6	7.4	72.4	12.9	127.8	319.3	322.3	92.7	1825.3
1973	71.1	0.5	302.8	338.3	118.1	66.3	22.4	35.0	5.3	412.0	270.0	311.7	1953.5
1974	0.0	253.2	131.1	359.9	97.3	75.7	120.9	44.2	98.0	123.7	126.5	419.6	1850.1
1975	92.2	263.7	114.3	240.5	232.4	275.6	31.5	20.3	93.2	61.5	457.2	154.2	2036.6
1976	21.8	68.8	2.3	263.7	78.0	5.8	0.8	52.8	38.3	255.3	218.9	107.4	1113.9
1977	167.6	329.9	265.2	352.8	192.3	59.2	34.3	0.0	36.3	534.2	336.3	3.0	2311.1
1978	65.3	152.1	365.8	269.5	383.5	28.7	69.6	99.3	89.4	335.8	530.4	259.8	2649.2
1979	21.8	11.7	183.6	253.2	245.6	73.2	80.0	37.6	142.5	390.4	289.3	272.5	2001.4
1980	2.0	33.5	130.8	195.3	156.2	55.4	36.6	73.2	28.2	347.7	561.3	26.9	1647.1
1981	8.6	125.2	167.9	132.8	156.5	118.4	39.9	70.4	135.6	53.3	371.3	24.9	1404.8
1982	56.4	0.0	212.8	209.3	320.5	191.8	41.2	4.3	13.6	386.8	450.9	158.1	2045.7
1983	14.4	21.3	108.6	196.6	312.2	18.8	10.7	34.0	70.2	369.3	232.2	203.3	1591.6
1984	270.8	152.8	404.2	397.2	60.5	83.0	92.1	6.9	154.7	123.3	457.9	243.3	2446.7
1985	133.6	197.8	379.8	119.9	321.9	351.2	5.4	10.8	70.1	—	—	—	—
1986	—	—	—	—	—	—	—	—	87.0	219.5	210.1	—	—
1987	72.9	20.8	105.7	332.6	28.9	36.1	12.5	65.0	33.7	190.3	448.9	174.9	1522.3
1988	42.6	92.9	354.3	348.6	183.3	100.0	78.7	123.6	13.3	159.8	35.0	72.8	1604.9
1989	—	—	—	—	—	—	—	—	—	—	—	—	—
1990	—	—	—	—	—	—	—	—	—	—	—	—	—
Ave.	102.4	117.7	245.6	291.3	187.7	85.1	55.5	40.6	82.3	286.9	330.3	194.3	2012.3
Max.	277.9	329.9	443.0	462.5	464.6	351.2	168.4	123.6	242.6	542.5	786.9	501.4	3420.4
Min.	0.0	0.0	2.3	119.9	1.8	5.8	0.8	0.0	5.3	53.3	35.0	3.0	1113.9

Table A 2.2-10 MONTHLY RAINFALL AT NAGARAT ESTATE(M408) (Historic)

Station code : M408 Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	100.8	200.9	304.3	391.2	102.9	31.5	360.7	61.2	184.9	331.0	489.2	159.3	2717.9
1961	172.5	178.3	187.5	311.1	239.3	35.6	66.0	70.6	59.2	426.2	314.7	181.6	2242.6
1962	80.3	50.8	286.3	440.9	278.9	87.4	148.6	90.4	108.5	317.5	308.4	216.7	2414.7
1963	217.7	204.7	131.6	567.7	255.3	132.1	137.7	55.1	158.8	609.1	713.2	324.1	3507.1
1964	156.7	120.7	222.8	216.9	96.0	152.4	167.4	129.0	159.5	213.1	144.5	143.0	1922.0
1965	22.6	34.0	190.5	565.1	460.2	116.1	0.0	152.4	64.3	415.8	451.1	322.3	2794.4
1966	41.7	76.2	217.4	470.7	19.0	74.9	55.7	39.2	44.7	320.0	417.1	239.0	2015.6
1967	87.9	100.8	213.7	247.6	62.9	102.0	41.6	53.7	53.1	569.2	739.8	329.8	2602.1
1968	124.9	86.6	148.6	355.5	163.1	164.8	126.5	79.0	77.7	428.8	242.1	216.9	2214.5
1969	64.5	125.5	221.0	539.0	283.7	60.5	65.3	154.2	99.3	479.3	209.3	473.7	2775.3
1970	191.3	290.8	311.9	467.9	571.5	62.5	84.3	65.0	40.9	204.7	350.3	285.0	2926.1
1971	140.7	125.0	128.8	241.6	69.8	129.3	109.7	184.4	287.5	173.7	296.2	247.1	2133.8
1972	99.8	36.1	202.9	277.4	345.4	46.5	124.2	78.7	236.0	620.8	456.9	107.2	2631.9
1973	35.3	72.9	114.6	392.9	60.7	54.9	39.4	44.2	43.9	419.6	341.9	351.6	1971.9
1974	2.5	166.4	154.4	246.4	144.8	45.7	61.0	67.3	148.6	85.1	163.8	199.4	1485.4
1975	151.1	36.8	121.9	576.3	106.9	217.2	41.9	31.0	239.8	246.1	502.2	340.4	2611.6
1976	214.6	22.9	132.1	798.1	22.9	114.3	38.1	28.2	111.3	594.6	599.7	302.0	2978.8
1977	32.3	132.6	280.9	653.0	311.7	85.8	125.5	100.3	111.0	687.1	590.3	236.0	3346.5
1978	229.4	282.2	388.6	150.1	580.9	22.6	49.8	85.8	110.2	499.7	466.4	123.7	2989.4
1979	37.6	220.7	36.1	225.8	120.9	38.3	42.9	25.1	303.0	705.1	908.0	341.1	3004.6
1980	27.9	56.9	347.7	557.8	66.0	72.1	1.0	11.4	0.0	38.3	308.0	298.0	1785.1
1981	131.3	92.8	171.0	363.2	129.8	144.5	89.8	43.9	162.6	90.9	272.3	129.1	1821.2
1982	44.7	37.3	178.3	362.0	349.2	221.5	43.5	144.1	27.8	391.2	580.6	195.2	2575.4
1983	2.0	33.0	11.2	10.1	25.8	0.3	4.7	5.0	2.5	28.4	43.2	38.3	204.5
1984	26.3	27.8	416.1	556.3	83.2	135.3	159.3	48.8	148.6	103.2	267.8	141.4	2114.1
1985	175.3	178.2	294.4	250.0	202.5	385.3	22.0	50.0	135.5	256.5	230.0	281.5	2461.2
1986	202.7	137.8	104.0	329.5	86.5	146.6	29.0	146.5	74.9	1025.3	163.0	179.0	2624.8
1987	107.0	37.0	228.0	440.7	194.0	85.0	0.0	84.0	55.7	468.0	266.5	59.0	2024.9
1988	5.4	98.2	623.0	916.5	185.0	67.0	98.0	147.3	265.4	41.2	324.7	80.3	2852.0
1989	8.1	28.0	130.0	379.3	116.4	51.7	474.5	308.4	163.5	261.0	309.7	50.0	2280.6
1990	—	—	—	—	—	—	—	—	—	—	—	—	—
Ave.	97.8	109.7	216.7	410.0	191.2	102.8	93.6	86.1	122.6	368.4	382.4	219.7	2401.0
Max.	229.4	290.8	623.0	916.5	580.9	385.3	474.5	308.4	303.0	1025.3	908.0	473.7	3507.1
Min.	2.0	22.9	11.2	10.1	19.0	0.3	0.0	5.0	0.0	28.4	43.2	38.3	204.5

