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TABLES

Table K.1 EXISTING FOREST RESERVES IN THE STUDY AREA

No.	Name of Reserves
1.	Andikulam Forest Reserve
2.	Vannivilankulam Forest Reserve
3.	Paranthan Forest Reserve
4.	N\anumadu Forest Reserve
5.	Irampaikkulam Forest Reserve
6.	Karunkalikulam Forest Reserve
7.	Melkulan Forest Reserve
8.	Mamadu Forest Reserve
9.	Maha irampaikkulam Forest Reserve
10.	Puwarasankulam Forest Reserve
11.	Tonigal Forest Reserve
12.	Irasenthirankulam Forest Reserve
13.	Etakachiwa Forest Reserve
14.	Wedakanda Forest Reserve
15.	Hinna Forest Reserve
16.	Medawachchiya Forest Reserve
17.	Issembessawewa Forest Reserve
18.	Anaolundawa Forest Reserve
19.	Hurulu Forest Reserve
20.	Aluthabendawewa Forest Reserve
21.	Nuwaragam Forest Reserve
22.	Yoda ela Forest Reserve
23.	Mihintale Forest Reserve
24.	Kahalla Forest Reserve
25.	Likolawewa Forest Reserve
26.	Lunu oya Forest Reserve
27.	Padaviya Forest Reserve
28.	Omunugala Forest Reserve
29.	Nuwaragala Forest Reserve
30.	Gal oya Forest Reserve
31.	Minneriya Forest Reserve
32.	Giritale Forest Reserve
33.	Medaulpotha Forest Reserve
34.	Dotalugala Forest Reserve
35.	Inamaluwa Forest Reserve
36.	Pelwehera Forest Reserve
37.	Barons Cap Forest Reserve
38.	Pamkulam Forest Reserve
39.	Kantalai Forest Reserve
40.	Chundankadu Forest Reserve
41.	ChundankaGdu Forest Reserve
42.	Mahaweli Ganga Forest Reserve
43.	Vappia Verugal Forest Reserve
44.	Kanniya Forest Reserve
45.	Koralai Forest Reserve
46.	Elagamuwa proposed Forest Reserve
47.	Pallegama Himbiligakade proposed Forest Reserve

Table K.2 LIST OF WILDLIFE RESERVES AND SANCTUARIES OF THE STUDY AREA

	Protected Area	Extent (ha)
A)	STRICT NATURAL RESERVES	
	1. Ritigala	1,528
	2. Hakgala	1,142
B)	NATIONAL PARKS	
	3. Wilpattu	131,692
	4. Maduru Oya	56,802
	5. Somawathiya	36,337
	6. Wasgomuwa	33,765
	7. Gal Oya	25,900
	8. Floodplain	17,350
C)	NATURE RESERVES	
	9. Trikonamadu	25,027
	10. Horton Plains	3,160
D)	SANCTUARIES	
	11. Victoria-Randenigala-Rantambe	41,600
	12. Madhu Road	26,677
	13. Trincomalee Naval	18,130
	14. Seruwila-Allai	15,540
	15. Gal Oya SW	15,280
	16. Gal Oya NW	12,432
	17. Kokkilai	12,400
	18. Chundikulam	11,150
	19. Senanayake Samudra	9,324
	20. Minneriya-Giritale	6,692
	21. Padaviya Tank	6,475
	22. Vavunikulam T	4,851
	23. Giants Tank	3,942
	24. Anuradhapura	3,502
	25. Mahakandarawewa	2,000
	26. Ravana Ella	1,932
	27. Buddhangala	1,841
	28. Polonnaruwa	1,523
	29. Mihintale	997
	30. Wilpattu North	624
	31. Udawatakelle	111

FIGURES

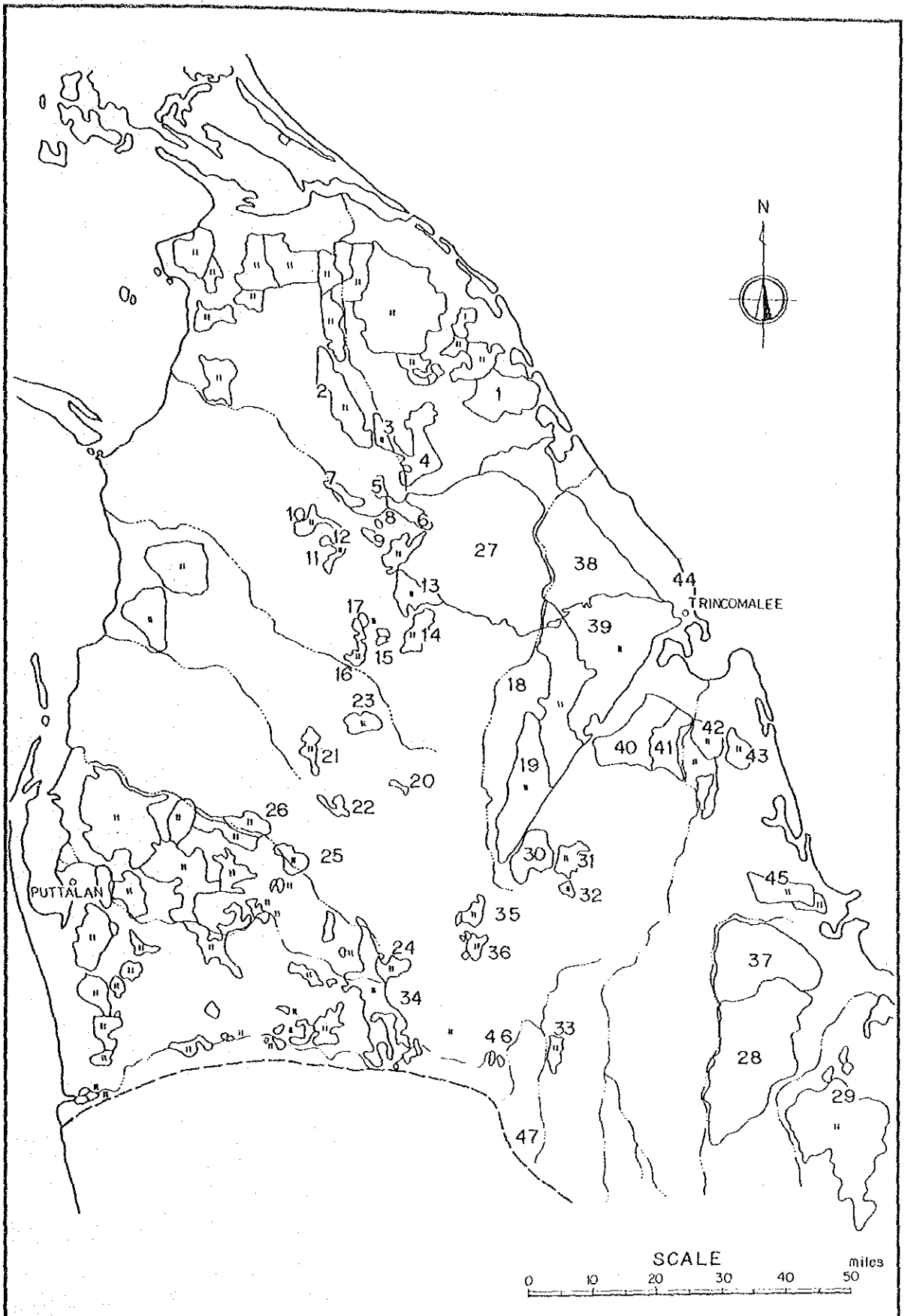

Fig. K-1 Forest Reserves and Proposed Reserves in Sri Lanka

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

THE STUDY ON EXTENSION OF THE MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

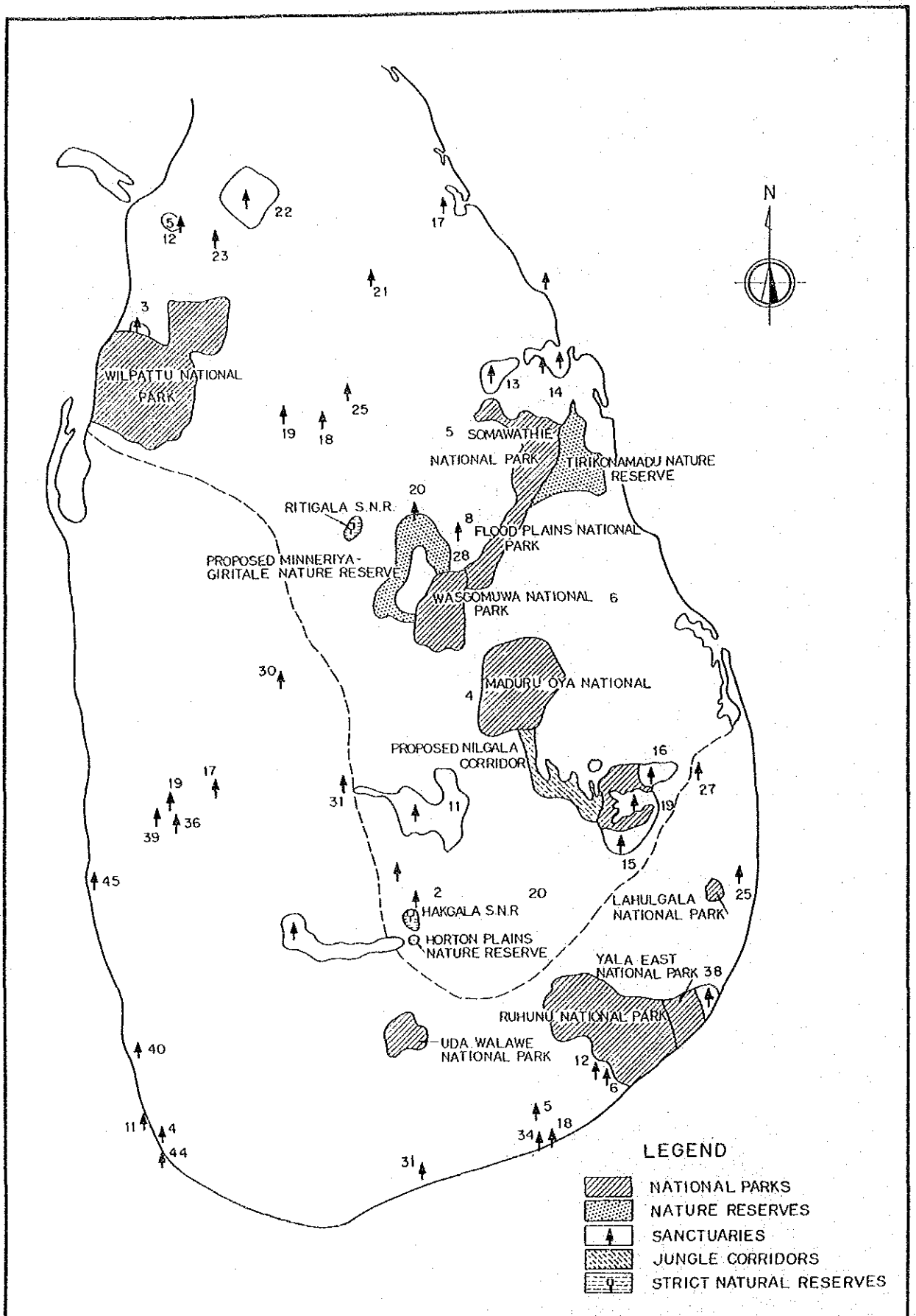

Fig. K-2 Wildlife Reserves in Sri Lanka

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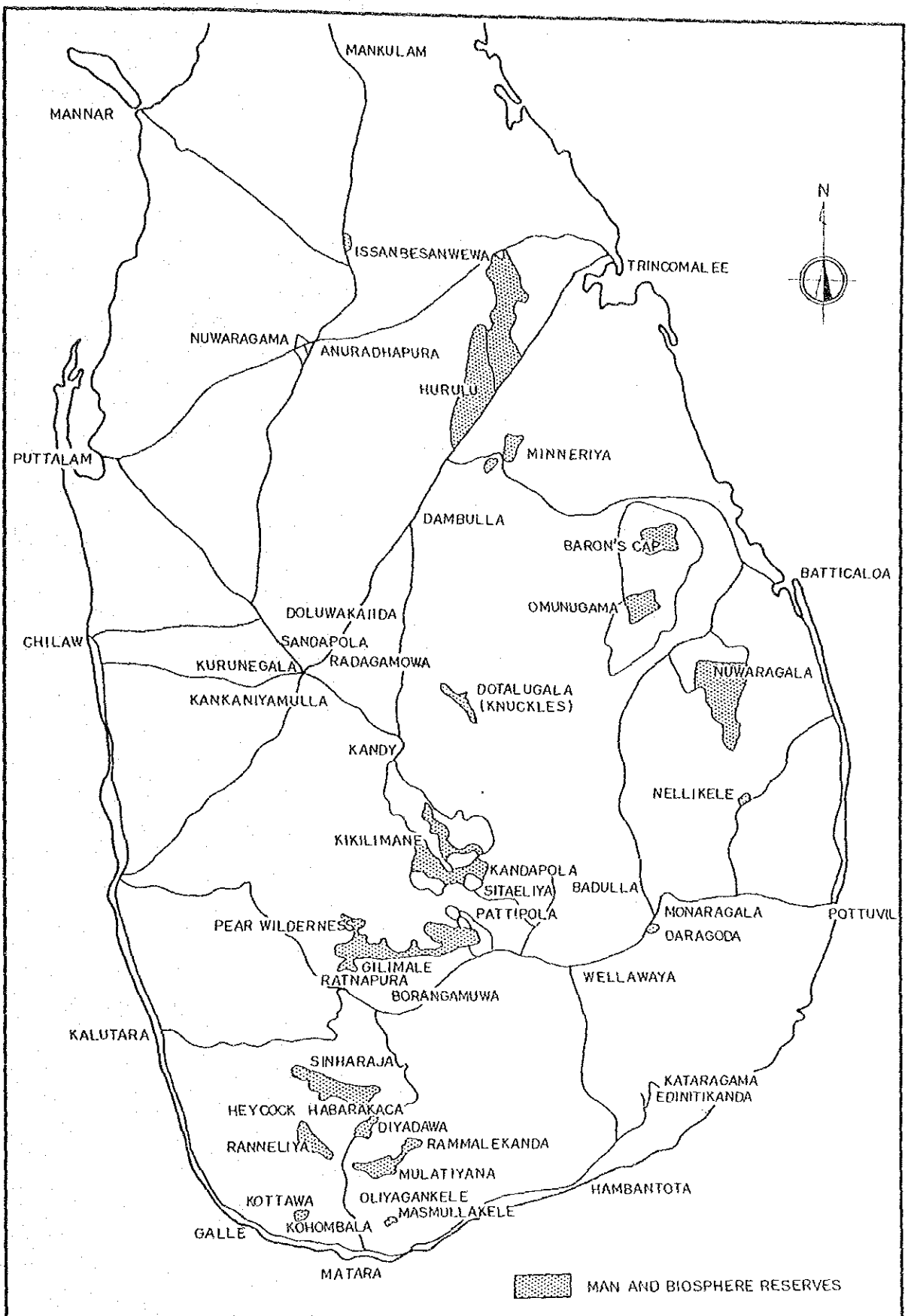

Fig. K-3 Man and Biosphere (MAB) Reserves

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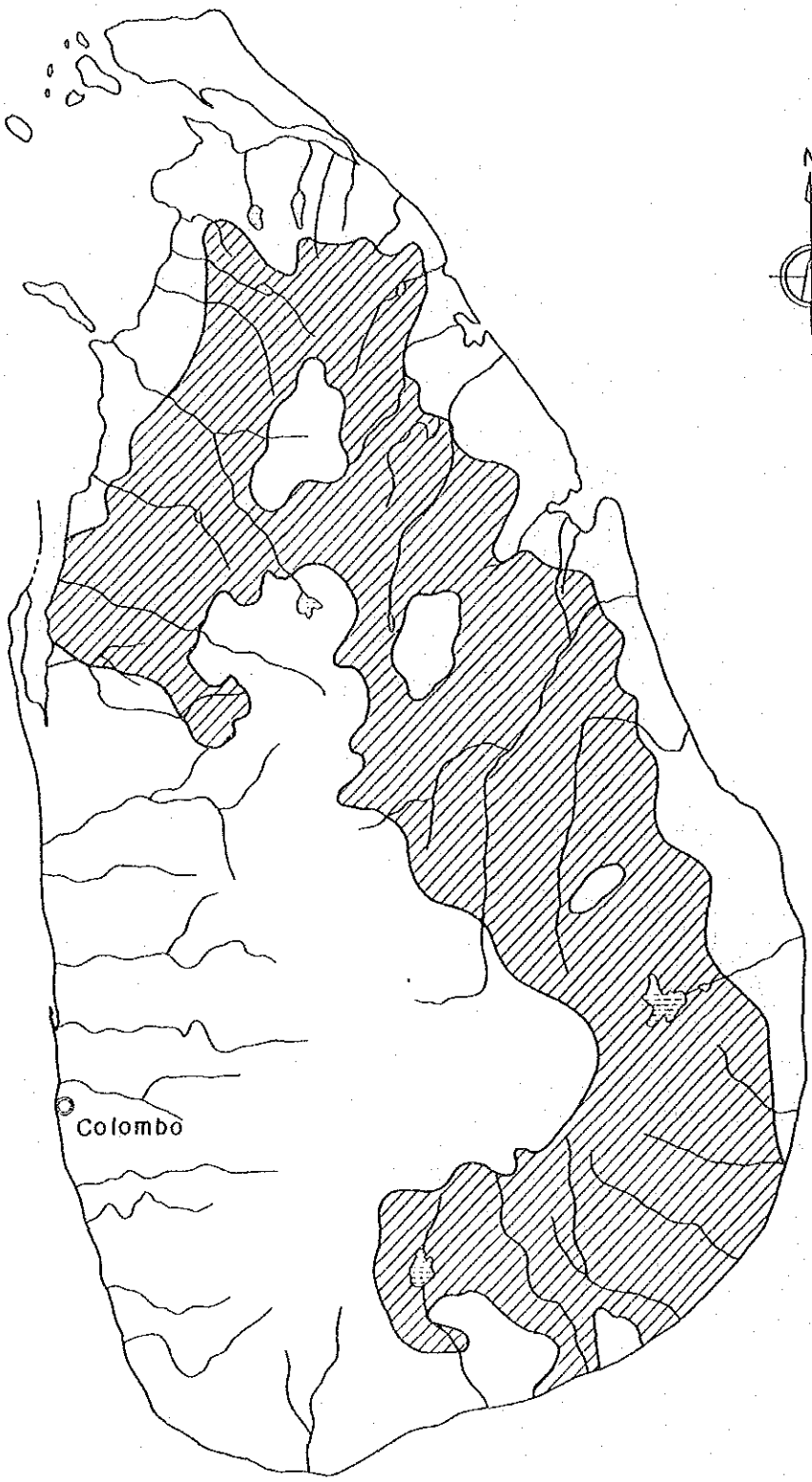

SCALE
0 30 60km

Fig. K-4 Distribution of Elephants in Sri Lanka

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

THE STUDY ON EXTENSION OF THE MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX–L

PROJECT EVALUATION

ANNEX - L

PROJECT EVALUATION

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ANNEX-L PROJECT EVALUATION

L.1 ECONOMIC EFFICIENCY OF PROJECTS

L.1.1 Precondition for Evaluation

An economic analysis in this Master Plan is carried out to ascertain economic efficiency of the proposed alternatives from the economic point of view. The economic efficiency is evaluated by a factor of Economic Internal Rate of Return (EIRR).