Table A 2.2-11 MONTHLY RAINFALL AT WEST HAPUTALE ESTATE (M624) (Historic)

Station code : M624 — Historic Data — Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	279.9	339.9	168.4	493.8	87.9	4.1	244.3	45.7	120.4	381.3	504.7	111.5	2781.9
1961	252.2	163.3	246.9	300.2	279.7	33.3	52.3	56.4	47.2	406.1	329.2	159.8	2326.6
1962	92.5	70.6	269.2	459.2	216.2	52.6	45.5	97.8	82.6	336.0	333.5	287.8	2343.5
1963	255.8	174.8	351.8	633.2	355.3	90.9	38.6	22.1	231.4	492.3	540.3	282.2	3468.7
1964	118.9	148.8	344.7	469.1	65.5	26.4	97.8	94.7	108.2	102.4	71.1	67.6	1715.2
1965	19.6	105.2	324.9	716.8	353.6	0.0	1.3	86.1	78.2	326.1	360.9	296.4	2669.1
1966	133.9	41.4	268.7	463.0	22.4	29.0	0.0	83.8	206.8	312.4	511.8	257.3	2330.5
1967	152.1	116.3	178.3	206.0	40.1	46.0	11.9	102.9	48.3	398.5	379.0	173.0	1852.4
1968	168.7	24.1	186.4	366.3	109.2	78.0	54.9	22.9	41.2	502.4	188.0	195.1	1937.2
1969	126.5	262.9	172.2	373.4	188.2	30.2	12.9	169.9	71.9	567.2	196.3	464.8	2636.4
1970	135.6	275.3	401.8	539.8	149.4	47.2	26.7	38.1	76.2	204.2	437.6	286.5	2618.4
1971	231.4	276.9	200.4	409.7	18.5	39.9	78.0	117.9	284.0	215.9	136.7	315.7	2325.0
1972	58.9	0.0	257.6	383.5	198.6	37.1	142.0	20.3	156.2	597.2	589.3	176.8	2617.5
1973	14.0	65.8	154.9	313.7	74.4	32.0	16.0	26.2	62.0	297.7	231.1	295.7	1583.5
1974	0.0	103.4	81.8	323.1	219.6	20.8	61.5	37.6	198.7	164.6	345.7	225.2	1782.0
1975	223.9	70.4	237.5	386.7	191.9	87.3	50.3	51.3	180.0	189.9	377.8	243.6	2290.6
1976	283.3	37.5	241.4	444.5	63.4	92.2	20.3	37.8	57.4	343.5	616.0	343.4	2580.7
1977	8.0	143.2	231.6	529.6	261.3	29.9	126.5	64.1	182.6	622.2	474.1	200.4	2873.5
1978	158.6	211.6	332.7	340.9	365.9	6.4	48.0	28.3	89.6	331.4	312.5	146.7	2372.6
1979	33.2	192.0	243.8	380.6	182.1	48.3	66.0	35.6	316.2	492.3	419.9	324.4	2734.4
1980	2.8	65.5	224.8	288.3	222.3	12.2	10.7	28.2	197.6	197.5	301.2	335.1	1686.2
1981	137.9	93.9	210.0	147.7	149.0	51.9	118.4	52.8	129.5	215.2	428.3	85.4	1820.0
1982	34.1	18.0	229.1	182.9	478.3	136.8	31.3	104.2	65.8	320.0	519.2	152.5	2272.2
1983	10.4	39.1	80.7	139.3	216.8	17.4	70.7	17.3	65.3	270.1	310.2	122.5	1359.8
1984	219.3	127.8	458.5	439.7	127.6	43.3	110.3	59.0	157.8	167.7	289.3	142.7	2343.0
1985	105.3	105.9	269.8	243.6	160.5	107.6	35.8	50.3	113.0	—	—	—	—
1986	—	36.4	155.7	549.3	347.5	26.4	29.1	102.9	73.0	478.0	134.5	159.4	—
1987	170.4	54.0	262.5	333.1	273.8	8.0	0.0	54.7	264.0	735.0	274.0	295.2	2724.7
1988	30.5	320.0	270.0	558.0	124.5	31.0	69.0	110.5	164.5	29.5	450.0	149.0	2306.5
1989	102.5	51.0	81.0	250.5	272.0	55.0	182.0	103.5	176.0	264.0	196.0	119.5	1853.0
1990	298.2	187.0	263.5	119.0	159.5	27.3	14.5	31.0	147.5	324.8	262.3	225.0	2059.6
Ave.	128.6	126.5	238.7	380.1	192.7	43.5	60.2	63.0	135.3	342.8	350.7	221.3	2291.9
Max.	298.2	339.9	458.5	716.8	478.3	136.8	244.3	169.9	316.2	735.0	616.0	464.8	3468.7
Min.	0.0	0.0	80.7	119.0	18.5	0.0	0.0	17.3	41.2	29.5	71.1	67.6	1359.8

Table A 2.2-12 MONTHLY RAINFALL AT MAHAWELI ECONOMIC AGENCY (Historic)