To estimate economic costs and benefits which are basic figures for calculation of evaluation factor, the economic prices and evaluation conditions are summarized as follows:

(1) Foreign exchange rates are applied at US$1.00 = Rs. 32.50 = J. Yen 140.00.

(2) The basic period for the cost estimation is set in October, 1988.

(3) The Standard Convention Factor (SCF) is estimated at 85% in general, to convert the financial costs into economic costs (refer to Phase I Report, ANNEX-M).

(4) The construction period of the project is assumed to be 5 years.

(5) The economic life of the project is taken as 50 years after completion of the project.

The all alternatives of the projects include several joint facilities such as multi-purpose dam and transbasin conveyance canal. These joint costs are allocated into respective project components related to the project on the basis of the size of benefits given by the proposed project.

L.1.2 Agricultural Development Project

L.1.2.1 Stagewise Development Plan

The NCRB, which is recommended for agricultural development in this Master Plan, is too large to be developed as one package. From the point of view of practical implementation, a stagewise implementation programme is necessary to temper technical and socio-economic constraints.

To make a development area stepwise, an unified package has to be taken following elements into consideration:

(1) Practical series of implementation package

a. Sequence of water distribution network in global water resource development.

b. Practical extent of on-farm development.

(2) Unification of regional development

a. Physical unity which is demarcated by geographical features

b. Social relationship among development clusters concerned, taking account of historical, religious, cultural and economic conditions

Therefore, the NCRB fell into 3 packages to work out a proper implementation programme in consideration of physical condition in particular. Joint facilities necessary for each package and beneficiaries such as irrigation systems and schemes are enumerated in Table L.1.1 and the stagewise development plan is shown on Fig. L.1-1. The total capital investment costs of three packages are also summarized in Table L.1.1 and the details are described in ANNEX-J. The summary of beneficial areas in each package is as follows:

Package 1	New Area	33,900 ha
	Rehabilitation Area	25,500 ha
Package 2	New Area	26,600 ha
	Rehabilitation Area	38,600 ha
Package 3	New Area	37,000 ha

L.1.2.2 Economic Cost

Allocated costs of 3 packages amount to US$411.1x10^6, US$507.8x10^6 and US$364.5x10^6 in economic terms respectively, which are broken down in Table L.1.2 (refer to ANNEX-J in detail). These costs include the all irrigation facilities such as transbasin canals, tanks and on-farm facilities but exclude social facilities for settlement such as schools, clinics, etc. Their disbursement of each package is assumed to extent over 5 years and to distributed as seen in Table L.1.3. Hence, the economic costs of joint facilities are distributed into each package in proportion to size of benefit accruing from the schemes in each package.

The operating and maintenance (O&M) costs of 3 packages are estimated as US$5.68x10^6, US$6.85x10^6 and US$4.76x10^6 respectively, of which the details are described in ANNEX-J. Although during construction period the reclaimed areas in new settlement schemes increase year by year as the newly developed area is enlarged, water distribution management cannot be carried out before completion of the project. Thus, the O&M costs are set to take place just after completion of the project.

While the economic project life is assumed to be 50 years, some of facilities have shorter life than the civil works. Then, their lives are assumed to be 25 years for irrigation mechanical equipment. The replacement costs are considered to be 90% for investment value at the end of life, because of salvage value (10% of financial costs) would be remained. The replacement costs of each package are estimated at US$38.80x10^6, US$54.26x10^6 and US$23.62x10^6 after subtracting the salvage value, respectively.

These packages will be implemented in accordance with the stagewise implementation schedule as illustrated in Fig. L.1-1. In this context, the total costs of three packages come out serially as shown in Table L.1.4. The total economic cost of all packages are: US$1,283x10^6 for the economic cost; US$17.5x10^6 for O&M cost after the stage of completion of all packages; and US$116.7x10^6 for replacement cost in total.

L.1.2.3 Economic Benefit

The agricultural benefit is estimated in terms of incremental benefit by a balance of "without" and "with" project conditions. The annual agricultural benefits are shown in Table L.1.3 and explained in ANNEX-E in detail at the stage of project completion. The net economic benefits at matured time amount to: US$50.9x10^6 for Package 1; US$60.4x10^6 for Package 2; and US$39.2x10^6 for Package 3.

By the time of project completion, the annual benefit increases as the irrigation system is enlarged. To estimate the increasing annual benefits up to the time of attaining matured benefits, the following growth programmes are assumed:

(1) In new settlement schemes, the reclaimed areas as irrigated field are cultivated as rainfed fields by completion of the project.

(2) The newly reclaimed areas in new settlement schemes increase as they are developed year by year for 5 years of construction period as follows: 20% of the total area in the third year from the start of construction; 40% in the fourth year; 70% in the fifth year; and 100% after completion.

(3) In new settlement schemes, the unit yield increases from 50% of the target yield at the first year cultivation to 100% at the sixth year cultivation, i.e., annual growth of 10% up to the matured yield.

(4) In rehabilitation schemes, the unit yield increases after completion of the project. It attains to the matured yield 3 years after completion.

(5) Cashew is harvested in the third year after the plantation starts. It is harvested at the yield of 20% of the target in the third year and attained to the matured yield in 8th year.

Based on the above conditions, the annual benefits are estimated as shown in Table L.1.3 for each Package. Table L.1.5 shows the total benefits accruing from the whole packages which are implemented serially under the implementation schedule as shown on Fig. L.1-2.

L.1.2.4 Economic Efficiency

Applying the economic costs and benefits estimated in the proceeding sub-sections, the cost and benefit streams of each Packages are given in Table L.1.4, respectively. The economic efficiency, examined by EIRR, is 9.3% for Package 1, 9.2% for Package 2 and

8.0% for Package 3 as seen in the tables. Accordingly, the Package 1 is the most efficient among 3 Packages.

The series of packages, i.e., the whole three packages implemented under the proposed implementation schedule, is expected to 8.9% in EIRR within the same economic life as the above packages, as shown in Table L.1.5. This economic efficiency is lower than those of Packages 1 and 2, but it is higher than that of Package 3.

L.1.3 Hydropower Development Project

L.1.3.1 Proposed Plans

The proposed alternatives of hydropower development are 8 schemes as discussed in ANNEX-G. They are (1) Watawala scheme; (2) Ulapane scheme; (3) Caledonia scheme; (4) Talawakele scheme; (5) Kotmale Extension; (6) Upper Uma Oya scheme (Scheme-1000); (7) Lower Uma Oya scheme (Scheme-500); and (8) Sudu Ganga scheme. Respective schemes are described in ANNEX-G, Chapter G.2.6.

L.1.3.2 Economic Cost

The total economic costs of respective alternative schemes are estimated in Table L.1.6. The initial costs of joint facility such as dam are allocated on the basis of benefits accruing from schemes related to the joint facility. Their disbursement of investment costs is assumed to extent over 5 years and allocated as follows: (1) 10% in the first year of the implementation; (2) 20% in the second; (3) 20% in the third; (4) 25% in the fourth; and (5) 25% in the fifth. These allocated costs are shown in Table L.1.7.

The O&M costs and the replacement costs are also summarized in Table L.1.6. The O&M costs generate just after completion of the project. The replacement costs take place in the 30th year after completion of scheme, as hydromechanical works and power generating equipment are considered to have economic life of 30 years. In the same manner as the irrigation scheme, the replacement costs are estimated as 90% of investment value at the end of each life.

L.1.3.3 Economic Benefit

The economic benefit of hydropower project is estimated as the cost saved in construction and operation (fuel cost) of the cheapest alternative facility that could provide power supplies of equivalent quality to the intended beneficiaries. This procedure is described in ANNEX-G in detail.

The unit benefit values are estimated to be US$93.1 per KW for capacity value, US$0.0674/KWh for firm energy value and US$0.0298/KWh for secondary energy value. The annual benefits of respective schemes are calculated as products of unit benefit value and dependable peak power and annual energy expected to respective schemes.

In addition to the above benefits, the proposed hydropower schemes would contribute to transfer from secondary energy to firm energy for the downstream power

stations resulting from the firming-up discharge by regulation. The benefit to be yielded by the said energy transfer was defined as the incremental benefit. In other words, the incremental benefit is the balance between the benefits with and without the upstream hydropower development. Details are described in ANNEX-G. Both the annual benefits and the annual incremental benefits were added up as the total benefits of respective schemes, as given in the following table:

(Unit: US$10^6)

	Scheme	Annual Benefit	Incremental Annual Benefit	Total Benefit
1.	Watawala	4.11	1.41	5.52
2.	Ulapane	9.32	4.51	13.83
3.	Caledonia	10.75	4.79	15.54
4.	Talawakele	52.75	-	52.75
5.	Kotmale Extension	13.25	7.66	20.91
6.	Upper Uma Oya (Scheme-1000)	19.74	2.21	31.95
7.	Lower Uma Oya (Scheme-500)	25.39	0.75	26.14
8.	Sudu Ganga	8.63	0.73	9.36

The total benefits in the above table are shown in Table L.1.7. The benefits are expected to be derived from the first year after the power station is putted in commission.

L.1.3.4 Economic Efficiency

Based on the above economic costs and benefits, the cost and benefit streams of respective schemes are given in Table L.1.7. The economic efficiency is calculated as follows:

	Scheme	EIRR	Ranking
1.	Watawala	9.8%	4
2.	Ulapane	9.6%	5
3.	Caledonia	11.9%	2
4.	Talawakele	15.1%	1
5.	Kotmale Extension	7.0%	8
6.	Upper Uma Oya (Scheme-1000)	10.3%	3
7.	Lower Uma Oya (Scheme-500)	9.2%	6
8.	Sudu Ganga	8.6%	7

Accordingly, Talawakele scheme has the best efficiency in economic terms among all schemes. Succeedingly, Caledonia is ranked as the second best. Tentative long-term system generation expansion plan is shown on Fig. L.2-2

L.2 IMPACTS OF AGRICULTURAL PROJECTS

L.2.1 Indirect Benefits

L.2.1.1 Foreign Exchange Saving

With project implementation, paddy production will increase to about 1.3×10^6 tons in the Project area at the stage of project completion from 0.30×10^6 tons at the present condition. Domestic production of grains at present will not sufficient to meet present consumption, and as a result, the deficit has to be supplemented by imports. Accordingly, the increasing paddy production will contribute the saving of foreign exchange.

L.2.1.2 Increase in Employment Opportunity

Employment opportunities for the local people will be increased by the project implementation, which will have a favourable impact on the national economy. Furthermore, employees will be able to gain more experience and technical skill in various working fields. These benefits would be applied to the future development of Sri Lanka.

In addition to the above construction work, other employment opportunities will be created through farming practices after completion of the project. In the Project area at the stage of project completion, farming activities will require about 33×10^6 man-days a year of labour. That amount of labour requirement is 2.0 times of the present requirement of about 16×10^6 man-days a year, due to intensive use of the land and high productivity.

L.2.1.3 Improvement of Living Standard

Upon completion of the proposed project, the living standard of the people in the Project area will be improved because their family income will increase in proportion to the rise of regional economy. The level of the living standard should reach the average level of the country. Thus, the agencies concerned should endeavor to help the people to improve the quality of their lives through increased income and improvement of productivity by means of appropriate incentives.

L.2.1.4 Inland Fishery

In 1986, Sri Lanka produced 35×10^3 tons of fish from inland fishery, sharing around 20% of the national fishery production of 183×10^3 tons. The 8 Districts related to the Project area produced 16×10^3 tons of inland fishery or 45% of the national inland fishery production.

Through implementation of the project, there is a certain possibility of inland fishery in reservoirs and irrigation tanks. Although it takes a certain time to mature inland fishery, some increase in inland fishery production may be expected in the proposed reservoir areas.

L.2.1.5 Rural Agro-industry

GOSL is promoting to introduce small-scale agro-industries in rural areas, in order to create other employment opportunities through crop diversification. The Project area is blessed with natural resources such as climate for agriculture, fertile soils as well as irrigation water upon completion of the project. The proposed cropping pattern would include vegetables such as tomatoes, cucumbers, eggplants, etc. There are certain possibilities to introduce small scale rural agro-industries for production of tomato juice, pickles of cucumbers, etc. being subject to improvement of variety and future studies.

L.2.1.6 Subsidiary Crops in Homestead

The new settlers would be allocated 0.2 ha homestead area in addition to 1.0 ha farming plot. In these homesteads, most settlers will plant subsidiary crops such as coconuts, cashew nuts, papaya, bananas, grapes, mangoes, etc. Since it might be difficult to quantify and identify subsidiary crops, such benefits from the homestead areas are not incorporated in the economic benefit. However, these are considered to be indirect benefits.

L.2.1.7 Stimulation to Regional Economy

Inter-industrial relationship is generally illustrated by an input-output table of industrial relations. "Input-Output Tables for Sri Lanka, 1980-83" by Department of Census and Statistics presents an updated input-output table and a total requirement co-efficient table for 1983, the latest version. The industrial sectors are divided into 25 economic sectors. According to the total requirement co-efficient of construction sub-sector, one unit of construction investment induces 1.22 units of production over 25 economic sub-sectors in the country. Then, 22% of construction investment value comes from production through the all economic sub-sectors. This stimulation would activate the regional economy.

L.2.2 Assessment of Social Impacts

L.2.2.1 Self-sufficiency of Food Crop

Provided that the proposed projects are accomplished on schedule depicted in Fig. L.2-1, paddy production in the Project area will meet the target production in the year 2020, as illustrated in Fig. L.2-1. Up to the year around 2000, paddy production in the Project Area will not be able to catch up with the regional target. After 2000, the production will exceed the regional target, but in 2020 the production will go down below the regional target again. Thus, to cover that deficit of paddy, the other irrigation projects should to be developed in outside fields of this current Project area.

L.2.2.2 Improvement of Living Standard and Enlightenment of Consumer's Behavior

In pursuance of the proposed projects the living standard of the people in the Project area will be improved in the future as mentioned in ANNEX-E. In spite of the increase of family income, however, people's behavior may remain unchanged in life style in general.

People are apt to use the increment of family income for enlarging their general household expenditure such as alcoholic beverage and companionship with relatives. They scarcely use it for an increase their assets or for an investment and savings as reproduciable wealth in order to enhance their life and to improve the productivity for the future. In other words, they are likely to use the increment not for qualitative improvement but for quantitative improvement of their living style. Furthermore, once they attain to some level of living conditions, they might lose a strong will to raise the industrial productivity. Thus, agencies concerned should make an endeavor in order that people are eager to improve the quality of their lives and to keep the improvement of industrial productivity by means of justified enlightenment of people's consumption behavior.

L.2.2.3 Improvement of Social Activities and Development of Rural Community

In accordance with the implementation of the projects, the supporting social systems for civilizing local societies will be improved in the future. For instance, a road density in the 8 Districts related to the Project area, one of the important physical infrastructure, was 0.31 km/km^2, which was lower than the national average of 0.39 km/km^2 in 1986. Water supply systems covered only 8% of the households in 8 Districts in 1981. Medical condition in 1987, one of the social infrastructure, was 2.4 hospital's beds per thousand inhabitants, which was far from the standard (5.0 hospital's beds per thousand people) recommended by WHO. These supporting systems will considerably be improved by the end of the target year. The improvement of these social systems makes people be awaken to a community and change their reversional consciousness from a tribe to a local society. In general a tribe problem is one of big difficulties to implement and to promote an economic development activities. Accordingly, establishment of a good community might function as a incentive to rectify tribe problems.

L.2.2.4 Inequality of Income Distribution and Redistribution Policy

After completion of the proposed projects, people in the Project area can get the fruits of development. For instance, net farm income in both new irrigation and rehabilitation schemes is expected to increase 2.2-3.3 times, as discussed in ANNEX-E. The better the proposed projects go on, the bigger becomes the difference in farm income between inside the sites of the projects and outside the projects. Although it works as an incentive to increasing the agricultural productivity, an inequality of income distribution is inevitable on the way of implementing the projects. In this context, a redistribution policy is quite important in order to attain more equitable distribution of the fruits of development. In the case of selection of redistribution policy, the real disparity should be taken into consideration not only in the agricultural sector but also among the whole economic sectors. In addition to taxation system, social welfare, intervention policy in market mechanism, etc., as a redistribution policy by the public sector, it is also important to stimulate activities of the private sector. Business enterprise sector invests to productive factors by utilization of private savings which come from living surplus of consumers, and produces goods and services to consumers. Thus, activation of private economic sector stimulates the market mechanism and creates new labour market.

L.2.2.5 Cultivation of Related Industries and Creation of Job Opportunities

In order that the main industry grows soundly, it is essential to cultivate industries related to and supporting the main industry. For example, following entities and industries are necessary as supporting systems for sound growth of the agricultural projects: rice-mill, fertilizer, agricultural implements, canned manufacturing, etc. These related industries are able to be clarified by means of inter-industrial relationship analysis in the basin. Furthermore, construction investment derived from proposed projects induces new production from related economic sub-sectors. According to the national inter-industrial relationship, one unit of construction investment induces about 20% of the original construction investment amount from all industries as mentioned in Sub-section L.2.1.7. In any case, agencies concerned make endeavors to promote these supporting industries as well as the main industry. At the same time, the growth of the related industries creates new job opportunity.