Station code : MEA Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	—	—	—	—	—	—	—	—	—	—	—	—	—
1961	—	—	—	—	—	—	—	—	—	—	—	—	—
1962	—	—	—	—	—	—	—	—	—	—	—	—	—
1963	—	—	—	—	—	—	—	—	—	—	—	—	—
1964	—	—	118.4	202.7	120.4	31.5	81.9	0.0	71.1	63.2	118.9	57.1	—
1965	0.0	54.9	154.4	120.4	193.8	11.9	15.0	117.9	83.3	273.5	261.1	182.4	1468.6
1966	71.1	61.0	134.2	249.2	5.6	13.0	0.0	0.0	103.9	385.3	183.4	105.9	1312.6
1967	52.1	42.9	28.4	209.0	84.6	26.7	43.7	30.0	104.9	311.1	264.9	48.8	1247.1
1968	286.8	—	99.8	100.3	59.7	55.4	38.6	0.0	30.7	250.9	68.3	228.6	—
1969	13.2	72.9	92.7	252.2	235.2	49.3	0.0	132.8	56.5	359.4	119.1	548.1	1931.4
1970	48.8	199.9	51.3	258.4	98.9	7.1	29.2	22.9	43.4	167.4	348.0	210.8	1486.1
1971	169.4	152.9	185.2	264.1	25.9	23.2	57.9	43.2	169.7	268.0	359.9	186.7	1906.1
1972	4.6	0.0	139.2	100.3	188.2	5.1	27.4	31.5	97.8	324.9	261.2	110.2	1290.4
1973	31.5	13.7	421.6	91.4	35.8	93.0	41.9	36.6	50.3	438.9	204.0	368.9	1827.6
1974	0.0	161.3	80.3	237.1	122.0	43.7	51.7	23.6	89.9	99.8	161.0	109.5	1179.9
1975	51.3	158.4	141.6	220.5	194.8	91.9	36.8	10.4	40.6	23.1	338.6	297.4	1605.4
1976	17.8	9.7	179.3	165.9	89.9	0.0	0.5	16.5	52.6	122.9	276.1	164.8	1096.0
1977	0.0	126.8	105.4	255.0	93.0	9.7	2.5	49.0	17.3	301.2	445.8	194.1	1599.8
1978	62.0	104.0	240.0	223.8	324.4	10.2	5.1	0.0	94.2	209.8	373.4	102.4	1749.3
1979	0.0	179.8	0.0	152.7	146.3	23.9	14.4	7.1	164.6	187.0	331.8	209.3	1416.9
1980	0.0	11.7	56.9	193.0	76.0	10.9	0.0	0.0	17.0	161.5	214.6	164.1	905.7
1981	23.9	46.7	75.4	247.4	98.0	34.0	11.4	45.0	109.5	94.5	311.9	96.5	1194.2
1982	1.5	68.1	—	—	—	—	—	—	—	—	—	—	—
1983	—	—	—	—	—	—	—	—	—	—	—	—	—
1984	—	—	—	—	—	—	—	—	—	—	—	—	—
1985	—	—	—	—	—	—	—	—	—	—	—	—	—
1986	—	—	—	—	—	—	—	—	—	—	—	—	—
1987	45.7	14.2	152.6	165.1	79.5	50.0	—	127.5	43.2	329.7	209.3	227.8	—
1988	67.1	162.3	258.8	366.0	25.9	76.5	22.4	49.7	121.2	128.5	313.4	197.9	1789.7
1989	34.8	17.5	55.9	204.4	50.0	45.0	108.9	39.6	117.6	240.8	208.7	44.4	1167.6
1990	104.4	136.9	210.0	132.3	130.0	23.9	30.0	3.3	19.3	290.8	328.0	101.1	1510.0
Ave.	49.4	85.5	135.5	200.5	112.6	33.5	29.5	35.8	77.2	228.7	259.2	179.9	1457.1
Max.	286.8	199.9	421.6	366.0	324.4	93.0	108.9	132.8	169.7	438.9	445.8	548.1	1931.4
Min.	0.0	0.0	0.0	91.4	5.6	0.0	0.0	0.0	17.0	23.1	68.3	44.4	905.7

Table A 2.2-13 MONTHLY RAINFALL AT SUGAR RESEARCH INSTITUTE IN SEVANAGALA (Historic)

Station code : SRI Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	—	—	—	—	—	—	—	—	—	—	—	—	—
1961	—	—	—	—	—	—	—	—	—	—	—	—	—
1962	—	—	—	—	—	—	—	—	—	—	—	—	—
1963	—	—	—	—	—	—	—	—	—	—	—	—	—
1964	—	—	—	—	—	—	—	—	—	—	—	—	—
1965	—	—	—	—	—	—	—	—	—	—	—	—	—
1966	—	—	—	—	—	—	—	—	—	—	—	—	—
1967	—	—	—	—	—	—	—	—	—	—	—	—	—
1968	—	—	—	—	—	—	—	—	—	—	—	—	—
1969	—	—	—	—	—	—	—	—	—	—	—	—	—
1970	—	—	—	—	—	—	—	—	—	—	—	—	—
1971	—	—	—	—	—	—	—	—	—	—	—	—	—
1972	—	—	—	—	—	—	—	—	—	—	—	—	—
1973	—	—	—	—	—	—	—	—	—	—	—	—	—
1974	—	—	—	—	—	—	—	—	—	—	—	—	—
1975	—	—	—	—	—	—	—	—	—	—	—	—	—
1976	—	—	—	—	—	—	—	—	—	—	—	—	—
1977	—	—	—	—	—	—	—	—	—	—	—	—	—
1978	—	—	—	—	—	—	—	—	—	—	—	—	—
1979	—	—	—	—	—	—	—	—	—	—	—	—	—
1980	—	—	—	—	—	—	—	—	—	—	—	—	—
1981	68.6	14.2	128.5	94.0	141.2	31.8	0.0	0.0	43.5	126.8	434.7	89.5	1172.8
1982	34.8	25.2	199.8	209.7	242.8	97.8	25.7	81.0	22.4	446.0	470.5	104.9	1960.6
1983	0.0	0.0	38.1	73.9	124.9	0.5	36.1	95.4	59.2	228.8	203.2	342.1	1202.2
1984	88.8	195.6	386.6	146.1	82.3	29.6	47.8	0.0	127.5	142.3	342.0	130.6	1719.2
1985	70.4	81.3	161.4	94.5	95.8	120.1	29.5	8.6	74.6	248.8	309.5	239.3	1533.8
1986	168.9	185.0	203.5	167.7	83.1	1.2	4.1	46.2	64.9	225.6	53.0	22.8	1226.0
1987	17.3	9.5	164.4	238.9	58.0	2.7	0.0	59.8	44.5	244.3	177.6	99.6	1116.6
1988	19.4	153.4	230.6	188.5	66.3	66.4	21.6	57.0	57.5	259.1	346.5	127.0	1593.3
1989	35.0	24.7	85.3	126.3	80.2	31.4	99.1	22.5	81.0	258.3	183.9	36.4	1064.1
1990	116.2	75.9	201.0	129.2	101.2	15.9	23.4	3.6	10.1	376.1	242.0	225.5	1520.1
Ave.	61.9	76.5	179.9	146.9	107.6	39.7	28.7	37.4	58.5	255.6	276.3	141.8	1410.9
Max.	168.9	195.6	386.6	238.9	242.8	120.1	99.1	95.4	127.5	446.0	470.5	342.1	1960.6
Min.	0.0	0.0	38.1	73.9	58.0	0.5	0.0	0.0	10.1	126.8	53.0	22.8	1064.1

Table A 2.2-14 MONTHLY RAINFALL AT LIYANGAHATOTA (Historic)