TABLES

Table L.1.1 BENEFICIAL AREA AND INVESTMENT COSTS BY STAGEWISE DEVELOPMENT PLAN

Package Component	System Project Scheme	Area (ha)	Investiment Cost (US$10^6)
Package 1			
1. Joint Facility	- Kalu Ganga dam	-	142.4
	- NCP canal (Kalu Ganga -> Huruluwewa)	-	197.1
	(Sub-total)	-	(339.5)
2. New Area	- System F	1,900	7.7
	- Huruluwewa Extension (System MH)	12,000	61.2
	- Cashew land (System MH, Rainfed)	10,000	4.1
	- Yan Oya (System M)	10,000	51.1
	(Tank)	-	72.5
	(Sub-total)	(33,900)	(196.6)
3. Rehabilitation	- System H (1/2)	21,200	5.9
	- Huruluwewa (System MH)	4,300	1.2
	(Sub-total)	(25,500)	(7.1)
	Total	59,400	543.2
Package 2			
1. Joint Facility	- NCP canal (Huruluwewa -> Mahakandarama)	-	23.8
	- Minipe LB canal	-	147.7
	(Sub-total)	-	(171.5)
2. New Area	- Maluwatu Oya (System I)	3,600	29.9
	(Tank)	-	37.7
	- Mahakandarama Extension (System I)	8,000	46.6
	- Holowupotanna (System M)	15,000	72.2
	(Tank)	-	67.1
	(Sub-total)	(26,600)	(253.5)
3. Rehabilitation	- System H (1/2)	21,200	5.9
	- System IH	4,700	1.3
	- Mahakandarama (System I)	2,800	0.8
	- Maluwatu Oya (System I)	9,900	2.8
	(Sub-total)	(38,600)	(10.8)
	Total	65,200	435.8
Package 3			
1. Joint Facility	- NCP canal (Mahakandarama -> Tammannewa)	-	23.8
	- Minneriya pump station	-	143.0
	(Sub-total)	-	(166.8)
2. New Area	- Tammannewa (System I)	27,000	155.1
	(Tank)	-	47.0
	- Cashew land (System I, Rainfed)	10,000	4.1
	(Sub-total)	(37,000)	(206.2)
	Total	37,000	373.0
	Grand Total	161,600	1,352.0

Table L.1.2 ECONOMIC COST BY STAGEWISE DEVELOPMENT PLAN

Project Scheme		Area (ha)	Economic Cost (US$10^6) Development Cost	Allocated Cost	Total
A. Joint Facility					
1. Kalu Ganga Dam					133.5
2. NCP (Kalu Ganga - Elahera) Canal					30.0
3. NCP (Elahera - Tammannewa) Canal					203.3
4. Minipe LB Canal					140.3
5. Minneriya Pump Station					140.4
Total					647.5
B. Irrigation Scheme					
I. Package-1					
1. System F	Irrigation	1,900	7.2	-	7.2
2. System H (1/2)	Rehabilitation	21,200	5.6	-	5.6
3. Huruluwewa (System MH)	Rehabilitation	4,300	1.1	-	1.1
4. Huruluwewa Extension (System MH)	Irrigation	12,000	58.0	-	58.0
5. Yan Oya (System M)	Tank &		68.0	-	68.0
	Irrigation	10,000	48.3	-	48.3
6. Cashew Land (System MH)	Rainfed	10,000	3.9	-	3.9
Total		59,400	192.1	219.0	411.1
II. Package-2					
1. System H (1/2)	Rehabilitation	21,200	5.6	-	5.6
2. System IH	Rehabilitation	4,700	1.3	-	1.3
3. Maluwatu Oya (System I)	Tank &		35.9	-	35.9
	Irrigation	13,500	29.1	-	29.1
4. Mahakandarama (System I)	Rehabilitation	2,800	0.7	-	0.7
5. Mahakandarama Extension (System I)	Irrigation	8,000	44.1	-	44.1
6. Holowupotanna (System M)	Tank &		62.8	-	62.8
	Irrigation	15,000	68.4	-	68.4
Total		65,200	247.9	259.9	507.8
III. Package-3					
1. Tammannewa (System I)	Tank &		43.2	-	43.2
	Irrigation	27,000	148.8	-	148.8
2. Cashew Land (System I)	Rainfed	10,000	3.9	-	3.9
Total		37,000	195.9	168.6	364.5
GRAND TOTAL		161,600	635.9	647.5	1,283.4

Table L.1.3 ECONOMIC BENEFIT BY STAGEWISE DEVELOPMENT PLAN

Project Scheme	Economic Benefit (US$10^6) 3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year	13th Year
I. Package-1											
1. System F	0.0	0.0	0.7	1.3	2.0	2.0	2.0	2.0	2.0	2.0	2.0
2. System H (1/2)	0.0	0.0	4.4	8.8	13.3	13.3	13.3	13.3	13.3	13.3	13.3
3. Huruluwewa *1 (System MH)	0.0	0.0	1.2	2.6	4.2	5.2	6.4	7.7	8.7	9.2	9.6
4. Huruluwewa Ex. (System MH)	0.1	0.2	4.1	9.7	13.8	14.1	14.4	14.7	14.8	14.8	14.8
5. Yan Oya (M) (System M)	0.0	0.1	3.3	7.5	10.8	11.0	11.2	11.3	11.3	11.3	11.3
Total	0.1	0.3	13.6	29.9	44.0	45.6	47.2	48.9	50.0	50.6	50.9
II. Package-2											
System H (1/2)	0.0	0.0	4.4	8.8	13.3	13.3	13.3	13.3	13.3	13.3	13.3
System IH	0.0	0.0	1.3	2.6	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Maluwatu Oya (System I)	0.0	0.0	4.2	8.5	12.7	12.7	12.7	12.7	12.7	12.7	12.7
Mahakandarama (System I)	0.0	0.0	4.0	8.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1
Holowupotanna (System M)	0.2	0.4	4.4	12.0	16.5	17.2	17.8	18.3	18.5	18.5	18.5
Total	0.2	0.4	18.4	40.0	58.4	59.2	59.8	60.2	60.4	60.4	60.4
III. Package-3											
Tammannewa *1 (System I)	0.1	0.2	10.0	22.1	32.7	34.1	35.6	37.2	38.3	38.8	39.2
Total	0.1	0.2	10.0	22.1	32.7	34.1	35.6	37.2	38.3	38.8	39.2

Remark: *1 Including cashew benefit

Table L.1.4 ECONOMIC COST AND BENEFIT STREAM OF AGRICULTURAL PROJECT (1/3): PACKAGE 1

EIRR : 9.3% (Unit : US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	20.6	-	-	20.6	0.0	-20.6
2	41.1	-	-	41.1	0.0	-41.1
3	82.2	-	-	82.2	0.1	-82.1
4	123.3	-	-	123.3	0.3	-123.0
5	143.9	-	-	143.9	13.6	-130.3
6	-	5.7	-	5.7	29.9	24.2
7	-	5.7	-	5.7	44.0	38.3
8	-	5.7	-	5.7	45.6	39.8
9	-	5.7	-	5.7	47.2	41.5
10	-	5.7	-	5.7	48.9	43.1
11	-	5.7	-	5.7	50.0	44.3
12	-	5.7	-	5.7	50.6	44.8
13	-	5.7	-	5.7	50.9	45.2
14	-	5.7	-	5.7	50.9	45.2
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	5.7	-	5.7	50.9	45.2
35	-	5.7	38.8	44.5	50.9	6.4
36	-	5.7	-	5.7	50.9	45.2
:	:	:	:	:	:	:
:	:	:	:	:	:	:
54	-	5.7	-	5.7	50.9	45.2
55	-	5.7	-	5.7	50.9	45.2
:						

Table L.1.4 ECONOMIC COST AND BENEFIT STREAM OF AGRICULTURAL PROJECT (2/3): PACKAGE 2

EIRR : 9.2% (Unit : US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	25.4	-	-	25.4	0.00	-25.4
2	50.8	-	-	50.8	0.00	-50.8
3	101.6	-	-	101.6	0.18	-101.4
4	152.3	-	-	152.3	0.39	-151.9
5	177.7	-	-	177.7	18.40	-159.3
6	-	6.9	-	6.9	40.02	33.1
7	-	6.9	-	6.9	58.43	51.5
8	-	6.9	-	6.9	59.17	52.3
9	-	6.9	-	6.9	59.77	52.9
10	-	6.9	-	6.9	60.21	53.3
11	-	6.9	-	6.9	60.43	53.5
12	-	6.9	-	6.9	60.43	53.5
13	-	6.9	-	6.9	60.43	53.5
14	-	6.9	-	6.9	60.43	53.5
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	6.9	-	6.9	60.43	53.5
35	-	6.9	54.3	61.2	60.43	-0.8
36	-	6.9	-	6.9	60.43	53.5
:	:	:	:	:	:	:
:	:	:	:	:	:	:
54	-	6.9	-	6.9	60.43	53.5
55	-	6.9	-	6.9	60.43	53.5

Table L.1.4 ECONOMIC COST AND BENEFIT STREAM OF AGRICULTURAL PROJECT (3/3): PACKAGE 3

EIRR : 8.0% (Unit : US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	18.2	-	-	18.2	0.0	-18.2
2	36.5	-	-	36.5	0.0	-36.5
3	72.9	-	-	72.9	0.1	-72.8
4	109.4	-	-	109.4	0.2	-109.1
5	127.6	-	-	127.6	10.0	-117.6
6	-	4.8	-	4.8	22.1	17.4
7	-	4.8	-	4.8	32.7	27.9
8	-	4.8	-	4.8	34.1	29.3
9	-	4.8	-	4.8	35.6	30.9
10	-	4.8	-	4.8	37.2	32.4
11	-	4.8	-	4.8	38.3	33.5
12	-	4.8	-	4.8	38.8	34.1
13	-	4.8	-	4.8	39.2	34.4
14	-	4.8	-	4.8	39.2	34.4
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	4.8	-	4.8	39.2	34.4
35	-	4.8	23.6	28.4	39.2	10.8
36	-	4.8	-	4.8	39.2	34.4
:	:	:	:	:	:	:
:	:	:	:	:	:	:
54	-	4.8	-	4.8	39.2	34.4
55	-	4.8	-	4.8	39.2	34.4

Table L.1.5 ECONOMIC COST AND BENEFIT STREAM OF AGRICULTURAL PROJECT : WHOLE PACKAGES

EIRR : 8.9% (Unit : US$10^6)

Year	Cost				Benefit				Balance
	Construction	O&M	Replacement	Total	Package-1	Package-2	Package-3	Total	
1	25.7	0.0	0.0	25.7	0.0	-	-	0.0	-25.7
2	51.4	0.0	0.0	51.4	0.0	-	-	0.0	-51.4
3	102.8	0.0	0.0	102.8	0.1	-	-	0.1	-102.7
4	154.1	0.0	0.0	154.1	0.3	-	-	0.3	-153.8
5	179.8	0.0	0.0	179.8	13.6	-	-	13.6	-166.2
6	0.0	3.3	0.0	3.3	29.9	-	-	29.9	26.6
7	20.5	3.3	0.0	23.8	44.0	0.0	-	44.0	20.2
8	41.1	3.3	0.0	44.4	45.6	0.0	-	45.6	1.2
9	82.1	3.3	0.0	85.4	47.2	0.2	-	47.4	-38.0
10	123.2	3.3	0.0	126.5	48.9	0.4	-	49.2	-77.3
11	143.7	3.3	0.0	147.0	50.0	18.4	-	68.4	-78.6
12	0.0	6.1	0.0	6.1	50.6	40.0	-	90.6	84.5
13	17.9	6.1	0.0	24.0	50.9	58.4	0.0	109.4	85.4
14	35.9	6.1	0.0	42.0	50.9	59.2	0.0	110.1	68.1
15	71.8	6.1	0.0	77.9	50.9	59.8	0.1	110.8	32.9
16	107.6	6.1	0.0	113.7	50.9	60.2	0.2	111.4	-2.3
17	125.6	6.1	0.0	131.7	50.9	60.4	10.0	121.4	-10.3
18	0.0	17.3	0.0	17.3	50.9	60.4	22.1	133.5	116.2
19	0.0	17.3	0.0	17.3	50.9	60.4	32.7	144.0	126.7
:	:	:	:	:	:	:	:	:	:
34	0.0	17.3	0.0	17.3	50.9	60.4	32.7	144.0	126.7
35	0.0	17.3	23.0	40.3	50.9	60.4	39.2	150.5	110.2
36	0.0	17.3	0.0	17.3	50.9	60.4	32.7	144.0	126.7
:	:	:	:	:	:	:	:	:	:
40	0.0	17.3	0.0	17.3	50.9	60.4	32.7	144.0	126.7
41	0.0	17.3	28.8	46.1	50.9	60.4	39.2	150.5	104.4
42	0.0	17.3	0.0	17.3	50.9	60.4	39.2	150.5	133.2
:	:	:	:	:	:	:	:	:	:
46	0.0	17.3	0.0	17.3	50.9	60.4	39.2	150.5	133.2
47	0.0	17.3	64.9	82.2	50.9	60.4	39.2	150.5	68.3
48	0.0	17.3	0.0	17.3	50.9	60.4	39.2	150.5	133.2
:	:	:	:	:	:	:	:	:	:
65	0.0	17.3	0.0	17.3	50.9	60.4	39.2	150.5	133.2

Table L.1.6 ECONOMIC COST AND BENEFIT, AND EIRR OF HYDROPOWER SCHEMES

(UNIT: US$10^6)

Scheme	Economic Cost (US$10^6)			Benefit (US$10^6)	EIRR
	Capital Investment	O&M	Replacement		
1. Watawala	42.8	0.45	10.5	5.52	9.8
2. Ulapane	112.0	1.01	21.0	13.83	9.6
3. Caledonia	98.3	1.19	14.5	15.54	11.9
4. Talawakele	260.7	2.08	43.6	52.75	15.1
5. Kotmale, Extension	232.7	1.86	5.9	20.91	7.0
6. Upper Uma Oya (Scheme-1000)	240.0	1.92	43.3	31.85	10.3
7. Lower Uma Oya (Scheme-500)	220.5	1.76	46.0	26.14	9.2
8. Sudu Ganga	80.8	1.05	25.6	9.36	8.6

Table L.1.7 ECONOMIC COST AND BENEFIT STREAM OF HYDROPOWER PROJECT (1/8): WATAWALA

EIRR : 9.8% (Unit: US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	4.3	-	-	4.3	0.0	-4.3
2	8.6	-	-	8.6	0.0	-8.6
3	8.6	-	-	8.6	0.0	-8.6
4	10.7	-	-	10.7	0.0	-10.7
5	10.7	-	-	10.7	0.0	-10.7
6	-	0.5	-	0.5	5.5	5.1
7	-	0.5	-	0.5	5.5	5.1
8	-	0.5	-	0.5	5.5	5.1
9	-	0.5	-	0.5	5.5	5.1
10	-	0.5	-	0.5	5.5	5.1
11	-	0.5	-	0.5	5.5	5.1
12	-	0.5	-	0.5	5.5	5.1
13	-	0.5	-	0.5	5.5	5.1
14	-	0.5	-	0.5	5.5	5.1
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	0.5	-	0.5	5.5	5.1
35	-	0.5	10.5	11.0	5.5	-5.4
36	-	0.5	-	0.5	5.5	5.1
:	:	:	:	:	:	:
:	:	:	:	:	:	:
54	-	0.5	-	0.5	5.5	5.1
55	-	0.5	-	0.5	5.5	5.1

Table L.1.7 ECONOMIC COST AND BENEFIT STREAM OF HYDROPOWER PROJECT (2/8): ULAPANE

EIRR : 9.6% (Unit: US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	11.2	-	-	11.2	0.0	-11.2
2	22.4	-	-	22.4	0.0	-22.4
3	22.4	-	-	22.4	0.0	-22.4
4	28.0	-	-	28.0	0.0	-28.0
5	28.0	-	-	28.0	0.0	-28.0
6	-	1.0	-	1.0	13.8	12.8
7	-	1.0	-	1.0	13.8	12.8
8	-	1.0	-	1.0	13.8	12.8
9	-	1.0	-	1.0	13.8	12.8
10	-	1.0	-	1.0	13.8	12.8
11	-	1.0	-	1.0	13.8	12.8
12	-	1.0	-	1.0	13.8	12.8
13	-	1.0	-	1.0	13.8	12.8
14	-	1.0	-	1.0	13.8	12.8
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	1.0	-	1.0	13.8	12.8
35	-	1.0	21.0	22.0	13.8	-8.2
36	-	1.0	-	1.0	13.8	12.8
:	:	:	:	:	:	:
:	:	:	:	:	:	:
54	-	1.0	-	1.0	13.8	12.8
55	-	1.0	-	1.0	13.8	12.8

Table L.1.7 ECONOMIC COST AND BENEFIT STREAM OF HYDROPOWER PROJECT (3/8): CALEDONIA

EIRR : 11.9% (Unit: US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	9.8	-	-	9.8	0.0	-9.8
2	19.7	-	-	19.7	0.0	-19.7
3	19.7	-	-	19.7	0.0	-19.7
4	24.6	-	-	24.6	0.0	-24.6
5	24.6	-	-	24.6	0.0	-24.6
6	-	1.2	-	1.2	15.5	14.3
7	-	1.2	-	1.2	15.5	14.3
8	-	1.2	-	1.2	15.5	14.3
9	-	1.2	-	1.2	15.5	14.3
10	-	1.2	-	1.2	15.5	14.3
11	-	1.2	-	1.2	15.5	14.3
12	-	1.2	-	1.2	15.5	14.3
13	-	1.2	-	1.2	15.5	14.3
14	-	1.2	-	1.2	15.5	14.3
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	1.2	-	1.2	15.5	14.3
35	-	1.2	14.5	15.7	15.5	-0.2
36	-	1.2	-	1.2	15.5	14.3
:	:	:	:	:	:	:
:	:	:	:	:	:	:
54	-	1.2	-	1.2	15.5	14.3
55	-	1.2	-	1.2	15.5	14.3

Table L.1.7 ECONOMIC COST AND BENEFIT STREAM OF HYDROPOWER PROJECT (4/8): TALAWAKELE

EIRR : 15.1% (Unit: US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	26.1	-	-	26.1	0.0	-26.1
2	52.1	-	-	52.1	0.0	-52.1
3	52.1	-	-	52.1	0.0	-52.1
4	65.2	-	-	65.2	0.0	-65.2
5	65.2	-	-	65.2	0.0	-65.2
6	-	2.1	-	2.1	52.8	50.7
7	-	2.1	-	2.1	52.8	50.7
8	-	2.1	-	2.1	52.8	50.7
9	-	2.1	-	2.1	52.8	50.7
10	-	2.1	-	2.1	52.8	50.7
11	-	2.1	-	2.1	52.8	50.7
12	-	2.1	-	2.1	52.8	50.7
13	-	2.1	-	2.1	52.8	50.7
14	-	2.1	-	2.1	52.8	50.7
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	2.1	-	2.1	52.8	50.7
35	-	2.1	43.6	45.7	52.8	7.1
36	-	2.1	-	2.1	52.8	50.7
:	:	:	:	:	:	:
:	:	:	:	:	:	:
54	-	2.1	-	2.1	52.8	50.7
55	-	2.1	-	2.1	52.8	50.7