Station code : A5 Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	90.9	179.8	34.0	89.9	44.5	6.6	78.0	2.0	32.8	161.8	96.3	44.2	860.8
1961	79.0	95.5	88.4	110.0	93.2	68.1	142.8	82.3	64.3	222.3	318.5	115.6	1480.0
1962	83.1	97.3	129.0	262.4	136.7	22.4	17.8	46.7	89.7	74.2	208.0	269.2	1436.5
1963	100.1	59.2	43.7	24.1	71.1	39.4	51.8	22.1	62.2	316.2	344.9	173.5	1308.3
1964	85.1	138.4	109.7	44.7	48.8	65.0	33.0	45.2	56.9	31.0	118.6	213.1	989.5
1965	0.0	82.3	62.7	65.0	128.5	0.0	0.0	58.4	70.1	260.9	362.2	223.0	1313.1
1966	48.8	68.8	184.2	215.7	63.3	15.0	10.7	0.0	0.0	0.0	149.6	0.0	756.1
1967	128.8	64.3	39.9	67.1	57.2	61.5	86.9	29.5	61.0	196.9	222.3	55.1	1070.5
1968	135.1	14.5	173.0	61.0	31.0	88.1	49.8	9.4	17.0	195.3	98.0	72.9	945.1
1969	31.5	46.7	88.4	227.1	219.0	69.3	0.0	229.9	20.1	279.2	221.0	—	—
1970	—	—	—	—	—	—	—	—	—	—	—	—	—
1971	—	—	—	—	—	—	—	—	—	—	—	—	—
1972	—	—	—	—	—	—	—	—	—	—	—	—	—
1973	—	—	—	—	—	—	—	—	—	—	—	—	—
1974	—	—	—	—	—	—	—	—	—	—	—	—	—
1975	—	—	—	—	—	—	—	—	—	—	—	—	—
1976	—	—	—	—	—	—	—	—	—	—	—	—	—
1977	—	—	—	—	—	—	—	—	—	—	—	—	—
1978	—	—	—	—	—	—	—	—	—	—	—	—	—
1979	—	—	—	—	—	—	—	—	—	—	—	—	—
1980	—	—	—	—	—	—	—	—	—	—	—	—	—
1981	—	—	—	—	—	—	—	—	—	—	—	—	—
1982	—	—	—	—	—	—	—	—	—	—	—	—	—
1983	—	—	—	—	—	—	—	—	—	—	—	—	—
1984	—	—	—	—	—	—	—	—	—	—	—	—	—
1985	—	—	—	—	—	—	—	—	—	—	—	—	—
1986	—	—	—	—	—	—	—	—	—	—	—	—	—
1987	—	—	—	—	—	—	—	—	—	—	—	—	—
1988	—	—	—	—	—	—	—	—	—	—	—	—	—
1989	—	—	—	—	—	—	—	—	—	—	—	—	—
1990	—	—	—	—	—	—	—	—	—	—	—	—	—
Ave.	78.2	84.7	95.3	116.7	89.3	43.5	47.1	52.6	47.4	173.8	213.9	129.6	1128.9
Max.	135.1	179.8	184.2	262.4	219.0	88.1	142.8	229.9	89.7	316.2	362.2	269.2	1480.0
Min.	0.0	14.5	34.0	24.1	31.0	0.0	0.0	0.0	0.0	0.0	96.3	0.0	756.1

Table A 2.2-15 MONTHLY RAINFALL AT RICE RESEARCH STATION IN AMBALANTOTA (Historic)

Station code : RRS Historic Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	—	—	—	—	—	—	—	—	—	—	—	—	—
1961	—	—	—	—	—	—	—	—	—	—	—	—	—
1962	—	—	—	—	—	—	—	—	—	—	—	—	—
1963	—	—	—	—	—	—	—	—	—	—	—	—	—
1964	—	—	—	—	—	—	—	—	—	—	—	—	—
1965	—	—	—	—	—	—	—	—	—	—	—	—	—
1966	—	—	—	—	—	—	—	—	—	—	—	—	—
1967	—	—	—	—	—	—	—	—	—	—	—	—	—
1968	—	—	—	—	—	—	—	—	—	—	—	—	—
1969	—	—	—	—	—	—	—	—	—	—	—	—	—
1970	—	—	—	—	—	—	—	—	—	—	—	—	—
1971	—	—	—	—	—	—	—	—	—	—	—	—	—
1972	—	—	—	47.0	126.6	—	12.5	70.9	140.1	253.5	110.4	93.5	—
1973	74.7	6.1	104.1	42.7	122.9	184.4	27.9	9.9	22.1	195.8	166.1	232.9	1189.6
1974	10.2	12.4	29.5	93.7	24.4	85.3	9.9	47.2	100.1	39.9	123.4	71.6	647.6
1975	77.7	46.7	185.4	89.9	261.6	188.5	46.7	32.3	31.5	77.2	129.3	213.9	1380.7
1976	72.1	0.0	33.5	66.0	43.4	34.8	0.0	46.0	0.0	192.5	333.5	90.2	912.0
1977	53.1	76.5	18.0	84.1	100.3	15.2	46.0	32.8	57.7	110.7	235.2	215.9	1045.5
1978	23.4	39.1	2.5	47.2	223.8	3.6	25.9	48.0	52.3	181.9	388.4	146.3	1182.4
1979	6.9	13.2	146.3	86.6	62.2	63.5	61.7	19.0	137.7	213.4	258.1	136.9	1205.5
1980	24.4	0.0	20.6	179.6	120.9	43.2	17.8	41.1	20.3	152.9	307.3	67.3	995.4
1981	7.9	22.4	67.1	77.7	61.5	12.7	13.2	59.4	62.0	118.4	60.4	245.4	808.1
1982	6.1	0.8	195.6	88.1	111.2	177.5	135.1	36.6	29.2	272.3	442.7	109.0	1604.2
1983	8.1	5.1	43.4	47.5	80.0	31.5	24.1	151.4	131.8	57.7	67.8	76.2	724.6
1984	99.6	212.8	147.1	162.8	61.2	68.8	80.5	0.0	40.6	175.8	145.8	44.7	1239.7
1985	0.0	53.3	110.7	53.1	86.1	174.7	1.8	41.1	128.3	139.4	115.1	141.7	1045.3
1986	161.5	25.9	212.8	67.3	12.2	4.8	3.0	85.1	93.7	133.1	99.1	63.0	961.5
1987	46.7	16.3	24.4	115.1	56.4	8.4	0.0	138.7	165.9	224.3	160.0	50.5	1006.7
1988	12.7	27.9	62.7	145.5	82.5	69.8	3.8	23.4	—	—	—	—	—
1989	113.0	40.6	125.7	28.2	21.6	54.9	115.8	78.7	30.7	82.0	45.7	9.1	746.0
1990	60.2	0.0	80.8	68.3	123.4	—	—	—	—	—	—	—	—
Ave.	47.7	33.3	89.5	83.7	93.8	71.9	34.8	53.4	73.2	154.2	187.5	118.1	1043.4
Max.	161.5	212.8	212.8	179.6	261.6	188.5	135.1	151.4	165.9	272.3	442.7	245.4	1604.2
Min.	0.0	0.0	2.5	28.2	12.2	3.6	0.0	0.0	0.0	39.9	45.7	9.1	647.6

Table A 2.2-16 CORRELATION COEFFICIENTS AND REGRESSION EQUATIONS (1)