Table L.1.7 ECONOMIC COST AND BENEFIT STREAM OF HYDROPOWER PROJECT (5/8): KOTMALE EXTENSION

EIRR : 7.0% (Unit: US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	23.3	-	-	23.3	0.0	-23.3
2	46.5	-	-	46.5	0.0	-46.5
3	46.5	-	-	46.5	0.0	-46.5
4	58.2	-	-	58.2	0.0	-58.2
5	58.2	-	-	58.2	0.0	-58.2
6	-	1.9	-	1.9	20.9	19.0
7	-	1.9	-	1.9	20.9	19.0
8	-	1.9	-	1.9	20.9	19.0
9	-	1.9	-	1.9	20.9	19.0
10	-	1.9	-	1.9	20.9	19.0
11	-	1.9	-	1.9	20.9	19.0
12	-	1.9	-	1.9	20.9	19.0
13	-	1.9	-	1.9	20.9	19.0
14	:	:	:	:	:	:
:	:	:	:	:	:	:
:	-	1.9	-	1.9	20.9	19.0
34	-	1.9	5.9	7.8	20.9	13.1
35	-	1.9	-	1.9	20.9	19.0
36	:	:	:	:	:	:
:	:	:	:	:	:	:
:	-	1.9	-	1.9	20.9	19.0
54	-	1.9	-	1.9	20.9	19.0
55	-	1.9	-	1.9	20.9	19.0

Table L.1.7 ECONOMIC COST AND BENEFIT STREAM OF HYDROPOWER PROJECT (6/8): UPPER UMA OYA (Scheme - 1000)

EIRR : 10.3% (Unit: US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	24.0	-	-	24.0	0.0	-24.0
2	48.0	-	-	48.0	0.0	-48.0
3	48.0	-	-	48.0	0.0	-48.0
4	60.0	-	-	60.0	0.0	-60.0
5	60.0	-	-	60.0	0.0	-60.0
6	-	1.9	-	1.9	31.9	30.0
7	-	1.9	-	1.9	31.9	30.0
8	-	1.9	-	1.9	31.9	30.0
9	-	1.9	-	1.9	31.9	30.0
10	-	1.9	-	1.9	31.9	30.0
11	-	1.9	-	1.9	31.9	30.0
12	-	1.9	-	1.9	31.9	30.0
13	-	1.9	-	1.9	31.9	30.0
14	:	:	:	:	:	:
:	:	:	:	:	:	:
:	-	1.9	-	1.9	31.9	30.0
34	-	1.9	43.3	45.2	31.9	-13.3
35	-	1.9	-	1.9	31.9	30.0
36	:	:	:	:	:	:
:	:	:	:	:	:	:
:	-	1.9	-	1.9	31.9	30.0
54	-	1.9	-	1.9	31.9	30.0
55	-	1.9	-	1.9	31.9	30.0

Table L.1.7 ECONOMIC COST AND BENEFIT STREAM OF HYDROPOWER PROJECT (7/8): LOWER UMA OYA (Scheme - 500)

EIRR : 9.2% (Unit: US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	22.1	-	-	22.1	0.0	-22.1
2	44.1	-	-	44.1	0.0	-44.1
3	44.1	-	-	44.1	0.0	-44.1
4	55.1	-	-	55.1	0.0	-55.1
5	55.1	-	-	55.1	0.0	-55.1
6	-	1.8	-	1.8	26.1	24.4
7	-	1.8	-	1.8	26.1	24.4
8	-	1.8	-	1.8	26.1	24.4
9	-	1.8	-	1.8	26.1	24.4
10	-	1.8	-	1.8	26.1	24.4
11	-	1.8	-	1.8	26.1	24.4
12	-	1.8	-	1.8	26.1	24.4
13	-	1.8	-	1.8	26.1	24.4
14	-	1.8	-	1.8	26.1	24.4
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	1.8	-	1.8	26.1	24.4
35	-	1.8	46.0	47.8	26.1	-21.6
36	-	1.8	-	1.8	26.1	24.4
:	:	:	:	:	:	:
:						
54	-	1.8	-	1.8	26.1	24.4
55	-	1.8	-	1.8	26.1	24.4

Table L.1.7 ECONOMIC COST AND BENEFIT STREAM OF HYDROPOWER PROJECT (8/8): SUDU GANGA

EIRR : 8.6% (Unit: US$10^6)

Year	Cost				Benefit	Balance
	Construction	O&M	Replacement	Total		
1	8.1	-	-	8.1	0.0	-8.1
2	16.2	-	-	16.2	0.0	-16.2
3	16.2	-	-	16.2	0.0	-16.2
4	20.2	-	-	20.2	0.0	-20.2
5	20.2	-	-	20.2	0.0	-20.2
6	-	1.1	-	1.1	9.4	8.3
7	-	1.1	-	1.1	9.4	8.3
8	-	1.1	-	1.1	9.4	8.3
9	-	1.1	-	1.1	9.4	8.3
10	-	1.1	-	1.1	9.4	8.3
11	-	1.1	-	1.1	9.4	8.3
12	-	1.1	-	1.1	9.4	8.3
13	-	1.1	-	1.1	9.4	8.3
14	-	1.1	-	1.1	9.4	8.3
:	:	:	:	:	:	:
:	:	:	:	:	:	:
34	-	1.1	-	1.1	9.4	8.3
35	-	1.1	25.6	26.7	9.4	-17.3
36	-	1.1	-	1.1	9.4	8.3
:	:	:	:	:	:	:
:	:	:	:	:	:	:
54	-	1.1	-	1.1	9.4	8.3
55	-	1.1	-	1.1	9.4	8.3