Station code : M060

Extended by:	Month	Correlation coefficient	Regression Equation
M624	Jan.	0.8502	Y = 0.9878*X + 11.3129
M624	Feb.	0.7915	Y = 0.9145*X + 27.0959
M624	Mar.	0.6242	Y = 0.5565*X + 95.0765
M408	Apr.	0.8455	Y = 0.7276*X + 105.4115
M624	May	0.7985	Y = 0.5390*X + 48.0886
M624	Jun.	0.8709	Y = 0.4008*X + 5.2714
M624	Jul.	0.8855	Y = 0.8911*X + 1.7708
M624	Aug.	0.8258	Y = 1.4927*X - 17.8928
M624	Sep.	0.9278	Y = 0.8055*X + 12.0613
M624	Oct.	0.8275	Y = 1.1846*X - 13.5670
M624	Nov.	0.8615	Y = 0.8837*X + 158.1713
M624	Dec.	0.8083	Y = 0.9964*X + 35.1223

Station code : M306

Extended by:	Month	Correlation coefficient	Regression Equation
M008	Jan.	0.7464	Y = 0.7974*X + 6.9257
M100	Feb.	0.6433	Y = 0.3939*X + 67.5961
M008	Mar.	0.7156	Y = 0.6855*X + 12.0403
SRI	Apr.	0.6961	Y = 2.4155*X + 10.3573
M008	May	0.8539	Y = 0.7758*X - 6.6932
M041	Jun.	0.9358	Y = 1.3159*X + 124.8487
M008	Jul.	0.7382	Y = 0.8841*X - 20.8144
M041	Aug.	0.6661	Y = 1.1772*X + 111.6029
M008	Sep.	0.8192	Y = 0.7259*X + 36.4808
M008	Oct.	0.6809	Y = 0.7093*X + 14.7556
SRI	Nov.	0.8288	Y = 0.9101*X + 102.2330
SRI	Dec.	0.8891	Y = 0.8540*X + 72.6653

Station code : M100

Extended by:	Month	Correlation coefficient	Regression Equation
	Jan.		
	Feb.		
	Mar.		
	Apr.		
	May		
	Jun.		
	Jul.		
	Aug.		
	Sep.		
	Oct.		
	Nov.		
M008	Dec.	0.7601	Y = 0.7997*X + 52.5179

Station code : M337

Extended by:	Month	Correlation coefficient	Regression Equation
M041	Jan.	0.7966	Y = 0.7383*X + 18.1422
M041	Feb.	0.8258	Y = 0.8786*X + 10.0141
SRI	Mar.	0.7304	Y = 0.8832*X + 82.4008
SRI	Apr.	0.6069	Y = 1.0403*X + 92.7579
M100	May	0.7836	Y = 0.5222*X + 61.1496
M041	Jun.	0.9306	Y = 0.5481*X + 0.2348
M100	Jul.	0.8489	Y = 0.4776*X + 11.2862
M100	Aug.	0.7133	Y = 0.3921*X - 2.6599
M041	Sep.	0.7697	Y = 0.4555*X + 23.4327
M060	Oct.	0.7406	Y = 0.4989*X + 105.4272
M041	Nov.	0.7149	Y = 0.7160*X + 75.3065
M041	Dec.	0.7361	Y = 1.0698*X - 53.1724

Table A 2.2-17 CORRELATION COEFFICIENTS AND REGRESSION EQUATIONS (2)

Station code : M408

Extended by:	Month	Correlation coefficient	Regression Equation
M624	Jan.	0.6945	Y = 0.5504*X + 26.6408
M060	Feb.	0.7367	Y = 0.5612*X + 35.2062
M100	Mar.	0.6922	Y = 0.5484*X + 51.3884
M100	Apr.	0.6579	Y = 0.7677*X + 83.8116
M100	May	0.8739	Y = 0.7929*X + 6.3914
M337	Jun.	0.8746	Y = 0.8681*X + 29.1386
M100	Jul.	0.8756	Y = 1.0352*X - 8.0002
M624	Aug.	0.7410	Y = 0.9491*X + 18.9331
MEA	Sep.	0.7631	Y = 1.5403*X + 0.7048
M060	Oct.	0.8045	Y = 0.8093*X + 46.7221
M624	Nov.	0.7675	Y = 0.7663*X + 97.6414
M624	Dec.	0.8369	Y = 0.9246*X + 21.1615

Station code : MEA

Extended by:	Month	Correlation coefficient	Regression Equation
M008	Jan.	0.8067	Y = 0.5530*X - 30.4452
M100	Feb.	0.8753	Y = 0.5828*X + 7.0875
SRI	Mar.	0.9821	Y = 1.4751*X - 88.3604
M041	Apr.	0.5948	Y = 0.3106*X + 87.9759
M337	May	0.8262	Y = 0.5765*X + 16.3310
M041	Jun.	0.9082	Y = 0.1924*X + 2.3574
M008	Jul.	0.7398	Y = 0.1111*X - 5.8418
M060	Aug.	0.6549	Y = 0.2689*X + 8.9872
M008	Sep.	0.6794	Y = 0.1086*X + 27.8046
M337	Oct.	0.6863	Y = 0.5286*X + 73.8476
M408	Nov.	0.6596	Y = 0.4993*X + 74.9790
M624	Dec.	0.7148	Y = 0.8588*X - 23.9789

Station code : M624

Extended by:	Month	Correlation coefficient	Regression Equation
M408	Jan.	0.8063	Y = 0.9497*X + 21.7364
	Feb.		
	Mar.		
	Apr.		
	May		
	Jun.		
	Jul.		
	Aug.		
	Sep.		
M408	Oct.	0.8434	Y = 0.6092*X + 114.1508
M408	Nov.	0.7675	Y = 0.7687*X + 69.5407
M408	Dec.	0.8369	Y = 0.7575*X + 49.4357

Station code : SRI

Extended by:	Month	Correlation coefficient	Regression Equation
M624	Jan.	0.8220	Y = 0.3294*X + 9.4785
M100	Feb.	0.8797	Y = 0.5152*X + 7.5912
M041	Mar.	0.8947	Y = 0.4190*X + 72.5832
M337	Apr.	0.6069	Y = 0.3541*X + 61.5091
M624	May	0.5905	Y = 0.2783*X + 43.3119
M041	Jun.	0.9265	Y = 0.2476*X - 9.1640
M100	Jul.	0.9151	Y = 0.2408*X + 11.0349
M008	Aug.	0.9452	Y = 0.1280*X - 13.4151
M337	Sep.	0.9116	Y = 0.5947*X + 26.7719
M337	Oct.	0.7709	Y = 0.6520*X + 99.0486
M624	Nov.	0.9103	Y = 0.9876*X - 41.6488
M100	Dec.	0.8867	Y = 0.4107*X + 17.6050

Table A 2.2-18 CORRELATION COEFFICIENTS AND REGRESSION EQUATIONS (3)

Station code : A5

Extended by:	Month	Correlation coefficient	Regression Equation
M008	Jan.	0.6534	Y = 0.3158*X - 1.8599
M100	Feb.	0.9673	Y = 0.4872*X + 3.3054
M008	Mar.	0.3346	Y = 0.1355*X + 50.7938
M060	Apr.	0.5270	Y = 0.2947*X + 7.5892
M041	May	0.8713	Y = 0.4104*X + 10.3046
M041	Jun.	0.8080	Y = 0.3072*X + 0.4642
M100	Jul.	0.8436	Y = 0.2410*X + 1.8258
M100	Aug.	0.9435	Y = 0.4253*X - 7.8497
M008	Sep.	0.3982	Y = 0.0708*X + 13.9155
M624	Oct.	0.7329	Y = 0.6071*X - 58.4180
M041	Nov.	0.7103	Y = 0.3919*X + 80.4136
M041	Dec.	0.6973	Y = 0.7559*X - 44.4612

Station code : RRS

Extended by:	Month	Correlation coefficient	Regression Equation
M337	Jan.	0.5828	Y = 0.2589*X + 16.9338
M100	Feb.	0.5643	Y = 0.2480*X - 3.1437
SRI	Mar.	0.3794	Y = 0.2566*X + 60.8689
M100	Apr.	0.7008	Y = 0.1912*X + 12.8536
M100	May	0.7066	Y = 0.2490*X + 29.2425
M041	Jun.	0.9226	Y = 0.3577*X + 2.5967
M408	Jul.	0.7678	Y = 0.2225*X + 10.5170
MEA	Aug.	0.8616	Y = 0.7727*X + 31.2288
M008	Sep.	0.8289	Y = 0.1684*X + 1.1638
M041	Oct.	0.5805	Y = 0.2415*X + 80.9198
M408	Nov.	0.6372	Y = 0.5119*X + 2.4877
M408	Dec.	0.6478	Y = 0.3937*X + 30.3591

Table A 2.2-19 MONTHLY RAINFALL AT ALUPOTA(M008) (Extended)

Station code : M008 Extended Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	279.9	346.7	151.1	353.6	487.9	363.2	518.9	249.9	673.6	308.9	422.1	188.7	4344.5
1961	179.1	274.6	287.3	432.3	692.7	370.1	380.2	660.9	455.4	473.7	490.0	374.4	5070.7
1962	325.1	181.6	351.5	344.7	780.5	305.8	329.7	267.5	487.9	733.3	624.8	471.2	5203.6
1963	355.1	295.1	452.1	604.8	608.6	638.0	550.9	472.7	656.1	675.6	911.9	376.2	6597.1
1964	246.4	216.7	446.0	532.6	960.4	451.6	778.3	331.2	669.3	440.7	585.0	290.3	5948.5
1965	133.3	189.7	321.1	677.2	1349.0	719.3	202.4	985.0	623.8	667.8	892.6	478.5	7239.7
1966	270.8	180.1	540.0	1058.0	283.0	424.2	361.2	495.0	1064.0	771.7	694.4	567.7	6710.1
1967	199.6	284.0	355.9	231.4	192.8	513.1	226.8	305.6	199.9	758.2	621.3	279.7	4168.3
1968	389.4	82.3	266.4	357.4	336.3	756.2	377.4	259.6	413.0	461.0	632.7	459.2	4790.9
1969	157.5	62.2	114.0	351.0	860.0	335.0	66.3	270.0	283.0	635.3	279.7	342.1	3756.1
1970	259.3	188.7	362.5	413.3	247.9	327.4	304.5	202.4	327.4	604.8	428.0	162.6	3828.8
1971	255.0	283.5	259.8	537.7	471.2	325.1	307.3	458.0	800.4	470.2	388.1	285.8	4842.1
1972	121.7	78.2	218.4	450.9	987.3	240.3	398.0	240.3	743.0	725.2	453.6	186.7	4843.6
1973	63.3	197.6	258.1	386.8	232.9	378.0	191.0	393.7	115.6	379.7	376.4	462.0	3435.1
1974	8.4	159.8	119.6	466.3	393.4	480.6	521.2	328.7	577.8	149.4	172.0	432.3	3809.5
1975	63.5	156.2	331.0	400.3	595.4	484.1	79.5	481.6	340.4	525.0	529.6	290.3	4276.9
1976	108.2	67.6	205.0	379.2	221.7	114.8	237.5	215.4	102.9	438.1	465.6	427.5	2983.5
1977	0.0	184.9	189.7	494.0	421.6	194.6	93.2	152.4	192.3	559.8	425.4	293.1	3201.0
1978	184.7	384.3	261.6	236.2	734.8	132.1	132.1	191.0	315.0	413.8	524.0	223.5	3733.1
1979	21.6	206.5	200.2	213.9	308.4	138.2	253.0	23.4	709.2	500.9	525.5	341.4	3442.2
1980	33.5	61.7	253.7	411.7	316.5	219.7	332.5	245.4	208.5	382.0	395.5	190.5	3051.2
1981	159.3	78.0	243.8	495.6	255.0	377.7	294.1	173.2	500.9	339.9	621.5	302.8	3841.8
1982	79.8	80.8	395.5	393.0	703.4	999.4	341.1	270.0	170.4	548.4	693.1	173.4	4848.3
1983	85.6	58.2	86.7	150.5	347.6	442.6	429.6	385.1	413.9	298.3	265.1	800.3	3763.5
1984	390.0	300.8	327.9	676.1	390.1	348.1	339.8	86.4	75.9	266.7	281.6	150.9	3634.3
1985	264.2	101.8	347.2	182.8	544.7	674.5	302.1	173.8	246.3	626.5	178.1	402.2	4044.2
1986	130.7	172.6	102.7	417.9	193.5	331.4	166.3	363.1	655.2	525.2	238.6	252.0	3549.2
1987	152.1	56.3	172.1	242.1	243.1	181.6	12.5	501.1	297.6	671.2	540.0	267.5	3337.2
1988	135.0	290.0	505.5	455.0	636.5	637.3	392.0	608.9	961.0	219.5	502.0	244.6	5587.3
1989	140.0	6.0	136.0	256.5	944.0	789.0	766.5	358.5	416.5	690.9	374.3	364.2	5242.4
1990	239.2	236.3	399.2	278.4	607.3	430.1	361.1	117.1	149.5	483.8	413.5	119.8	3835.3
Ave.	175.2	176.2	279.4	415.5	527.3	423.3	324.1	331.2	446.6	507.9	482.1	329.1	4418.1
Max.	390.0	384.3	540.0	1058.0	1349.0	999.4	778.3	985.0	1064.0	771.7	911.9	800.3	7239.7
Min.	0.0	6.0	86.7	150.5	192.8	114.8	12.5	23.4	75.9	149.4	172.0	119.8	2983.5

Table A 2.2-20 MONTHLY RAINFALL AT BALANGODA(M041) (Extended)