FIGURES

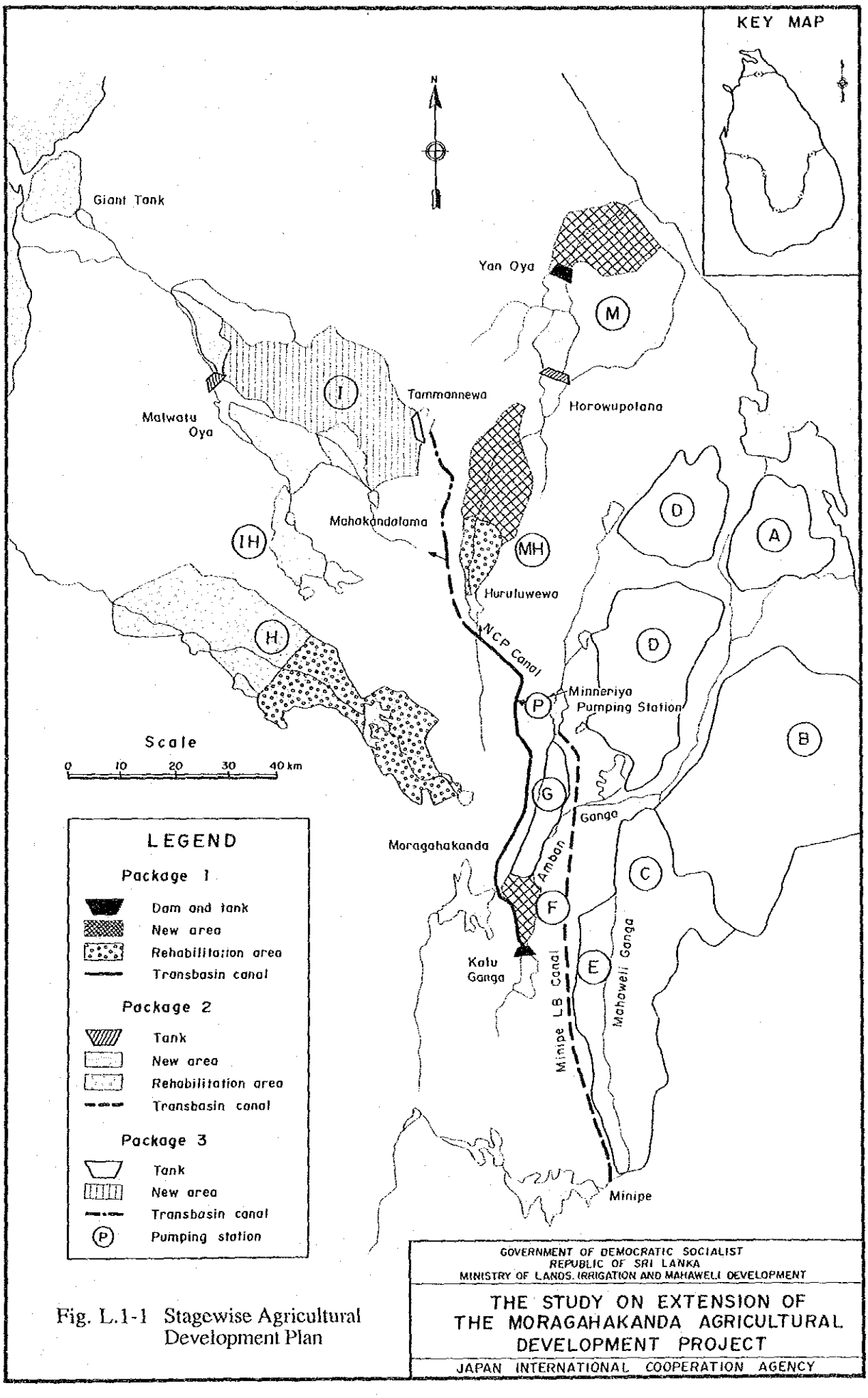

Fig. L.1-1 Stagewise Agricultural Development Plan

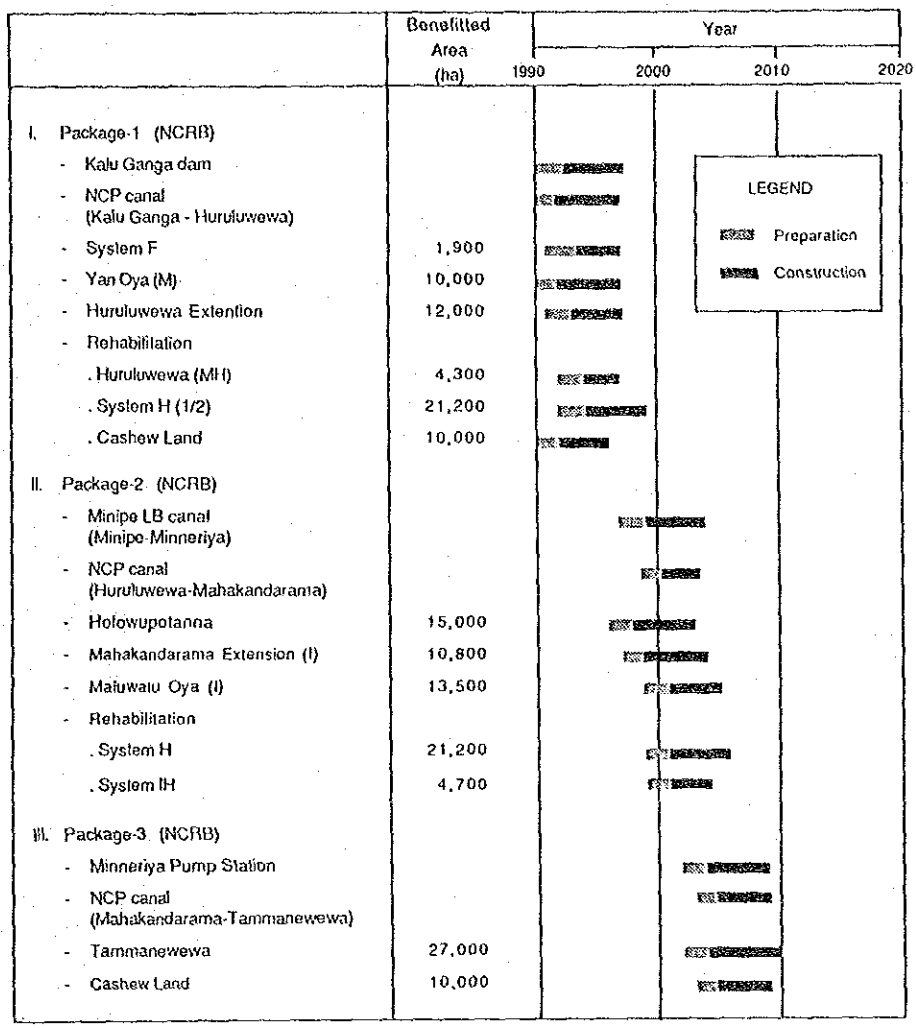

Fig.L.1-2 Implementation Schedule

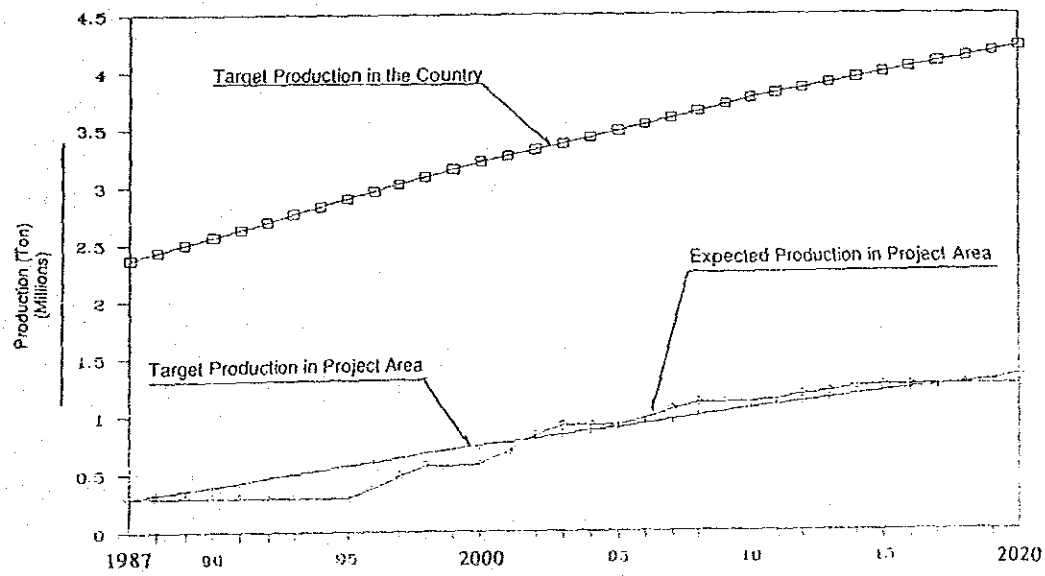

Fig.L.2-1 Projected Paddy Production: 1987-2020

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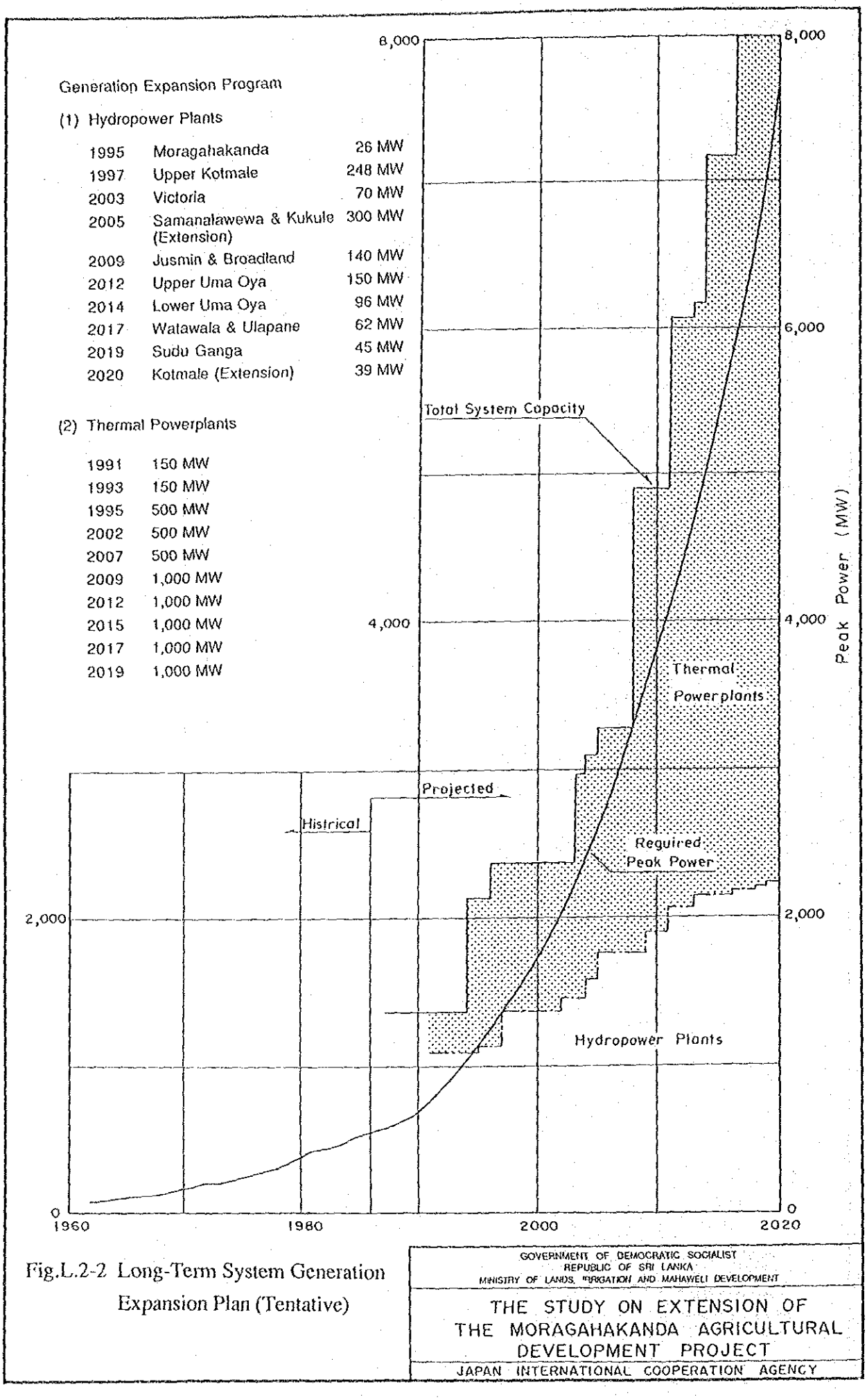

Fig.L.2-2 Long-Term System Generation Expansion Plan (Tentative)

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