Station code : M041 Extended Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	192.8	351.8	273.3	284.7	113.0	45.0	195.3	22.4	188.5	150.9	144.5	151.9	2114.1
1961	176.8	101.3	194.8	281.7	262.6	177.8	40.6	138.9	17.8	330.2	594.4	201.9	2518.8
1962	149.6	152.9	174.8	331.5	320.8	69.8	204.0	100.3	186.4	100.3	240.0	184.1	2214.5
1963	327.9	124.7	208.3	459.7	121.9	246.4	139.7	61.0	94.0	218.4	538.5	332.7	2873.2
1964	99.1	124.5	223.5	195.6	129.5	119.4	181.1	48.3	144.3	135.4	133.1	206.8	1740.6
1965	23.6	100.6	170.9	411.2	333.5	64.5	19.6	125.7	122.4	236.0	397.3	308.9	2314.2
1966	194.8	90.4	169.2	435.9	14.0	46.7	36.3	38.6	309.1	381.8	277.4	232.9	2227.1
1967	167.6	142.5	231.9	326.9	154.7	173.7	36.3	60.5	20.3	462.0	607.1	162.1	2545.6
1968	2.5	0.0	134.4	164.6	96.5	247.4	107.9	52.8	124.0	542.5	278.4	234.7	1985.7
1969	32.5	114.0	164.6	350.0	379.2	211.6	203.5	207.3	113.8	462.3	196.6	442.5	2877.9
1970	135.6	114.0	315.2	330.5	229.9	52.1	70.9	89.2	51.6	148.1	388.9	178.8	2104.8
1971	361.9	189.7	231.7	368.6	154.7	180.6	78.0	294.9	442.0	291.3	382.8	157.2	3133.4
1972	46.5	20.6	443.0	238.3	343.7	29.2	62.7	73.4	233.9	362.5	508.0	166.9	2528.7
1973	54.6	29.2	288.3	165.6	64.3	142.5	30.5	120.9	30.5	366.3	291.3	368.0	1952.0
1974	0.0	236.2	241.8	398.5	104.6	165.1	176.0	151.9	212.1	54.1	254.3	412.8	2407.4
1975	72.4	187.7	368.0	504.4	200.7	490.0	41.2	180.3	141.0	123.7	499.9	198.4	3007.7
1976	38.1	55.9	167.9	274.3	173.7	7.6	26.2	70.4	22.9	483.9	218.9	107.4	1647.2
1977	167.6	329.9	345.4	546.9	310.9	88.9	85.1	81.0	36.6	375.7	377.2	263.7	3008.9
1978	29.7	152.1	73.9	90.9	350.5	57.4	50.3	162.1	169.9	247.9	386.1	77.2	1848.0
1979	167.1	59.9	16.3	269.5	472.9	95.5	153.9	27.7	224.8	617.5	490.2	231.9	2827.2
1980	9.9	33.5	85.6	333.2	151.6	70.1	80.0	71.9	113.5	140.6	523.0	183.5	1796.4
1981	103.0	74.6	102.1	159.9	173.6	165.1	7.6	45.6	0.0	125.7	297.0	140.5	1394.7
1982	70.2	22.5	143.7	212.1	118.0	448.8	89.0	93.0	0.0	529.0	701.0	120.3	2547.6
1983	20.0	57.5	18.0	200.9	314.3	33.1	30.5	55.0	83.4	258.2	281.6	282.5	1635.0
1984	292.8	184.3	701.5	403.7	82.0	142.3	124.0	43.0	177.0	196.3	488.4	206.9	3042.2
1985	85.9	123.1	291.7	244.7	424.8	516.0	31.1	21.4	107.1	513.3	362.0	365.4	3086.5
1986	135.2	55.0	172.0	662.8	18.1	90.9	58.5	141.1	217.6	168.1	123.5	178.1	2020.9
1987	105.1	55.5	175.6	135.1	312.8	106.1	0.0	129.8	185.0	272.2	410.0	220.9	2108.1
1988	67.0	204.3	436.4	458.5	127.4	144.6	210.1	66.5	222.5	208.3	252.7	255.8	2654.1
1989	25.4	0.0	157.2	310.7	185.0	162.3	283.0	68.0	49.7	320.0	396.4	72.1	2029.8
1990	86.4	221.9	363.8	364.8	290.1	166.2	81.4	58.0	19.5	268.4	390.6	132.6	2443.7
Ave.	111.0	119.7	228.5	319.9	210.6	153.4	94.7	93.6	131.0	293.3	368.7	218.7	2343.1
Max.	361.9	351.8	701.5	662.8	472.9	516.0	283.0	294.9	442.0	617.5	701.0	442.5	3133.4
Min.	0.0	0.0	16.3	90.9	14.0	7.6	0.0	21.4	0.0	54.1	123.5	72.1	1394.7

Table A 2.2-21 MONTHLY RAINFALL AT BLACKWOOD(M060) (Extended)

Station code : M060 Extended Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	435.6	333.0	102.6	429.8	80.3	10.4	278.4	33.0	63.2	296.2	507.0	81.3	2650.8
1961	321.6	297.7	357.4	347.2	225.6	19.6	37.1	24.4	70.4	408.2	432.6	231.6	2773.4
1962	98.6	101.1	359.9	503.7	238.5	35.3	19.1	82.0	83.8	554.5	438.9	281.9	2797.3
1963	338.0	216.9	208.0	464.1	244.9	21.3	50.0	32.0	139.4	485.1	533.4	391.0	3124.1
1964	171.2	124.5	159.5	249.2	108.7	17.0	123.7	36.6	118.6	276.0	265.8	96.0	1746.8
1965	22.6	132.1	258.8	567.4	280.7	7.1	30.0	128.0	78.2	285.7	405.1	330.2	2525.9
1966	127.0	25.4	202.9	381.5	15.2	14.2	24.4	125.5	189.0	422.1	775.7	297.7	2600.6
1967	205.0	154.4	210.8	151.6	86.6	13.7	29.2	10.9	43.4	333.2	473.5	99.3	1811.6
1968	181.4	87.9	207.0	385.1	142.2	36.6	23.1	9.1	65.0	585.0	377.7	371.9	2472.0
1969	147.1	97.8	135.1	630.7	128.8	12.4	10.4	268.5	91.9	541.0	416.6	526.8	3007.1
1970	85.6	258.8	414.5	402.1	86.4	35.1	13.5	20.3	64.5	146.3	620.5	298.4	2446.0
1971	240.5	326.9	205.7	661.7	58.7	13.0	83.8	241.6	283.7	251.2	278.1	391.7	3036.6
1972	68.1	20.0	238.9	336.8	253.2	21.3	96.0	18.8	130.8	688.8	816.4	222.0	2911.1
1973	24.9	39.1	162.1	271.5	26.7	41.4	50.5	36.3	87.1	644.9	388.4	556.8	2329.7
1974	56.4	276.4	117.1	490.0	220.7	10.7	45.5	43.4	181.4	128.5	483.6	277.9	2331.6
1975	80.0	105.2	224.8	487.2	219.2	41.1	64.3	113.5	154.9	70.1	466.3	216.4	2243.0
1976	207.3	32.3	360.7	744.5	118.6	62.0	26.7	67.3	41.1	554.5	1157.0	523.7	3895.7
1977	0.0	262.0	221.6	628.9	228.8	16.2	71.6	61.5	184.2	828.6	587.5	225.0	3315.9
1978	183.7	240.0	259.2	270.4	195.3	4.7	33.0	9.9	79.6	326.2	405.3	189.6	2196.9
1979	52.8	221.7	230.7	349.1	101.6	36.8	37.8	14.9	284.8	698.5	541.9	206.1	2776.7
1980	27.1	29.9	221.1	458.6	113.2	6.3	11.9	15.4	118.9	216.1	371.5	255.9	1845.9
1981	124.7	79.2	213.5	286.9	99.0	25.3	737.0	49.3	116.3	183.9	463.4	119.2	2497.7
1982	42.4	19.3	230.0	266.8	259.7	60.8	23.0	64.0	76.0	383.6	619.5	202.3	2247.4
1983	10.6	39.8	146.7	136.1	107.1	15.7	33.6	23.5	38.3	227.3	359.8	217.1	1355.6
1984	130.7	91.6	326.0	479.3	115.4	20.8	72.4	107.1	147.5	139.8	356.3	166.9	2153.8
1985	128.3	85.1	240.9	187.8	81.2	42.8	50.6	88.7	94.6	306.7	375.8	296.9	1979.4
1986	222.9	60.4	181.7	345.2	235.4	15.9	27.7	135.7	70.9	552.7	277.0	193.9	2319.4
1987	179.6	76.5	241.2	426.1	195.7	8.5	1.8	63.8	224.7	857.1	400.3	329.3	3004.6
1988	41.4	319.7	245.3	772.3	115.2	17.7	63.2	147.1	144.6	21.4	555.8	183.6	2627.3
1989	112.6	73.7	140.2	381.4	194.7	27.3	164.0	136.6	153.8	299.2	331.4	154.2	2169.1
1990	305.9	198.1	241.7	318.9	134.1	16.2	14.7	28.4	130.9	371.2	390.0	259.3	2409.4
Ave.	141.1	142.8	227.9	413.3	152.0	23.5	75.7	72.2	121.0	389.8	479.7	264.3	2503.3
Max.	435.6	333.0	414.5	772.3	280.7	62.0	737.0	268.5	284.8	857.1	1157.0	556.8	3895.7
Min.	0.0	19.3	102.6	136.1	15.2	4.7	1.8	9.1	38.3	21.4	265.8	81.3	1355.6

Table A 2.2-22 MONTHLY RAINFALL AT DETANAGALA(M100) (Extended)

Station code : M100 Extended Data Unit : MM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1960	247.6	366.5	405.4	431.3	116.1	55.1	318.8	45.0	106.4	377.4	226.1	178.1	2873.8
1961	150.9	154.9	394.5	363.2	423.7	131.3	122.7	208.3	82.0	402.8	437.4	490.0	3361.7
1962	210.3	190.8	232.9	389.4	388.9	104.1	117.1	142.2	116.8	193.8	582.4	259.8	2928.5
1963	259.8	329.9	309.4	607.3	266.4	253.2	104.6	56.9	130.3	472.9	859.8	330.2	3980.7
1964	245.4	268.2	317.8	325.9	159.0	178.6	189.0	87.4	158.5	272.0	167.9	286.8	2656.5
1965	155.4	155.7	217.7	469.4	541.3	79.2	26.4	167.4	147.1	504.4	533.7	520.2	3517.9
1966	383.3	103.9	287.8	614.7	26.2	78.2	55.9	40.1	414.8	308.1	393.4	321.3	3027.7
1967	169.2	154.9	258.1	246.1	161.5	97.5	45.5	61.0	50.5	486.7	822.5	295.4	2848.9
1968	191.8	26.2	218.7	447.0	223.5	162.1	107.9	52.8	124.0	486.2	229.4	435.9	2705.5
1969	85.1	134.4	257.8	517.1	293.6	211.6	20.3	207.3	113.8	455.9	201.2	412.5	2910.6
1970	289.3	291.6	436.9	404.9	129.3	52.1	70.9	89.2	51.6	276.4	400.1	228.9	2721.2
1971	216.9	272.0	207.0	493.0	47.8	140.5	75.7	124.5	613.2	191.3	473.7	356.6	3212.2
1972	144.8	11.4	144.5	368.3	300.2	21.3	246.9	65.8	256.0	554.5	516.6	158.2	2788.5
1973	115.3	211.8	309.4	329.7	120.4	85.6	54.9	95.0	39.1	471.7	261.9	925.3	3020.1
1974	17.0	205.0	287.5	414.8	175.0	197.4	173.7	148.8	146.3	77.7	256.3	484.6	2584.1
1975	146.3	271.8	413.0	534.4	207.3	467.9	91.9	78.2	126.7	94.0	527.6	349.5	3308.6
1976	137.2	26.9	149.4	381.3	38.6	17.3	36.8	70.4	0.0	525.5	530.4	382.8	2296.6
1977	61.5	106.4	384.3	432.8	179.1	17.3	79.5	73.7	35.1	569.2	528.6	455.7	2923.2
1978	220.7	234.9	297.9	334.5	655.6	57.4	116.8	188.0	199.9	360.2	340.4	211.8	3218.1
1979	41.7	219.7	130.3	289.6	43.2	83.8	52.3	98.8	261.6	309.9	476.2	254.0	2261.1
1980	86.4	30.5	457.2	421.6	237.5	78.7	5.1	45.2	196.4	159.0	407.9	286.5	2412.0
1981	240.8	95.8	243.8	286.5	128.8	78.7	79.8	21.3	238.1	156.9	221.4	274.6	2066.5
1982	126.4	10.2	243.7	255.8	338.5	187.9	25.8	50.6	8.4	305.6	478.1	118.9	2149.9
1983	34.9	12.6	45.4	149.4	331.5	20.4	61.3	57.5	75.1	349.5	562.8	817.5	2517.9
1984	455.4	396.8	627.2	645.3	140.6	112.5	154.3	51.6	146.6	115.6	366.7	204.7	3417.3
1985	218.3	118.0	261.0	149.2	255.6	368.8	18.8	27.3	90.5	349.8	201.7	323.8	2382.8
1986	197.6	214.5	116.6	310.2	101.1	40.8	9.4	65.2	74.4	114.1	116.2	158.9	1519.0
1987	166.0	42.0	170.8	279.6	300.2	71.8	6.4	99.5	119.4	302.7	294.8	175.7	2028.9
1988	45.2	215.0	368.0	511.4	127.6	162.5	130.7	78.1	169.7	173.8	451.5	320.6	2754.1
1989	67.7	0.0	172.7	221.2	256.5	159.6	345.4	56.6	99.1	374.9	589.3	122.5	2465.5
1990	106.9	232.1	386.6	273.0	262.2	50.5	28.6	89.0	58.5	443.4	434.6	148.3	2513.7
Ave.	168.9	164.7	282.4	383.8	225.1	123.3	95.9	88.5	143.5	330.2	415.8	331.9	2754.0
Max.	455.4	396.8	627.2	645.3	655.6	467.9	345.4	208.3	613.2	569.2	859.8	925.3	3980.7
Min.	17.0	0.0	45.4	149.2	26.2	17.3	5.1	21.3	0.0	77.7	116.2	118.9	1519.0